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Determinants of Services Sourcing Performance

16 December 2010

by

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ABSTRACT

The need for reform in the Department of Defense's (DoD) acquisition and management of services acquisitions has been recently highlighted by the Government Accountability Office and by top leadership within the DoD acquisition community. However, problems with the acquisition of business-to-business services have not been limited to purchasing in the public sector; industry has also struggled with the effective acquisition of business-to-business services because the complexities and unique nature of services render the definition of requirements and the specification and measurement of contractor performance problematic. Despite these difficulties, little research has been conducted to examine the determinants of sourcing performance in services acquisitions.

This study uses structural equation modeling to examine the relationships between service quality and its determinants in the U.S. Air Force's acquisition of business-to-business services. Data were collected by surveying a sample of contract administrators assigned to services acquisitions. The results of a statistical analysis on this data suggest that requirement definition sufficiency and government–contractor communication strongly affect the contract outcomes of service quality and regulatory and statutory compliance. A non-positive relationship was also found between the extent of compliance with regulations and statutes and the quality of the service rendered. Other results include a significant relationship between the level of commitment by the internal customer and the sufficiency of the requirement definition as well as the deleterious effects of personnel turnover on compliance with regulations and statutes. While the results present several practical implications for the DoD's acquisition and management of service contracts, this study also makes contributions to service quality theory in business-to-business contexts. A new service quality framework is proposed for customer-defined services, along with a revised scale for measuring service quality in business-to-business applications.

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TABLE OF CONTENTS

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LIST OF FIGURES

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LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

AFFARS	Air Force Federal Acquisition Regulation Supplement
AFI	Air Force Instruction
AFMS	Air Force Manpower Standard
AIC	Akaike Information Criterion
ANOVA	Analysis of Variance
APDP	Acquisition Professional Development Program
APT	Annualized Percent Turnover
AVE	Average Variance Extracted
B2B	Business-to-Business
B2C	Business-to-Consumer
BIC	Bayesian Information Criterion
CE	Civil Engineering
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CPARS	Contractor Performance Assessment Reporting System
DF	Degrees of Freedom
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
EFA	Exploratory Factory Analysis
FAR	Federal Acquisition Regulation
GAO	Government Accountability Office
MANOVA	Multivariate Analysis of Variance
MLE	Maximum Likelihood Estimation
NNFI	Non-Normed Fit Index
OFPP	Office of Federal Procurement Policy
OMB	Office of Management and Budget
OSD	Office of the Secretary of Defense
PBSA	Performance-based Services Acquisition
PWS	Performance Work Statement
RMSEA	Root Mean Square Error of Approximation

SD	Standard Deviation
SE	Standard Error
SEM	Structural Equation Modeling
SOW	Statement of Work
SRMR	Standardized Root Mean Square Residual
TCE	Transaction Cost Economics
TLI	Tucker-Lewis Index
U.S.	United States
USD(AT&L)	Under Secretary of Defense for Acquisition, Technology & Logistics
WBS	Work Breakdown Structure

ACKNOWLEDGMENTS

First, I would like to thank my thesis advisors, Lt Col Timothy Hawkins, PhD, and Lt Col (Ret.) Gregory Hildebrandt, PhD. This research would not have been possible had it not been for their vision and tireless efforts.

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I. INTRODUCTION

A. BACKGROUND

Over the past several decades, the United States has transitioned from a goods-based economy to a services-based economy. As of 2005, services accounted for more than 78% of the country's gross domestic product and employed 80% of the country's workforce (Coalition of Service Industries [CSI], 2007). Federal spending on services has also sharply increased. Most recently, the Department of Defense (DoD) reported obligating $212 billion on service contracts during 2009, an amount that accounted for more than 50% of the DoD's 2009 contract spend (Under Secretary of Defense for Acquisition, Technology, and Logistics [USD(AT&L)], 2010a, 2010b). In that year alone, the DoD utilized more than 100,000 contract vehicles to acquire services from 32,000 different service suppliers (USD[AT&L], 2010b).

Despite these substantial increases in spend on contract services, the size of the DoD's acquisition workforce has decreased in recent years. As seen in Figure 1, the DoD's spend on services acquisitions in real dollars grew more than 100% between 2001 and 2008, increasing from $92 billion to slightly more than $200 billion, while the DoD's contracting workforce grew only 1% and the DoD's total acquisition workforce shrank nearly 3% (Government Accountability Office [GAO], 2009b). The Government Accountability Office (GAO) contends that the DoD carried out this downsizing without regard to retention of the specific skills and competencies needed to accomplish the Department's mission (GAO, 2007a), such as the skills required to manage increasingly complex service contracts.

At the same time that demand for services has rapidly increased within the DoD, so have the demands on service contract administrators. Some of this burden can be attributed to the uniqueness of services—the properties of intangibility, heterogeneity, perishability of output, and simultaneity of production and consumption—all characteristics that differentiate services from the acquisition of goods (Ellram, Tate, & Billington, 2007). Because of these attributes, it is more difficult to control quality

levels, more difficult to evaluate quality, more difficult to manage service personnel, and more difficult to manage time, which is the process of synchronizing the resources required for service delivery with the time of consumption (Lovelock & Wirtz, 2007).

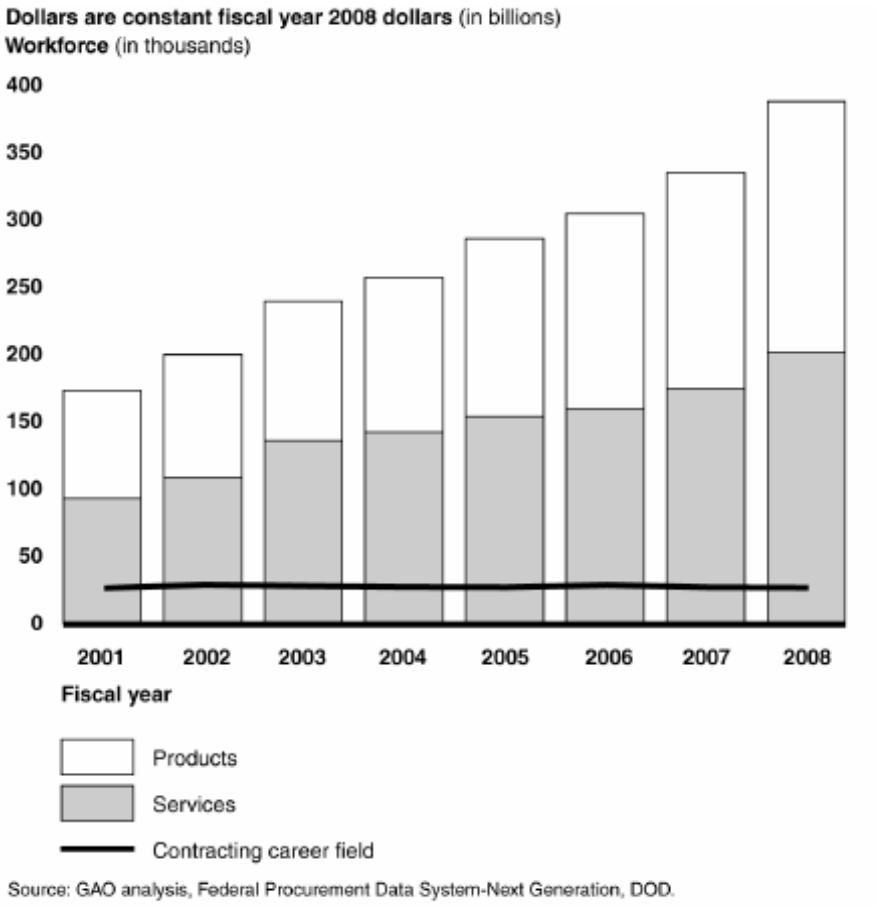

Figure 1. Changes in DoD's Contract Obligations and Contracting Workforce, Fiscal Year 2001 to Fiscal Year 2008
(GAO, 2009a)

This study intends to determine the explanatory structure of services sourcing performance, specifically that of service quality and contracting compliance within the U.S. Air Force. Although significant research has been conducted in the area of service quality, the relationships between contract administration functions and service contract outcomes have yet to be examined. This is not surprising given the number of variables potentially involved and the complexity of their interaction. However, the need for this knowledge has become increasingly more critical in recent years.

B. PROBLEM STATEMENT AND GAP IN LITERATURE

With service contract administration challenges mounting, the DoD has recently come under scrutiny by the GAO regarding the acquisition and management of service contracts. In 2001, the GAO labeled the DoD's acquisition of services as "high risk" (GAO, 2001a), stating that the department's poor management of service contracts undermined the government's ability to obtain value for the taxpayer's dollar. Additional findings in the 2001 report highlighted the DoD's difficulties in defining requirements as well as in providing sufficient contractor oversight and adequately staffing contracting professionals.

A second GAO report in 2001 reiterated findings concerning DoD and federal deficiencies in service contract management and made three recommendations: appoint a chief acquisition officer for each agency, improve training of the acquisition workforce, and increase the use of performance-based contracting (GAO, 2001b). As defined by the Office of Federal Procurement and Public Policy (OFPP), performance-based contracts describe contractual requirements in terms of the government's desired results and measurable outcomes, and they establish procedures to manage performance if it falls below established thresholds. If appropriate, performance-based contracts can use incentives to motivate contractor efforts that otherwise might not be emphasized and to discourage waste and inefficiency. At the time of the GAO report, in 2001, a mere 15% of federal service contracts were using performance-based contracting methods, despite the Office of Management and Budget's (OMB) 20% goal (GAO, 2001b). To date, improvements in acquisition training and in the implementation of the role of the chief acquisition officer have not been fully realized (see, for example, GAO, 2010b; Falcone, 2010).

The following year, in 2002, the GAO asked five of the major government agencies, including the DoD, to identify contracts that exemplified performance-based service contracting (GAO, 2002b). The GAO reviewed 25 of these contracts and found that only 9 of 25 exhibited all of the attributes of performance-based service contracts as defined by the OFPP. Of the remaining 16 contracts, 4 did not exhibit any of the attributes. It was evident, based on this study, that agencies were only partially

complying with the OMB's guidance to implement the use of performance-based contracting procedures.

Also in 2002, the GAO released a study conducted on six leading companies that had instituted a strategic approach to the acquisition of services. Brunswick Corporation, Dun & Bradstreet Corporation, Electronic Data Systems Corporation, Exxon Mobile Corporation, Hasbro Incorporated, and Merrill Lynch & Company Incorporated have all successfully reengineered their business practices for acquiring services and, as a result, have netted cost savings as high as 15% while maintaining or even improving service levels (GAO, 2002a). The GAO found similar key elements among the strategic approaches adopted by these companies; consequently, it recommended that the DoD incorporate these elements as a general framework for services acquisition reform.

As seen in Figure 2, commitment to taking a strategic approach to services acquisition was central to the successful implementation of change within the six companies studied. The companies first had to secure buy-in from top corporate leadership, who could communicate the urgency for change and establish acquisition goals and targets for the company. The framework followed a logical order for process implementation:

- Develop the strategic structure, processes, and roles; establish business relationships between all services stakeholders; identify service experts.
- Support the people and processes involved; maintain open communication between parties; use metrics to reinforce process credibility.
- Employ information systems to uncover the who, what, and where of spending; analyze spend data to identify opportunities for increased value.

In this same study, the GAO compared the DoD's current service acquisition environment to that of the six companies prior to their implementation of a strategic approach to services acquisition. The report contended that the enterprise-wide, one-size-fits-all solution adopted by these companies may not be suitable for the DoD, but stressed that the Department develop a framework for services reform using a strategic approach modeled after successes in industry.

However, more than four years later, in November 2006, the GAO issued another report stating that the DoD still had not implemented a strategic approach to the management of service contracts (GAO, 2006b). Rather, the GAO found that the DoD was reactively managing its service contracts, due in part to a lack of information on service requirements, volume, and composition. The DoD concurred with these findings and the Under Secretary of Defense for Acquisition, Technology, and Logistics (USD[AT&L]) issued a policy memorandum to strengthen the management of DoD services acquisition (USD[AT&L], 2006). This memorandum called for reform at the strategic and tactical levels to ensure services acquisitions were enhancing the capabilities of the warfighter and to achieve specific objectives such as the use of performance-based measures, contract action reporting, and regulatory compliance. Additionally, the memorandum implemented the changes required by Section 812 of the National Defense Authorization Act for Fiscal Year 2006, which required the DoD to establish a management structure for the acquisition of contract services.

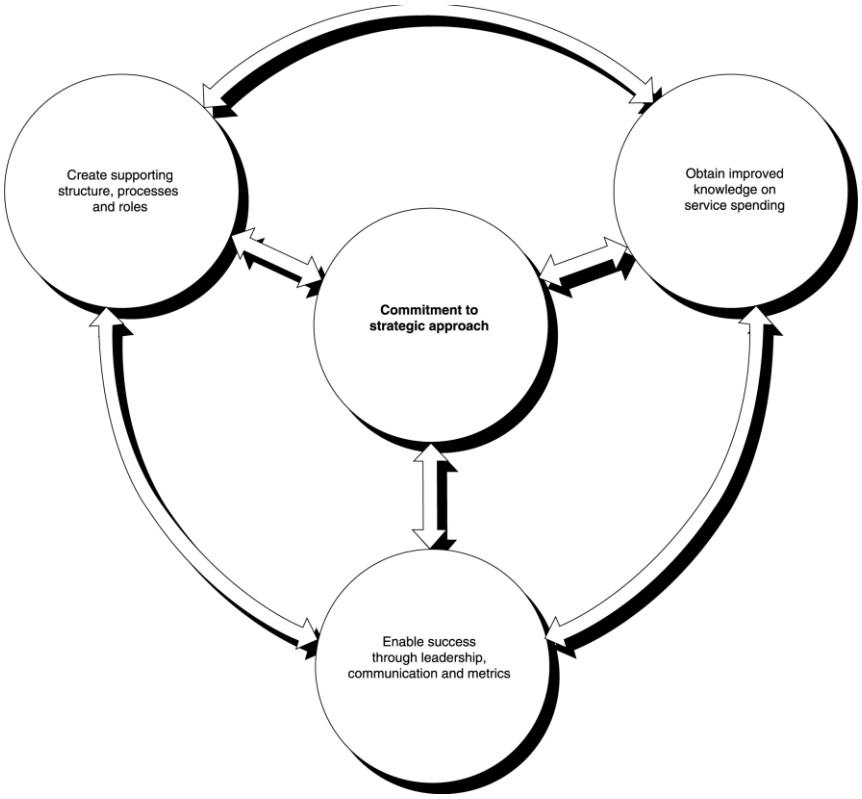

Figure 2. Key Elements of Strategic Approach Taken by Leading Companies
(GAO, 2002a)

Despite these changes, the GAO still saw little improvement in the DoD's acquisition and management of services. In 2007, the GAO reported that the DoD increasingly relied on defense contractors for business-to-business services but lacked the key elements at the strategic and tactical levels to make service contracts a managed outcome (GAO, 2007a). These results were reiterated in another 2007 GAO report (GAO, 2007b), which questioned whether the DoD applies sound business practices to the acquisition and management of contracted services in the following competencies:

- Defining requirements,
- Obtaining adequate competition,
- Managing contractors in a deployed (contingency) environment,
- Assessing contractor performance, and
- Executing interagency contracts and task orders.

Recent legislation passed within the National Defense Authorization Act of 2008 required the DoD to submit to Congress an annual inventory of contracted services and also required the Secretary of Defense to issue guidance, with detailed implementation instructions, providing for periodic independent management reviews of the Department's service contracts. The DoD's resultant guidance memorandum required contract peer reviews at the DoD level for service acquisitions above $1 billion and placed the responsibility of conducting reviews within each component for all other service acquisitions falling below that threshold. However, the GAO recently contested the effectiveness of these policies, asserting that the same pattern of service acquisition mismanagement still exists within the DoD (GAO, 2009a). In April 2009, the GAO published a testimony before Congress on the DoD's progress toward improving its acquisition of contract services. In this report, the GAO contended that the DoD has made little headway on its longstanding issues in service contracting (GAO, 2009a). This report cited many of the same issues as previous reports and focused on the Department's challenges employing sound business practices, such as defining requirements, selecting contract type, and adequately overseeing contractor performance.

The DoD has also been highly scrutinized for its lack of compliance with contracting-related statutes and regulations. Recent reports have highlighted compliance issues ranging from a lack of required documentation, such as determinations and findings for the use of time and materials contracts (GAO, 2007c), to issues meeting competition requirements (Department of Defense Inspector General [DoDIG], 2004, 2010a; GAO, 2004) and managing and definitizing undefinitized contractual actions (DoDIG, 2010b; GAO, 2007d, 2010a). Many of the other reports related to services acquisition have focused on the application of performance-based services acquisition (PBSA) procedures, such as a recent GAO report (2009b) that identified challenges faced by the DoD in applying PBSA procedures to professional and management support contracts and task orders.

But why is the DoD experiencing so much trouble with the acquisition and management of contract services? Recent literature has uncovered similar problems for firms purchasing business-to-business (B2B) services in the commercial marketplace. Like the DoD, firms are spending increasingly more on outsourced services, but the resources dedicated to managing those services have not kept pace (Ellram et al., 2007). Additionally, overworked services acquisition personnel often use supplier-provided information to determine the cost structure and cost drivers of acquired services (Ellram et al., 2007). An opportunistic service firm can take advantage of this circumstance to reduce the resources applied to perform the service at the expense of the purchasing firm.

To address these issues, Ellram et al. (2007) called for firms that purchase B2B services to take six steps to improve services supply management. First, firms should conduct a spend analysis to determine on what services company resources are being spent, who the customers of the service are within the firm, the level at which services acquisitions are approved within the organization, the structure of services management personnel, and their relationships to service performance. The second step is for firms to segment their services spending based on the value to the organization and on the level of risk, in part to determine the appropriate level of interaction between the users (requesters) of the service and the service supply personnel. Similarly, in the third step, firms should allocate resources toward the management of the service requirements in a

manner consistent with economic return. For example, in developing requirements documents, a firm should use more of its own resources on high-risk, high-importance services than on those that provide very little value or present little risk to the organization. Fourth, Ellram et al. (2007) called for firms to increase the professionalism of their services management personnel. And in the fifth step, they advised that firms should measure effectiveness and ensure proper business controls through the use of supplier audits, information technology, and the incorporation of concrete performance requirements into contracts. Finally, Ellram et al. (2007) argued that, as a sixth step, firms should recruit and place their best talent into services supply management.

However, a general lack of knowledge by public and private purchasers in the subject matter incorporated into several of these steps results in unique challenges. For example, purchasing organizations know neither how many resources are appropriate to allocate toward the acquisition and management of services nor how to measure the effectiveness of services. Furthermore, in order to improve the performance of service contract management within the U.S. Air Force, or within the DoD as a whole, the determinants of performance need to be identified. Once these are known, leaders in public procurement can more effectively allocate resources toward those factors that have the greatest impact on performance and avoid the inefficient use of resources on those factors that have little or no impact.

C. RESEARCH OBJECTIVES

The objective of this research is to address existing gaps in the literature and to offer service contract practitioners within the U.S. Air Force a comprehensive model to use in improving the acquisition of services and increasing compliance with federal, DoD, and Service acquisition regulations. This study will answer the following research questions:

Research Question 1: What are the determinants of services sourcing performance?

Research Question 2: Which determinant(s) have the greatest impact on the key contract outcomes of service quality and regulatory and statutory compliance?

Research Question 3: How can service quality be validly measured in a business-to-business context?

D. METHODOLOGY

This research provides a quantitative examination of the determinants of service sourcing performance using structural equation modeling (SEM). SEM is a multivariate statistical method that extends confirmatory factor analysis to test causal relationships between combinations of manifest and latent variables. Latent variables are those variables that are not directly observable, but that are inferred from a set of manifest (observed) variables. They are often measured through the application of a pre-defined scale when a survey is utilized for the data collection. In general, both latent and observed variables that are unexplained in a model are considered to be exogenous. Exogenous variables have one or more causal paths that lead from them to endogenous variables. Endogenous variables are explained in the model and have one or more hypothesized causal paths leading to them from other endogenous or exogenous variables. In path analysis and in SEM, an endogenous variable may be both explanatory and explained within a model, when such a variable is dependent on certain endogenous or exogenous variables while explaining one or more other variables. Indeed, the ability to model a series of dependent variables is a unique strength of SEM. In this study, endogenous variables consisted of the service acquisition outcomes of service quality and compliance with regulations and statutes as well as with the sufficiency of the requirement definition. Several exogenous latent and manifest variables were also used in the study and stemmed from theories presented in the literature review.

Existing literature was used to develop hypotheses, a conceptual model, and a survey, all of which were later pre-tested and refined through interviews with practicing contract administrators. The final survey was deployed online to a population of U.S. Air Force contract administrators. Usable responses were collected from 240 participants,

and survey data were initially analyzed using exploratory and confirmatory factor analysis. Finally, the structural model was tested for overall model fit as well as for the significance of individual causal paths; a trimmed and final structural model is presented in this thesis for parsimony and future replication.

E. ORGANIZATION OF THE STUDY

A literature review is first presented in Chapter II. Recent literature concerning service quality is discussed and brief overviews are provided on several applicable theories, including agency theory, the resource- and competence-based views of the firm, and relational exchange. The research methodology, including development of a conceptual model, sampling, and survey design, is located in Chapter III; the results of the data collection and analysis are located in Chapter IV. Finally, managerial and theoretical implications and several recommendations for future research are discussed in the concluding chapter, Chapter V.

F. SCOPE

Literature addressing service quality has generally been limited to examinations of practices within the setting of commercial industry. However, due to limits on time and resources, the scope of this research was restricted to the study of services sourcing performance within the U.S. Air Force. Furthermore, this study is focused on services contracting within the United States and excludes overseas contracting activities because cultural and business norms, as well as standards for the application of contracting procedures, may differ in other countries. The services acquisitions analyzed in this study were conducted using the relevant mandatory rules and procedures for contracting within the DoD, including the procedures established in the Federal Acquisition Regulation (FAR), the Defense Federal Acquisition Regulation Supplement (DFARS), and any applicable U.S. Air Force supplements. Such a study in a government context is appropriate because the standardized rules and procedures can better exclude the type of systematic bias that is commonly found due to widely differing contract management processes across commercial firms.

G. MANAGERIAL AND THEORETICAL IMPLICATIONS

A study that identifies the determinants of key service contract outcomes can offer tremendous utility to practitioners. First, the development of a model for services sourcing performance may assist in the effective assignment of contract procurement and administration resources to service contracts. It may also provide a framework that can be used to assess the effectiveness of regulations and statutes on the quality of contracted services. Some of the findings (e.g., a strong relationship between the commitment of the internal customer and the sufficiency of the requirement definition) suggest that a paradigm shift in the assignment of upstream resources—such as those assigned by requiring activities—may be fundamental to improving service contract outcomes. Further findings suggest that adequate communication between the contractor and government acquisition personnel is fundamental to achieving the government's desired level of service performance and to achieving full compliance with acquisition statutes and regulations. The amount of turnover of acquisition personnel was also found to be directly related to the reported level of compliance; acquisitions with more than 100% turnover across the life of the contract or with more than 42% turnover annually were found to be significantly less compliant with statutes and regulations. Furthermore, low buyer experience was found to be significantly related with lower levels of service quality, as was the amount of compliance with regulations and statutes.

In addition to the managerial implications, this study addresses a theoretical need for additional research of service quality in B2B contexts—a field where previous research on the determinants of service quality has been sparse. A new framework is proposed in this thesis for the sourcing of B2B services—a framework that is based on the works of Kong and Mayo (1993) and Parasuraman, Zeithaml, and Berry (1985). This framework presents the gaps that exist between buyers and suppliers in B2B service acquisitions when service requirements are defined by the purchasing organization. Additionally, a more relevant measure of service quality was needed for studies of B2B services; many previous researchers have simply excluded measurement dimensions from an existing B2C service quality scale without giving consideration to the unique aspects of B2B service acquisitions. As such, a new service quality scale is proposed in this

study that incorporates the measurement of the service supplier's responsiveness to the buyer's requirements, a dimension that is particularly applicable to measuring quality in the acquisition of services that are not available off-the-shelf and when performance requirements are defined by the purchasing organization.

H. CONCLUSION

In summary, this study uses structural equation modeling to identify several determinants of service quality and regulatory and statutory compliance through a quantitative analysis of survey data. With the literature gap and problem statements identified, the following chapter discusses the theories that are relevant to this study and introduces the research hypotheses.

II. LITERATURE REVIEW

A. INTRODUCTION

Multiple theories are often relied upon to explain B2B exchange. The following theories are relevant to services procurement: service quality theory, relational exchange theory, agency theory, the resource-based view of the firm, and the competence-based view of the firm. Hypotheses for this study are proposed in each section of this chapter and are later summarized in the conclusion.

B. NATURE OF SERVICES

Quality is an immensely important yet fleeting measure for firm success (Anderson & Zeithaml, 1984) in that it is not easily articulated by service providers or by customers (Takeuchi & Quelch, 1983). This is especially true when it comes to the quality of services because they differ drastically in nature from goods, primarily through the four characteristics of intangibility, heterogeneity, perishability, and inseparability (Ellram et al., 2007).

First, the intangible nature of services renders specifications and customer expectations to be imprecise (Ellram et al., 2007). A purchaser of office furniture may have little trouble articulating customer requirements for a desk and may be able to employ several senses to determine the quality of a good. However, it may be impossible for an individual requiring an appendectomy to establish a desired level of performance for the surgical procedure. This is due not only to a knowledge gap between the provider and receiver of the service but also to the little physical evidence that exists of the service provided.

Second, services are, by nature, heterogeneous. This is especially true of services with a high labor content (Parasuraman et al., 1985) because performance will vary between providers and will likely differ between customers and with time. Like providers, customers lack a homogenous definition of service quality for any specified service. Because of this, and because consistency in levels of performance from service

personnel is difficult to attain, the level of quality that a service provider expects to deliver may vary greatly from the level of quality that the customer expects to receive (Parasuraman et al., 1985).

Third, services are frequently perishable; unlike goods, services cannot be held or stocked in inventory. While inventory policies for goods allow firms to buffer future demand with safety stock, service providers must change service capacity to meet demand fluctuations (Ellram et al., 2007). The perishability of services also presents challenges for inspection; service delivery or outcomes for many services can only be inspected or evaluated at the time the service is performed. For example, security guard services cannot be rendered for a previous period of time nor can the services be easily inspected or evaluated after the period of performance is complete.

Fourth, the production and consumption of services are often inseparable. During the production of a good, such as a television set, quality can be engineered into the end product at a factory and then delivered intact to the customer. The customer's input into the quality of the television will have little or no impact on the good produced. Alternatively, quality in a service environment often occurs through interactions between the customer and the service provider (Lehtinen & Lehtinen, 1982). These interactions become even more influential on quality for services in which higher degrees of customer input are required (Parasuraman et al., 1985), such as with real estate or cosmetology services.

C. SERVICE QUALITY

Parasuraman et al. (1985) performed an examination of literature surrounding service quality and suggested the following three underlying themes to defining service quality:

- "Service quality is more difficult for the consumer to evaluate than goods quality." (p. 42)
- "Service quality perceptions result from a comparison of consumer expectations with actual service performance." (p. 42)

- "Quality evaluations are not made solely on the outcome of a service; they also involve evaluations of the process of service delivery." (p. 42)

Parasuraman et al.'s (1985) analysis and measurement of these themes included the notion of expectation-disconfirmation theory, or the gap between customer expectations and perceptions of actual performance. Other researchers have also considered that the delivery of quality services means minimizing the expectation-disconfirmation gap on a consistent basis (Lewis & Booms, 1983) and that multiple forms of service quality may exist. For example, technical quality, which is what the customer actually receives from the performance of the service, may differ from the method of service performance, defined as functional quality (Gronroos, 1982). Alternatively, Lehtinen and Lehtinen (1982) offer a three-dimensional view of service quality consisting of physical quality, interactive quality, and corporate quality, the last of which they define as the customers' perceptions of the service firm's image.

Parasuraman et al. (1985) developed a conceptual model of service quality (Figure 3), hereafter referred to as the Gaps Model, which was developed from an exploratory investigation and is based on the gaps between corporate executives' perceptions of service tasks and quality and their expectations of the same. The first gap presented in this model is a gap between the consumer's expectations of the service and the service provider's perception of the consumer's expectations. Parasuraman et al. (1985) found that service provider's perceptions of consumer expectations were often accurate; however, discrepancies exist. The second gap is the difference between the service provider's perceptions of consumer expectation and the translation of those perceptions into corporate specifications for service quality. This gap can often be attributed to the uncertainty of demand for a service, but Parasuraman et al. (1985) also theorized that it is due to a lack of total commitment among management to deliver quality services. The third gap is the difference between the corporate specifications for service quality and the actual service performance. In Parasuraman et al.'s (1985) investigation, executives of service-delivery firms routinely stressed the critical function of service employees. Therefore, the depth of this gap is contingent on the difference between the performance of the firm's service delivery employees and the specifications

established by the firm. The authors' fourth gap is the difference between advertized (i.e., promised) service delivery and actual service performance. This gap, relating the use of media to the expectancy-disconfirmation paradigm, suggests that a consumer will have a lower perception of service quality if the firm advertizes an inaccurately high level of service quality through external communications. Finally, Parasuraman et al. (1985) concluded that the fifth gap, which is the total difference between the consumer's expected level of service and the perceived level of service received, is, by design, a function of all earlier gaps.

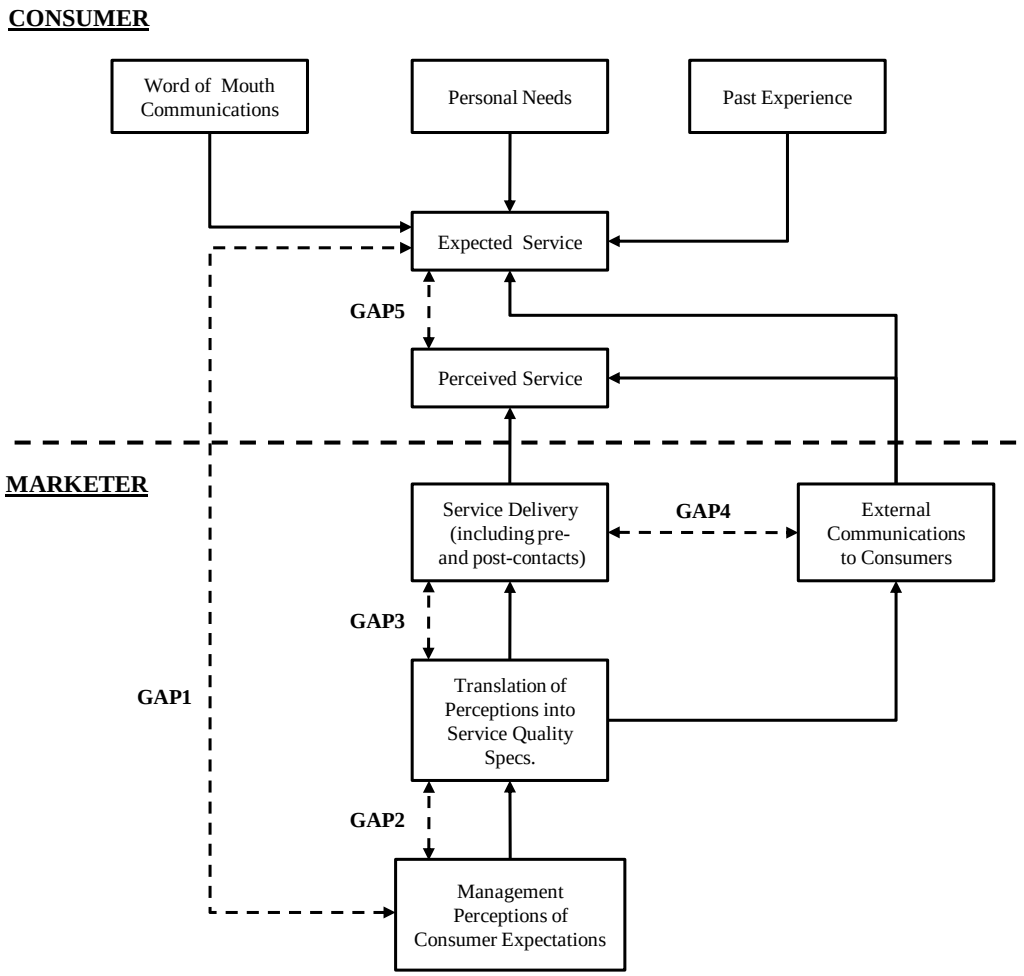

Figure 3. Gaps Model
(Parasuraman et al., 1985)

The exploratory research of Parasuraman et al. (1985) also included an investigation into the consumer's view of service quality, in which they uncovered the following 10 common determinates:

1. Reliability—consistency of performance, dependability;
2. Responsiveness—timeliness of service delivery, readiness of employees;
3. Competence—possession of requisite knowledge and skills;
4. Access—approachability of contact personnel, ease of contact;
5. Courtesy—politeness, respect, friendliness;
6. Communication—extent that the customer is informed;
7. Credibility—reputation of firm and employees, honesty, trustworthiness;
8. Security—freedom from danger, risk, or doubt;
9. Understanding/knowing the customer—comprehending customer needs; and
10. Tangibles—physical evidence of service performance.

Later, Parasuraman et al. (1988) categorized the 10 determinates into five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Factors shaping the customer's expectations of service quality may include the customer's past experience, personal needs, and word-of-mouth communications. They developed a 44-item scale for the measurement of service quality in which 22 items measure customer expectations of service quality and the same 22 items are repeated to measure customer perceptions of quality from actual service delivery. It is important to note a paradigmatic limitation of the Gaps Model. Going back to the first gap, the presumption is that the service provider must anticipate the consumer's expectations. Hence, there is some uncertainty. Yet, this presumption does not apply to many services. For example, customized services in which customers and service providers communicate expectations and capabilities prior to exchange (e.g., swimming pool installation), deviate from this paradigm.

In contrast to the Gaps Model, Cronin and Taylor (1992) argued that the expectancy-disconfirmation theory is actually a measure of satisfaction and not a measure of service quality. They concluded, using an empirical study, that service quality directly

affects customer satisfaction, which, in-turn, affects the customer's future purchase intentions. From this relationship, they theorized that perceived service quality is, in fact, a long-term evaluation, whereas the gap-based model measures customer satisfaction, a short-term, transaction-based measure. They advocated for an alternative performance-based paradigm that measures service quality using a performance-only, unidimensional score rather than the gap-based, multidimensional model introduced by Parasuraman et al. (1985). Cronin and Taylor's (1992) position is based on the notion that the level of service quality should meet customer needs first and foremost, rather than simply meet customer expectations.

While the works of Parasuraman et al. (1985, 1988) and Cronin and Taylor (1992) have significantly advanced service quality theory, their research has been limited to applications of service quality in business-to-consumer (B2C) contexts. Kong and Mayo (1993) recognized a need for a deeper theoretical foundation of service quality in B2B contexts and attempted to address this need through the development of an alternative framework, hereafter referred to as the B2B Gaps Model. This framework was developed as an extension to Parasuraman et al.'s (1985) Gaps Model and involves account services rendered between channel members (e.g., manufacturers and retailers) in a supply chain for physical goods. The first gap in the B2B Gaps Model (Figure 4) is the difference between the management's perceptions of consumer expectations and the actual expectations of the consumer and channel member. The second and third gaps are retained directly from the Gaps Model; the second gap is the difference between manager's perceptions of consumer expectations and the translation of these perceptions into service quality specifications, and the third gap is the difference between the translated quality specifications and the actual service delivery. The fourth gap in the B2B Gaps Model is an extension of the fourth gap from the Gaps Model, which is the difference between the service marketer's external communications to consumers regarding the service and the actual service delivery. The B2B Gaps Model extends this gap by acknowledging that supplier communications to consumers likely differ from those to channel members. The final gap is simply the difference between service

expectations and perceptions of actual service delivery by the consumer and the channel member.

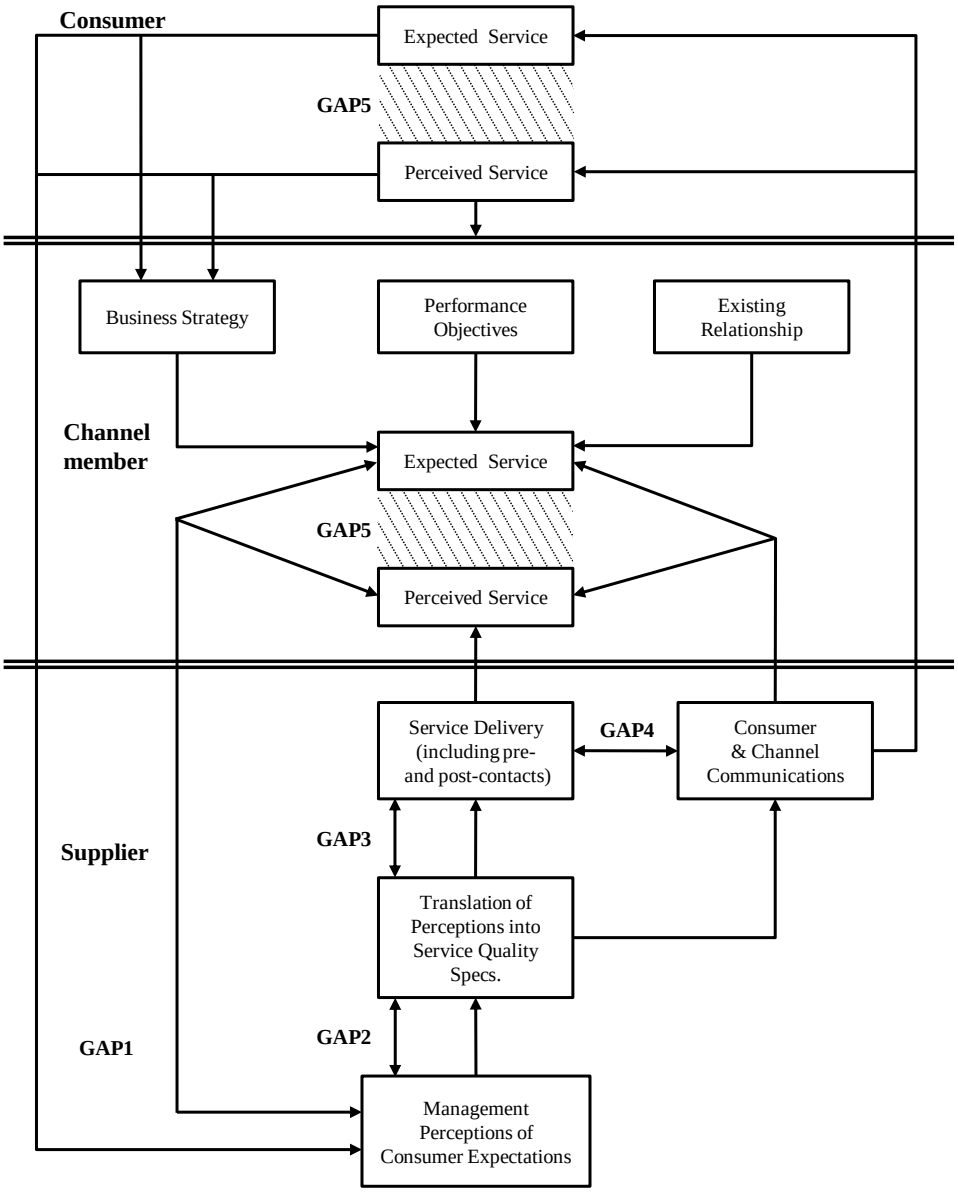

Figure 4. B2B Gaps Model
(Kong & Mayo, 1993)

While the B2B Gaps Model developed by Kong and Mayo (1993) addressed the importance of the channel member (e.g., a retailer) in B2B supply chains, its frame of reference was services rendered between channel members (e.g., a manufacturer and a

retailer) rather than satisfaction of customer demand. In practice, many organizations acquire services in which service requirements and acceptable levels of performance are defined by the customer, as is standard practice in public procurement. In these instances, the channel member role depicted in the B2B Gaps Model is often performed by an acquisition professional in the buying organization such as a program manager, who oversees the procurement from the early planning phases to the evaluation of suppliers, selection and award, payment and performance, and, finally, to contract closeout. Because this role is not considered in either Kong and Mayo's (1993) or Parasuraman et al.'s (1985) framework, the supply chain process for the acquisition of customer-defined B2B is absent of supporting theory.

In customer-defined B2B service acquisitions, organizational requirements are first crafted into requirements documents based on an agent's perception of the organization's needs. A gap exists at the point in which there is potential for incongruity between the agent's perception of the organization's requirements and the organization's actual requirements. A second gap may occur between the agent's perception of the organization's requirements and the sufficiency with which those requirements are translated into service specifications, such as the description of the service(s) to be purchased and the expected level of quality.

The use of customer-defined service specifications also complicates the role of the supplier in the B2B framework. First, the customer's requested service may differ from the supplier's typical methods of service delivery and the standards of quality that the supplier customarily performs. In some cases, a knowledge or capability disparity may exist between the supplier's customary service offerings and the service requirements of the customers. In other cases, the customer may request service levels that are substantially less than the service levels that the supplier typically offers. As such, a gap exists between the supplier's customary service and the resourcing of the supplier's management or work breakdown structure (WBS). The actual interpretation of the management's vector by the supplier's employees may present an additional gap, in which service delivery differs from the WBS or the management's resourcing.

Finally, in a customer-defined B2B framework, the role of the acquisition professional is central as a liaison between the customer and the supplier. This individual, or group of individuals, has expectations of service delivery that may differ from the end customer's service expectations. For one, the acquisition professional may rely on outside sources of information to form expectations, such as research of the marketplace, communications with the supplier's employees before and after service performance, and reviews of the WBS and other tools provided by the supplier's management. Internal sources also shape the acquisition professional's expectations, such as the requirements documents and performance objectives. The difference between the level of service that this acquisition professional expects and the level of service that is actually performed is the final gap in the framework.

As such, a new gaps model is proposed for B2B services in which service requirements are defined by the customer and the organization's acquisition staff acts as a channel member between the supplier and the customer. This model is presented in Figure 5.

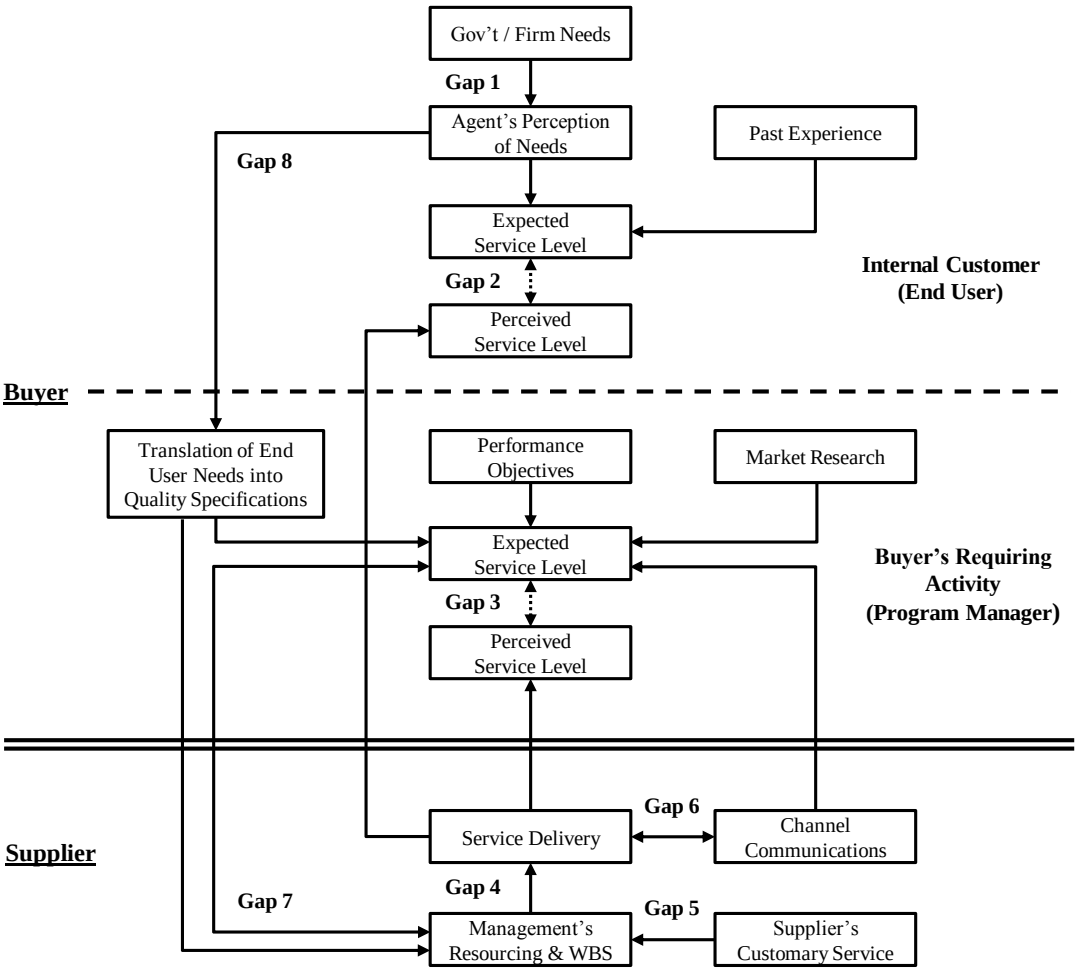

Figure 5. Proposed B2B Gaps Model for Customer-Defined Services

D. REGULATORY AND STATUTORY COMPLIANCE

The government's purchasers, administrators, and inspectors of services acquisitions are tasked with ensuring compliance to the multitude of federal regulations and statutes as well as to any additional regulations or procedures that may be required by the procuring agency in supplements to the Federal Acquisition Regulation (FAR), collectively referred to as the Federal Acquisition System (FAR, 2005; Riddell, 1985). For U.S. Air Force acquisition personnel, the Federal Acquisition System includes the Federal Acquisition Regulation, the Defense Federal Acquisition Regulation Supplement (DFARS), and the Air Force Federal Acquisition Regulation Supplement (AFFARS). Additional acquisition regulations that are outside of the Federal Acquisition System may

include agency guidance, mandatory procedures, policy letters, and case law. A review of FAR 1.102 states that the use of the Federal Acquisition System will satisfy the customer in terms of quality, among other objectives, as a guiding principle.

However, the U.S. Air Force and the DoD have come under much scrutiny regarding compliance with procurement regulations and statutes (see, for example, GAO, 2000, 2005a, 2005c, 2007a). Not all cases of non-compliance are due to fraud, waste, or abuse; in fact, many cases are simply the result of unknowledgeable and inadequately trained personnel—an effect of large-scale increases in agency contracting without commensurate changes to hiring or training practices, termed "corruption by incompetence" by Cohen and Eimicke (2008, p. 30). Nonetheless, recent statistics about procurement fraud have been astonishing: DoD personnel alone accounted for 718 criminal indictments and 565 criminal convictions in procurement fraud cases between fiscal years 2001 and 2005 (GAO, 2006a). Whether caused by poor ethics, incompetence, or other factors, non-compliance with regulations and statutes undermines acquisition policy objectives and often thwarts those procedures established to ensure that the government receives the best value for the taxpayer dollar. Therefore, it is hypothesized that,

> *Hypothesis 1: The greater the compliance with regulations and statutes, the greater the service quality.*

E. REQUIREMENT DEFINITION

Purchasers of goods and services must clearly define contractual requirements in order to properly achieve acquisition objectives, as is evident in the gaps model that is proposed in this thesis for customer-defined services (Figure 5) and in the gaps models developed by Parasuraman et al. (1985) and Kong and Mayo (1993). In these models, one or more gaps exist between the buyer's expectations of the service and the supplier's interpretation of the buyer's expectations. Because the supplier's interpretation of the buyer's expectations ultimately affects the level of service performance, the buyer's perception of the quality of the actual service delivery is largely dependent upon how sufficiently the buyer's expectations and the supplier's interpretation of those

expectations (expectations and disconfirmation) align. Buyers of customer-defined B2B services often state service expectations in requirements documents that are incorporated into purchase agreements or contracts.

Within public procurement, 10 U.S.C. § 2305 requires purchasers to state government specifications in terms of function, performance, or design requirements. However, when acquiring services, specification and measurement of the required level of quality is often more complex than when acquiring goods (Brynste, 1996). This dichotomy is prevalent within the DoD where recent reports have highlighted several instances of decreased acquisition outcomes due to insufficiently defined service requirements (GAO 2002b, 2007b, 2009b). To address some of these issues, the USD(AT&L) has recently called for the strengthening of services requirements documents through the use of standardized work statements and the establishment of market research teams at the portfolio management level (USD[AT&L], 2010b). Even with these additional tools, the added complexity of differing interpretations of requirements documents by the buyer and supplier renders the exact communication of the contents of the service and the desired service level to be nearly impossible. Without a complete understanding of the buyer's service requirement, a supplier may not perform tasks that the government expects to receive under the terms of the contract; may not meet the buyer's expectations in terms of function, performance, and quality; or may not perform those functions necessary for the contract to adhere to regulations, statutes, and policy. Furthermore, because the requirement definition represents the buyer's expectations of service levels, and the supplier's performance is often largely dependent on interpretation of the requirements documents, the buyer's perception of service quality is intrinsically linked to the sufficiency with which requirements are defined and communicated. Therefore,

Hypothesis 2: There will be a direct, positive relationship between the sufficiency of the requirement definition and service quality.

Hypothesis 3: There will be a direct, positive relationship between the sufficiency of the requirement definition and regulatory and statutory compliance.

Recent literature has indicated that an early involvement of suppliers into supply chains may produce positive outcomes for both buyers and suppliers (see, for example, Handfield, Ragatz, Petersen, & Monczka, 1999; Seshadri, 2005). Briscoe, Dainty, Millett, and Neale (2004) examined strategies for the improvement of construction supply chains and found that the early involvement of suppliers resulted in increased integration into the supply chain, improvements to schedule, and a better understanding of client needs and objectives, among other benefits. With respect to services acquisitions, Briscoe et al.'s (2004) conclusion represents a logical outcome as purchasing organizations step away from an introverted approach to procurement planning and capitalize on the expertise of suppliers that are often more experienced and knowledgeable in their respective industries than the purchasing organization's buyers. As such,

> *Hypothesis 4: The greater the extent to which the contractor defines requirements, the greater the service quality.*
>
> *Hypothesis 5: The greater the extent to which the contractor defines requirements, the greater the sufficiency of the requirement definition.*

F. RELATIONAL EXCHANGE

Relational contract theory, also called essential contract theory, was introduced by Macneil (1980), who contended that relationships, rather than discrete transactions, are at the core of contracts. Discrete transactions are of a short duration, have a definite beginning and end, and involve anonymous parties. Conversely, relationships are a sequence of exchanges between parties that are known to each other, typically lasting a long period of time or indefinitely (Dwyer, Schurr, & Oh, 1987). Macneil (1980) developed a list of 10 norms, or expectations of behavior, that are common to all contracts to some degree and that would increase contractual benefits for both parties if present. These norms, which are at least partly shared by all members in a transaction, largely govern individual exchange relationships between firms (Heide & John, 1992). The 10 norms are as follows:

1. role integrity;
2. reciprocity;
3. implementation of planning;
4. effectuation of consent;
5. flexibility;
6. contractual solidarity;
7. restitution, reliance, and expectation interests;
8. creation and restraint of power;
9. propriety of means; and
10. harmonization with the social matrix.

In an extension on relational contract theory, Morgan and Hunt (1994) developed the commitment-trust theory for relational marketing. In their model, commitment and trust are central because they encourage marketers to work toward preserving investments in relationships through cooperation; favor beneficial long-term partnerships over short-term, volatile pacts; and consider higher-risk endeavors without fear of partners acting in opportunistic manners (Morgan & Hunt, 1994). Commitment is a long-term desire to maintain a relationship that is considered to be important or valuable, and trust is a reflection of willingness to depend on a business partner. In Morgan and Hunt's model, communication is a precursor to trust, which ultimately results in successful relational exchanges between parties by providing a mechanism for partners to resolve disputes, align their expectations and perceptions, and jointly develop strategies (Wittmann, Hunt, & Arnett, 2009).

Two of the procurement theories that explain firm governance are relational exchange and transaction cost economics (TCE). TCE theory suggests that activities will be outsourced when transaction costs are lower than the cost of performing the work in-house (Williamson, 1975). The transaction costs of contracting in the market include the costs of writing and negotiating contracts and the costs of monitoring suppliers—actions needed to thwart supplier opportunism. Relational exchange offers a more efficient alternative to governing suppliers. By establishing trust and commitment, suppliers need not be monitored as closely and the contract need not be written as thoroughly. After all,

even the most thorough contracts cannot possibly cover all contingencies. Numerous positive effects of relational exchange include increased cooperation (Morgan & Hunt, 1994, reduced opportunism (Brown, Dev, & Lee, 2000; Joshi & Stump, 1999), increased performance (Skarmeas, Katsikeas, & Schlegelmilch, 2002), and increased satisfaction and service quality (Paulin, Perrien, & Ferguson, 1997). Therefore, given the centrality of relational exchange or buyer–supplier dynamics, any study of B2B exchange should include the effects of relational norms.

When contracting for services, proper communication between a services purchaser, contractor, and end user is critically important to handle variations or unforeseen events in service delivery (Bryntse, 1996). Cohen and Eimicke (2008) included several forms of government–contractor communication problems among their list of top issues within public procurement. First, they argued that poor communication between the government and the contractor's management team often produces an unacceptable level of performance and causes conflicts between the parties, particularly when communication issues result in poorly defined tasks or when projects fail. Similarly, they reasoned that communication issues between the government and the contractor's employees at the staff level may result in employee confusion regarding direction on tasks or assignments. In these situations, the authors argued that the contractor's staff-level employees are often forced to establish direction and solve problems internally, which may result in methods or levels of performance that do not match the government's expectations. In parallel with this line of reasoning, inadequate communication between the government and the contractor's managerial or staff-level employees may result in undesirable contractor performance on those actions required to ensure compliance with the government's procurement policies. Kong and Mayo (1993) reiterated the importance of this function-level communication. They emphasized the need for supply chain members to integrate (e.g., through high involvement and frequency of contact) the respective functional areas of each firm in order to minimize gaps and maximize service levels to the end consumer. Likewise, they also warned that where buyer–supplier interfaces are constrained (e.g., because cross-functional, cross-organizational dialogue is controlled or stymied), gaps in service delivery will occur.

This is logical—particularly when requirements documents inadequately define expectations and needs. Where specifications are vague, communication can fill the void. As such,

> *Hypothesis 6: The greater the communication between the government and the contractor, the greater the service quality.*
>
> *Hypothesis 7: The greater the communication between the government and the contractor, the greater the regulatory and statutory compliance.*

G. AGENCY THEORY

In agency theory, the agency relationship is defined as an agreement in which at least one person, the principal, delegates duties and some decision-making authority to another, the agent (Jensen & Meckling, 1976). Jensen and Meckling (1976) described the agency problem as the likelihood that the agent will not act in the interest of the principal if both parties seek to maximize their utility. Eisenhardt (1989) asserted that two fundamental problems may occur in principal–agent relationships. The first problem will ensue when the principal and agent have conflicting goals, and it is either difficult or expensive for the principal to monitor the agent. The second problem occurs when the principal and agent have different attitudes toward accepting risk. The principal can limit actions by the agent that are misaligned with the principal's interests by expending additional resources on monitoring the agent, by offering incentives, or by paying for the agent's bonding. Therefore, the cost of the agency relationship, or the agency cost, is the sum of these three actions by the principal (Jensen & Meckling, 1976).

Within public procurement, a misalignment of interests between the government (principal) and a contractor (agent) is typically identified through the use of surveillance methods, often termed *quality assurance*. Lam (2008) asserted that surveillance is necessary to ensure service quality in public procurements and argued for its effectiveness. Other authors tend to agree; Axelsson and Wynstra (2002) wrote that service quality is as dependent on the post-award management of performance as it is on the pre-award specification of service requirements and source selection. Despite this,

the GAO found that contracting activities within the DoD have typically placed a far greater emphasis on the act of awarding service contracts than on ensuring that trained and knowledgeable quality assurance personnel are assigned prior to contract award (GAO, 2005b). The GAO also reported that these actions, and others that lead to inadequate post-award surveillance, reduce the government's ability to assure that service suppliers are providing timely and quality services and mitigating performance problems. Therefore,

> *Hypothesis 8: The greater the amount of government surveillance of contractor performance, the greater the service quality.*

The federal government and the DoD prescribe the implementation of performance-based services acquisition (PBSA) procedures in order to address agency problems that occur in the acquisition of services. Most notably, PBSA promotes the procurement of commercial services and promotes contractor innovations through the use of outcome-based requirement definitions, as opposed to requirement definitions that specify the inputs and tasks necessary for performance (USD[AT&L], 2000). The OFPP enumerated four requirements that, at a minimum, must be included in a service contract for the proper implementation of PBSA procedures: an outcome-based requirement definition, performance standards that are tied to requirements, a government-developed plan for monitoring contractor performance against performance standards, and, when appropriate, positive and negative performance incentives (Office of Federal Procurement Policy [OFPP], 1997). Although the DoD has had some issues fully implementing PBSA procedures (see, for example, Ausink, Baldwin, Hunter, & Shirley, 2002; GAO, 2002b), the use of PBSA in public procurement has been linked to improved acquisition outcomes—most notably, reduced cost and improved performance (OFPP, 1998). As such,

> *Hypothesis 9: The greater the extent to which performance-based services acquisition procedures are used, the greater the service quality.*

H. RESOURCE-BASED VIEW

The resource-based view of the firm states that a firm's competitive advantage in the marketplace is based on its ability to acquire and maintain valuable resources important to production (Connor, 1991). Resources are a firm's physical capital, human capital, and organizational capital that improve efficiency or effectiveness (Barney, 1991). However, not all of a firm's capital should be considered a resource because some capital could, in fact, reduce efficiency or effectiveness.

For a firm to build a sustained competitive advantage, defined as a competitive advantage that lasts a long period of time (Jacobsen, 1988), firms must possess resources that are rare, valuable, imperfectly imitable, and non-substitutable by other resources that are valuable but neither rare nor imperfectly imitable (Barney, 1991). Barney (1991) asserted that no firm can gain a competitive advantage in an industry in which firms possess exactly the same resources (homogeneity) and in which the resources are perfectly mobile. However, for a firm that possesses a competitive advantage to achieve returns that are above normal, it must either produce a product that is distinctive in the eyes of buyers or sell a product that is comparable to that of other firms but at a lower cost (Connor, 1991; Porter, 1985).

In terms of the acquisition of services in the U.S. Air Force, alliance resources between the purchasing activity and the requiring activity include acquisition personnel and the time allotted for those personnel to perform all of the functions necessary for the acquisition of the service. First, the sufficiency of the procurement lead-time, or time available to perform those contractual functions required prior to award, varies between procurements and is dictated by the period between the purchaser learning of the requirement and the contract being awarded. The length of this period may determine how well the requirement is defined, the amount or depth of market research that is performed, the appropriateness of the acquisition strategy, and the ability of the contracting activity to comply with applicable directives such as advertising requirements, competing requirements, applying appropriate socio-economic strategies (e.g., set-asides), documenting determinations and findings, and conducting solicitation and contract reviews. As such, it is posited that,

Hypothesis 10: The greater the sufficiency of procurement lead-time, the greater the service quality.

Hypothesis 11: The greater the sufficiency of procurement lead-time, the greater the compliance with regulations and statutes.

Hypothesis 12: The greater the sufficiency of procurement lead-time, the greater the sufficiency of the requirement definition.

As a resource in the purchaser–supplier alliance, the assignment of an adequate number of personnel to perform contract award and administration functions is crucial to the acquisition's overall success. Recent reports by the DoD Inspector General highlighted issues resulting from insufficient manpower and increased turnover due to acquisition workforce reductions (DoDIG, 2000a, 2000b, 2003). Several key areas in which problems were noted include increased program costs, reduced scrutiny and timeliness in reviewing acquisition actions, lost opportunities to develop cost–saving initiatives, insufficient staff to manage requirements, and increased backlogs in closing out completed contracts (DoDIG, 2000a). In particular, the excessive turnover of acquisition personnel threatens the long-term success of acquisitions as government administration functions that are required by contract terms, regulations, or statutes may not be properly accomplished (Special Inspector General for Iraq Reconstruction [SIGIR], 2008).

Dalton, Krackhardt, and Porter (1981) offered multiple classifications for employee turnover, noting that some forms of turnover may not be harmful to organizations. For example, organizations may benefit when lower-performing or disruptive employees depart (Mathis & Jackson, 2003). Other forms of turnover, such as the departure of high-performing personnel at critical times, are clearly detrimental to an organization's ability to achieve desired objectives. As such, some authors have argued that an optimal level of employee turnover exists for firms (see, for example, Abelson & Baysinger, 1984). Other authors broadly contend that turnover is associated with decreased organizational effectiveness (Glebbeek & Bax, 2004). Despite these differing views, research has generally supported the deleterious effects of high levels of employee

turnover on organizational performance (see, for example, Glebbeek & Bax, 2004; Huselid, 1995), regardless of turnover cause or classification. Schlesinger and Heskett (1991) asserted that high employee turnover in service organizations results in long-term decreases in sales and profitability as well as in lower levels of service quality. Harrison (2008) noted that high levels of employee turnover in the aerospace and defense industry have created a knowledge gap; vital information has left companies along with their employees. As such, increased employee turnover is generally associated with decreased efficiency and a diminished ability to meet organizational objectives, especially when the level of turnover is high or excessive. Therefore,

Hypothesis 13: The greater the turnover of government acquisition personnel, the lesser the service quality.

Hypothesis 14: The greater the turnover of government acquisition personnel, the lesser the compliance with regulations and statutes.

I. COMPETENCE-BASED VIEW

Often considered an extension to the resource-based view, the competence-based view claims that competitive advantage is a function of a firm's core competencies. Sanchez, Heene, and Thomas (1996) defined competence as the ability to sustain the coordinated deployment of assets in ways that help a firm achieve its goals. Prahalad and Hamel (1990) applied a three-part litmus test to identify core competences in a firm. First, a core competency should offer potential access to a range of markets, such as Intel's core competency of manufacturing semiconductors. Semiconductors have a broad range of uses in multiple markets from consumer electronics—such as computers, televisions, radios, and phones—to the high-tech worlds of aerospace and medicine. Second, a core competency should provide a benefit to the consumer; such a benefit may be perceived or actual. Intel's corporate experience and status as a frontrunner in the semiconductor industry are likely viewed as benefits by many of the company's customers. Finally, the competency should be difficult for competitors to imitate, such as

Intel's implementation of simultaneous multithreading into the central processing units of personal computers.

Econom (2006) argued that federal agencies must consider contract management as a core competency because the functions performed by third-party contractors are often essential in successfully achieving organizational goals, and she concluded that the success of acquisition organizations is largely dependent on hiring personnel who possess the right mix of skills, abilities, experience, and training. Other studies have also found that this right mix is critical to achieving contract performance outcomes (United States Merit Systems Protection Board, 2005). Within services acquisition, personnel education, training, and experience are enablers for the purchasing organization to effectively deploy assets, monetary and otherwise, to achieve acquisition objectives. Those individuals with the greatest breadth of education, training, and experience may be capable of effectively purchasing and administering a wider range of service contracts to meet customer requirements. Although the development of knowledge may be a result of broad-based practical and educational exposure, experience is often a function of time spent performing tasks. Purchaser education typically occurs outside of the work environment and may be reflected by the granting of degrees or by professional certifications. The level of training of the federal acquisition workforce is measured using the Acquisition Professional Development Program (APDP), which offers three levels of certification in several areas of acquisition based on the completion of training courses and modules, on-the-job experience (time), and the applicant's level of education. In practice, federal acquisition personnel who demonstrate a capability for increased responsibility through competencies of education, training, and work experience may be assigned to award or administer acquisitions that are more complex in definition or structure, requiring compliance with increased numbers of regulations and statutes. As such,

> *Hypothesis 15: There will be a direct, positive relationship between the amount of contract administrator experience and the sufficiency of the requirement definition.*

Hypothesis 16: There will be a direct, positive relationship between the amount of contract administrator experience and regulatory and statutory compliance.

Hypothesis 17: The greater the contract administrator's APDP certification level, the greater the sufficiency of the requirement definition.

Hypothesis 18: The greater the contract administrator's APDP certification level, the greater the regulatory and statutory compliance.

Hypothesis 19: The greater the contract administrator's education level, the greater the sufficiency of the requirement definition.

Hypothesis 20: The greater the contract administrator's education level, the greater the regulatory and statutory compliance.

J. INTERNAL CUSTOMER COMMITMENT

The many roles of the client, or internal customer, are critical to the success of a supply chain throughout the life cycle. Briscoe et al. (2004) found that the internal customer's desire to develop supply chain relationships was the single most important factor to achieving supply chain integration. The authors also found that, during the requirements definition stage of procurement, client organizations influenced how the project team was shaped and the selection of the procurement method. Similarly, the many roles of internal customers in U.S. Air Force services acquisition are critical to overall acquisition success.

First, the internal customer often provides the necessary funding to acquire the service. This level of funding may permit the use of certain performance-based incentives, if appropriate for the contractual action. Second, the internal customer plays an integral role in the generation of requirements documents, such as the Statement of Work or the Performance Work Statement, as well as in the creation of other documents that may be necessary for the proper execution or surveillance of the acquisition. Third, the internal customer must devote manpower to the services acquisition for (1) the evaluation of offers throughout the source selection process, (2) the performance of

quality-assurance functions that are necessary to the surveillance of contractor performance, and (3) the management of the requirement, including contract-change requests, development of past performance information, and the determination of performance-based incentive awards. This level of manpower is often based on manpower standards that allocate full-time positions based on the number of contracts that a unit manages, among other factors (Reed, 2010; U.S. Air Force, 2001). In such a situation, the assignment of available personnel to contracts within a unit's portfolio would be an indication of the level of commitment to each acquisition. Without an acceptable level of commitment from the internal customer to properly conduct the acquisition, adequate standards for the level of service quality may not be established and the contract may not be effectively managed after award to ensure that contractual, regulatory, and statutory requirements are met. As such,

> *Hypothesis 21: The greater the internal customer's commitment to the service acquisition, the greater the compliance with regulations and statutes.*
>
> *Hypothesis 22: The greater the internal customer's commitment to the service acquisition, the greater the sufficiency of the requirement definition.*

K. CONCLUSION

In this chapter, a total of 22 relationships were hypothesized based on a review of relevant literature and theory; a summary of these hypotheses can be found in Table 1. The following chapter presents the research and statistical methods used to explore these relationships, along with measurement scales and a path diagram of the conceptualized modeling of the determinants of services sourcing performance.

Table 1. Research Hypotheses

Notation	Hypothesis
H1	The greater the compliance with regulations and statutes, the greater the service quality.
H2	There will be a direct, positive relationship between the sufficiency of the requirement definition and service quality.
H3	There will be a direct, positive relationship between the sufficiency of the requirement definition and regulatory and statutory compliance.
H4	The greater the extent to which the contractor defines requirements, the greater the service quality.
H5	The greater the extent to which the contractor defines requirements, the greater the sufficiency of the requirement definition.
H6	The greater the communication between the government and the contractor, the greater the service quality.
H7	The greater the communication between the government and the contractor, the greater the regulatory and statutory compliance.
H8	The greater the amount of government surveillance of contractor performance, the greater the service quality.
H9	The greater the extent to which performance-based services acquisition procedures are used, the greater the service quality.
H10	The greater the sufficiency of procurement lead-time, the greater the service quality.
H11	The greater the sufficiency of procurement lead-time, the greater the compliance with regulations and statutes.
H12	The greater the sufficiency of procurement lead-time, the greater the sufficiency of the requirement definition.
H13	The greater the turnover of government acquisition personnel, the lesser the service quality.
H14	The greater the turnover of government acquisition personnel, the lesser the compliance with regulations and statutes.
H15	There will be a direct, positive relationship between the amount of contract administrator experience and the sufficiency of the requirement definition.
H16	There will be a direct, positive relationship between the amount of contract administrator experience and regulatory and statutory compliance.
H17	The greater the contract administrator's APDP certification level, the greater the sufficiency of the requirement definition.
H18	The greater the contractor administrator's APDP certification level, the greater the regulatory and statutory compliance.
H19	The greater the contract administrator's education level, the greater the sufficiency of the requirement definition.
H20	The greater the contract administrator's education level, the greater the regulatory and statutory compliance.
H21	The greater the internal customer's commitment to the service acquisition, the greater the compliance with regulations and statutes.
H22	The greater the internal customer's commitment to the service acquisition, the greater the sufficiency of the requirement definition.

III. METHODOLOGY

A. INTRODUCTION

This chapter will first discuss the design of the research study, including the statistical methodology and the data collection methodology selected. A conceptual model is then presented in which all variables and hypothesized relationships are visually depicted in a path diagram. Finally, the population sampled in the study is discussed, followed by a presentation of the measurement scales for constructs and manifest variables.

B. RESEARCH DESIGN

This study seeks to precisely identify and measure the determinants of services sourcing performance through the testing of models and hypotheses. As a result, the research lends itself to a quantitative approach because hypothesized relationships have been identified and because the scales for measurement of these hypothesized relationships already exist, can be adapted from previous research, or can be created. Quantitative analysis is an explanation of phenomena, in numerical terms, through statistical and mathematical testing of numerical data. This study will primarily use Structural Equation Modeling (SEM) for statistical analysis—a method chosen due to its numerous advantages over other common statistical techniques.

SEM is a multivariate statistical method used to conduct confirmatory factor analysis and to test causal hypothesized relationships between manifest and unobserved (latent) variables. Latent variables are those variables that are not directly observable but that are inferred from a set of other observed variables and, when utilizing a survey for data collection, are often measured using a scale. In SEM, latent or observed variables that are unexplained in a model are considered to be exogenous, having one or more causal paths that lead from them to other variables. Conversely, variables that are explained in the model are considered to be endogenous and have one or more causal paths leading to them from other endogenous or exogenous variables.

At the most fundamental level, SEM provides researchers a tool to measure multivariate relationships containing a mixture of latent constructs and observed variables (MacCallum, 1995). One primary advantage lies in the ability of SEM to simultaneously evaluate all relationships in a research model (Hair, Black, Babin, & Anderson, 2010). Additionally, unlike other multivariate techniques, SEM provides an assessment of construct measurement error; alternative statistical tools such as regression analysis typically assume that there is no error in measured variables, which may subject a researcher to the interpretation of faulty results (Byrne, 2010). Furthermore, SEM allows for the analysis of mediating variables and can perform a simultaneous analysis of multiple dependent variables, which may be critical to accurately estimating complex models (Hoyle, 1995). Finally, SEM can be used to assess the overall level of model fit for adequacy and for comparison against alternative, competing models (Hoyle & Panter, 1995).

After selection of the statistical method, the second step in the research design was the development of a conceptual model that visually depicted the hypothesized relationships that were studied. Thus, the path diagram of the conceptual model (Figure 6) contains 22 relationships that represent the 22 hypotheses, 3 endogenous latent variables, 4 exogenous latent variables, and 6 exogenous observed variables. In this path diagram, latent constructs are depicted using ellipses and observed variables are depicted using rectangles. Hypothesized relationships between variables are depicted using arrows; the directionality of causal paths begins from a variable at the arrow's tail and ends at a variable about the arrow's point. These arrows are annotated with a plus or minus sign to reflect the expected sign of the relationship.

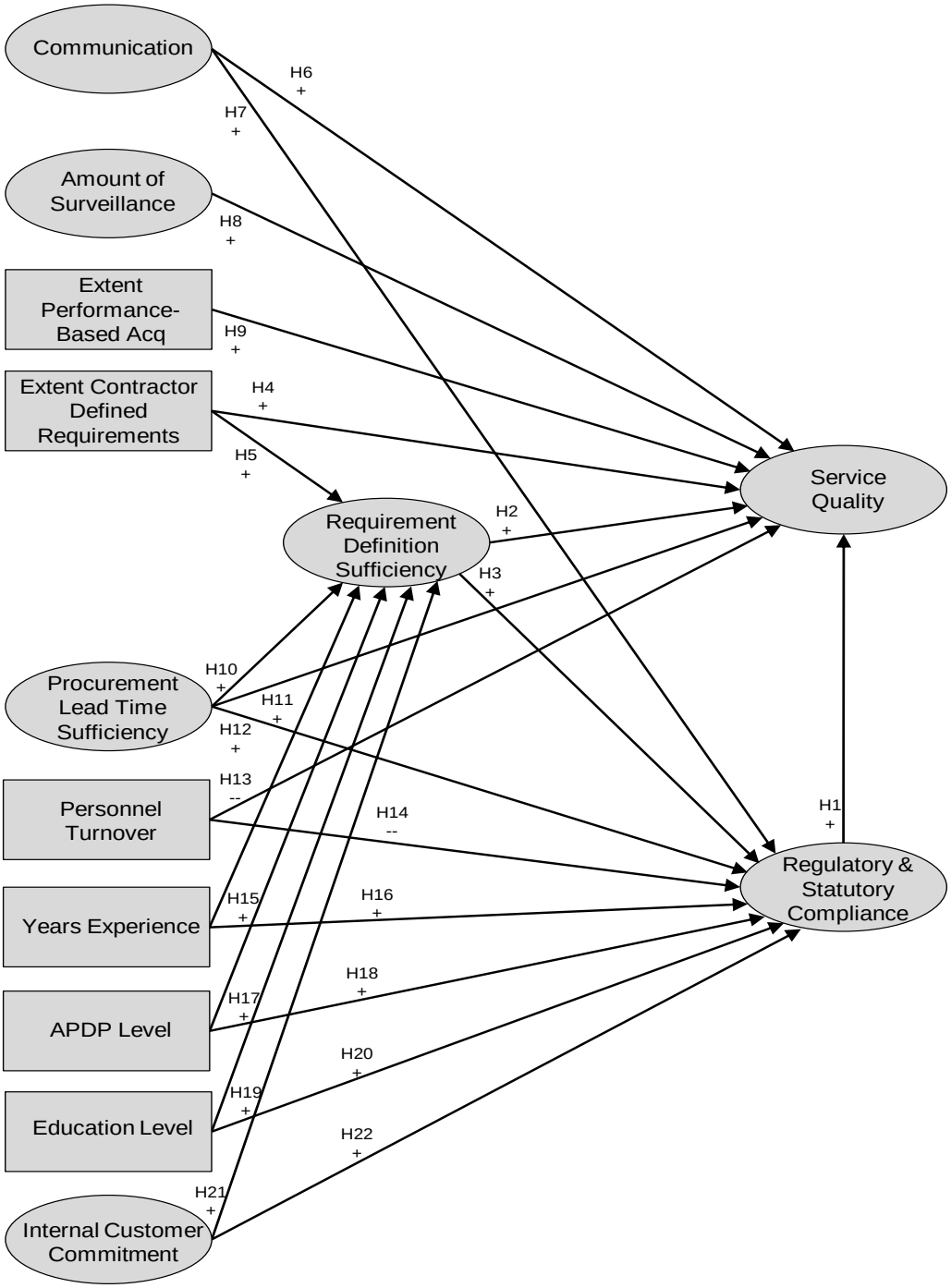

Figure 6. Conceptual Model

C. SAMPLE

The population for this study consisted of U.S. Air Force civilian and military contracting personnel who administer service contracts within the United States. Several constraints existed for surveying this population. First, because resources and timing prohibited data collection from every individual in the population, data were drawn from a sample consisting of the broadest range of contract administration personnel within the U.S. Air Force using a web-based survey. Second, a list of contact information for potential respondents did not exist and could not reasonably be created. Due to the costs required to mail a sufficient quantity of surveys to contracting units and the resources required to manually input responses into a dataset, surveys were deployed by forwarding to commanders and supervisors at contracting units an e-mail that contained a link to an online survey. Finally, the population was limited to contracting personnel who administer service contracts within the United States because cultural and business norms, as well as standards for the application of contracting procedures, may differ in other countries.

Efforts were made to ensure that the sample provided an accurate representation of the population; however, the possibility exists that unknown factors may have predisposed the selection towards a biased sample (Kerlinger & Lee, 2000). Tests for bias due to non-response are presented in Chapter IV.

D. SURVEY DESIGN AND CONSTRUCT MEASUREMENT

A total of 44 measures were used to capture the 7 latent constructs, which underlie these measures. While some scales had to be created, existing, proven scales were used when possible. All latent constructs were measured using 7-point Likert-type scales.

Hartline and Ferrell (1996) suggested that unresolved issues with the measurement of service quality have caused the proper selection of construct measures to become problematic. The five-dimension SERVQUAL scale developed by Parasuraman et al. (1988) has been criticized for its use of gap scores, its mixture of positively and

negatively worded questions, and its inability to permit researchers to generalize the service quality dimensions to multiple contexts. This scale consists of 44 questions, measuring *ex ante* service expectations and *ex post* perceptions of actual service quality. Conversely, Cronin and Taylor (1992) contended that a performance-only measure of service quality, such as SERVPERF, is more effective and includes dimensions that can be generalized over a broader range of services. However, neither scale has been widely adopted as a single measure of service quality. As an alternative, Hartline and Ferrell (1996) argued for the appropriateness of modification to the SERVQUAL scale so that each separate set of 22 questions for the measurement of expectations and perceptions is combined into one question each (for a total of 22) through modification of the Likert scale. Hartline and Ferrell (1996) contended that service customers will respond to questions regarding quality using expectancy-disconfirmation without the need for such a separation. A similar approach was taken in this study.

The five dimensions of SERVQUAL proposed by Parasuraman et al. (1988) were tangibles, reliability, responsiveness, assurance, and empathy. Reliability and assurance are specifically applicable and of interest to the study of B2B services, such as those services acquired through service contracts by the U.S. Air Force. However, tangibles, responsiveness, and empathy do not fit within a B2B context. Tangibles refers to physical evidence of the service—specifically the appearance of the supplier's facility; the appearance of personnel, tools, or equipment used in the service; the physical representations of the service; and the perceptions of other customers in the supplier's facility. In a B2B context, and specifically on a military installation, it is unlikely that customers would be exposed to the tangibles of service delivery for many contracts. Similarly, responsiveness and empathy assume that the purchaser has face-to-face contact with the service provider during service delivery, which is less typical with the purchasing of business-to-business services. The scales for reliability and assurance were therefore retained for inclusion in the study, and the scales for tangibles, empathy, and responsiveness were discarded.

A new dimension, responsiveness to requirements, was added to better suit the assessment of service quality in customer-defined B2B acquisitions. Kong and Mayo

(1993) attempted to address the additional gaps required to adapt the Gaps Model developed by Parasuraman et al. (1985) to the context of B2B services but fell short; the five dimensions of SERVQUAL still do not fit within their framework for B2B services. As such, a new scale containing an additional dimension is needed to accurately and validly measure service quality in customer-defined B2B service acquisitions. The items in this new dimension, responsiveness to requirements, address the additional gaps in the proposed gaps model (Figure 4) by measuring how well perceived service levels reflect expected service levels, as defined in customer-generated requirements documents. To assess the content validity of the proposed dimension, items were reviewed by three academicians in business- and supply-chain-related fields and were later pre-tested qualitatively by practitioners at three different buying locations. Acquisition personnel at each of these locations administered portfolios of customer-defined B2B service acquisitions ranging in type from low-complexity grounds maintenance services to highly technical engineering support and research and development services. The final dimension consists of five items that, like the remainder of the SERVQUAL dimensions, were measured on a 7-point Likert-type scale, with anchors of *much worse than I expected* and *much better than I excepted*. This final scale for the measurement of service quality is presented in Table 2.

Table 2. Construct Measurement of Service Quality

Scale item	Survey question
SQa*	When the contractor's management promises to do something by a certain time, it does so.
SQb*	When you have problems, the contractor's management is sympathetic and reassuring.
SQc*	The contractor's dependability.
SQd*	The contractor provides its services at the time it promises to do so.
SQe*	The contractor's keeping of its records accurately.
SQf**	How much you can trust employees of the contractor.
SQg**	How much you feel safe in your interactions with the contractor's employees.
SQh**	How polite the contractor's employees are.
SQi**	The adequacy of the support the contractor's employees receive from their company to do their jobs well.
SQj***	The contractor met the requirements of the contract.
SQk***	The contractor satisfied our need.
SQl***	The contractor performed the work we needed it to do.
SQm***	The timeliness of the contractor's work.
SQn***	The quality of the contractor's work.

*Reliability, **Assurance, ***Responsiveness to Requirements.

No appropriate, previously validated scales were available for the measurement of regulatory and statutory compliance. Because an observable measure for compliance that cited specific regulations and statutes could not be generalized across all service contracts, a semantic differential scale (Table 3) was generated that broadly assessed the respondent's perception of compliance with regulations and statutes. The scale consists of five questions that were measured on a 7-point Likert-type scale with anchors of *strongly disagree* and *strongly agree*.

Table 3. Construct Measurement of Regulatory and Statutory Compliance

Scale item	Survey question
RSCa	This contract is compliant with all applicable policy letters, the Federal Acquisition Regulation and its Supplements, and procurement law.
RSCb	There is nothing wrong with this contract.
RSCc	This contract does not violate applicable requirements of policy letters, the Federal Acquisition Regulation (FAR), FAR Supplements, or procurement law.
RSCd	If this contract were to be inspected by an independent organization it would be deemed compliant.
RSCe*	There are aspects of this contract that, if changed, would make it more compliant with policy, laws, or regulations.

*Reverse-coded item.

Similarly, no appropriate, previously validated scales were available for the measurement of the sufficiency of the requirement definition. Because contract requirements and, by extension, the definitions of those requirements vary broadly between acquisitions, the developed scale assessed the administrator's overall perception of the sufficiency of the definition. The scale (Table 4) consists of five questions measured on a 7-point Likert-type scale with anchors of *strongly disagree* and *strongly agree*.

Table 4. Construct Measurement of Requirement Definition Sufficiency

Scale item	Survey question
RD1a	The requirement was very well defined in the contract.
RD1b	The contract (including the statement of work, performance work statement, specification, drawings, etc.) defined the requirement very well.
RD1c	There were no flaws or omissions in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.)
RD1d	The requirement, as defined in the contract, expressed to the contractor exactly what we needed.
RD1e	There were no ambiguities in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.)

The scale for the measurement of communication (Table 5) was adapted from Morgan and Hunt (1994). In the original three-item reflective scale, all measures began with "In our relationship, my alliance partner and I … ." The text was modified to read as follows: "In our relationship, the government and contractor … ." Additionally, two items were added to the scale to assess how effectively the administrator was able to communicate the government's needs and how carefully the contractor listened to the government's requests. The final scale consists of five questions measured on a 7-point Likert-type scale with anchors of *strongly disagree* and *strongly agree*.

Table 5. Construct Measurement of Communication

Scale item	Survey question
REa	In our relationship, the government and contractor effectively communicate expectations for each other's performance
REb	In our relationship, the government and contractor keep each other informed of new developments.
REc	In our relationship, the government and contractor provide each other with information that helps both parties.
REd	I am able to communicate my needs effectively to this contractor.
REe	This contractor listens carefully to my requests.

No appropriate, previously validated scale was available for the measurement of the amount of contract surveillance. A scale was developed (Table 6) based on surveillance practices established in the FAR, in which surveillance occurs in four primary areas: service quality, timeliness of performance, fulfillment of requirements included in the requirements document, and fulfillment of other contract terms and conditions (such as adherence to the labor rates established by the Department of Labor). The scale asked respondents to use a 7-point Likert-type scale to rate the amount of surveillance in each area. Scale anchors were *no monitoring of supplier* and *extensive monitoring of supplier*.

Table 6. Construct Measurement of Amount of Surveillance

Scale item	Survey question
AT1a	Service Quality
AT1b	Timeliness of Performance
AT1c	Fulfillment of Requirements in the Statement of Work / Performance Work Statement
AT1d	Compliance with Contract Terms & Conditions

The scale for the measurement of internal customer commitment (Table 7) was adapted from Garbarino and Johnson (1999), who developed a four-item scale for the measurement of customer commitment. All four items could be generalized to fit a business-to-business context with some modification and were measured on a 7-point Likert-type scale with anchors of *no extent* and *great extent*.

Table 7. Construct Measurement of Internal Customer Commitment

Scale item	Survey question
ICCa	To what extent is your primary internal customer proud to be a member of this service acquisition team?
ICCb	To what extent does your primary internal customer feel a sense of purpose when the team achieves specific acquisition objectives?
ICCc	To what extent does your primary internal customer care about the long-term success of this acquisition?
ICCd	To what extent is your primary internal customer dedicated to ensuring the acquisition meets requirements?

No appropriate, previously validated scales were available for the measurement of procurement lead-time sufficiency. A five-item scale was developed (Table 8) to measure the administrator's perception of the adequacy of the procurement lead-time. The scale consists of five questions measured on a 7-point Likert-type scale with anchors of *strongly disagree* and *strongly agree*.

Table 8. Construct Measurement of Procurement Lead-Time Sufficiency

Scale item	Survey question
RBV1a*	I did not have enough time to award a quality contract.
RBV1b*	The milestones for awarding this contract were too aggressive.
RBV1c*	My leadership or my customer wanted this contract awarded too fast.
RBV1d	I was not rushed to award this contract.
RBV1e	I had sufficient time to get this contract awarded.

*Reverse-coded item.

Questions were constructed to measure single indicators and to collect demographic data. First, 7-point Likert-type scales were employed to measure the extent that PBSA procedures were used and the extent that the contractor defined requirements (Table 9). Anchors for both scales were *none* and *substantial*.

Table 9. Measurement of Extents PBSA and Contractor Defined Requirements

Variable	Survey question
AT2	The extent to which this contract is performance based.
RD2	To what extent, if any, did the contractor help define the requirements prior to contract award? (The contractor's help defining requirements includes questions before and after the issuance of the solicitation, participation in industry days, responses to requests for information, responses to draft RFQ/RFP, and any other dialogue with the contacting officer or specialist.)

The number of personnel required to administer a service contract may vary substantially based on scope, value, or other factors. Therefore, personnel turnover was measured by dividing the number of times personnel had turned over by the number of personnel assigned to the contract. This allowed turnover to be measured as a percentage and required two questions for measurement. The survey questions for the measurement of turnover can be found in Table 10.

Table 10. Measurement of Turnover

Variable	Survey question
RBV2a	How many acquisition personnel (contracting officers + contract specialists + contracting officer representatives + quality assurance evaluators/personnel + inspectors + program/project manager or other active representative of the user) are currently assigned to this contract? Include only those individuals who actively, routinely help manage the contract.
RBV2b	Over the life of this contract, how many different times have personnel turned over? Consider all Contract Administrators, Contract Specialists, Contracting Officers, Contracting Officer's Representatives, and Quality Assurance Personnel who actively, routinely helped manage the contract.

The contract administrator's levels of APDP certification and education were measured using ordinal scales, and the administrator's number of years of contracting experience was measured by text input into a field. For APDP certification level, possible responses were *no contracting APDP certification*, *APDP Level I*, *APDP Level II*, and *APDP Level III*. For level of education, possible responses were *high school diploma/GED*, *associate's degree*, *bachelor's degree*, *master's degree*, and *doctoral/professional degree*.

Table 11. Measurement of Experience, APDP Level, and Education Level

Variable	Survey question
CBV1	How many years of experience do you have in contracting?
CBV2	At the time you started working on this service contract, what was the highest level of Acquisition Professional Development Program (APDP) certification that you held in the area of Contracting?
CBV3	What is the highest level of education that you have attained?

Finally, questions were included in the survey to measure sample demographics. Respondent-related demographics included the respondent's age, gender, agency of employment, workload, and whether the respondent held professional certifications outside of those offered by the APDP. Demographic questions to assess the makeup of

sample service contracts included the service type and commerciality; the contract type, instrument, age, and value; the type and amount of incentives; the type and amount of quality-assurance inspections and the experience of inspectors; the number of formal communications to the contractor; and a direct measure of procurement lead-time. These survey questions can be found in Appendix A.

All survey questions were pre-tested through interviews with current U.S. Air Force contract administrators at three separate installations and through reviews by graduate-level students and professors who specialize in the field of DoD acquisition. Inputs received from these individuals on scale items were used to refine the measures. Interviewees and reviewers were also presented with a copy of the conceptual model to verify content validity. Responses from these individuals supported the proposed research hypotheses and did not reveal a need to re-specify the conceptual model by adding new relationships or by removing existing ones.

Once constructed, the order of the survey questions was structured to reduce bias among scale items by mixing questions with like scales; the complete survey can be found in Appendix A. As required for the deployment of surveys for data collection from U.S. Air Force personnel, the survey was reviewed and approved by the Air Force Survey Office. An additional review was conducted through the Department of the Navy's Institutional Review Board to ensure the protection of human subjects.

E. CONCLUSION

This chapter first presented the research methodology and statistical method used in this study. A conceptual model was then presented, followed by a discussion of the population and sampling methods and the survey design. The next chapter reports the results of the data collection and statistical analysis.

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IV. RESULTS

A. INTRODUCTION

This chapter presents the results of the survey deployment and of the model and hypothesis testing. The results of the data collection efforts are discussed first, along with a presentation of sample demographics. Next, data are examined to verify that the assumptions of SEM analysis are met. These examinations include tests for normality, outliers, scale and construct reliability, convergent validity, and discriminate validity. Exploratory factor analysis (EFA) is then performed in PASW Statistics Version 18.0 to purify scales, and confirmatory factor analysis (CFA) and structural equation modeling (SEM) are accomplished in Mplus Version 6.0. Two competing structural models are presented: a hypothesized structural model containing all hypothesized relationships and a trimmed structural model in which non-significant, originally hypothesized causal paths have been removed. Finally, an alternative model is analyzed in SEM and further analysis is performed using other statistical methods.

In the presentation of the results in this chapter, the level of support for a path was determined by the significance level of the estimated path coefficient; supported path estimates have significance levels less than 0.05, moderately supported path estimates have significance levels between 0.05 and 0.10, and non-supported path estimates have significance levels greater than 0.10. Path estimates and their respective effect sizes are standardized. As opposed to unstandardized estimates, which retain the scaling information of those variables involved, the scaling of standardized estimates is not linked to the scale of the variables; they estimate the change in standard deviation of the dependent variable based on a change of one standard deviation to the independent variable when all other independent variables are held at zero (Hoyle, 1995). When interpreting standardized estimates, a relationship with a parameter estimate greater than 0.50 is considered to have a large effect; a relationship with a parameter estimate between 0.20 and 0.50 is considered to have a moderate effect; and a relationship exhibiting a parameter estimate less than 0.20 is considered to have a small effect (Hair et al., 2010).

Because this study used psychometric scales to measure unobserved variables, it is not appropriate to interpret the estimate as a marginal change; rather, it is more appropriate to generalize the interpretation of estimates into effect sizes and to employ a comparative approach.

B. DATA COLLECTION

Data were collected electronically using a web-based survey deployment. Because it is difficult to identify personnel who have the necessary service contracting experience required for response to the survey, an invitation (Appendix B) was forwarded via e-mail to eligible individuals through supervisors of U.S. Air Force contracting units. A memorandum of support for the study from the Deputy Assistant Secretary of the Air Force for Contracting and from the Air Force Program Executive Officer for Services was attached to the message (Appendix C). Of the 60 units invited to participate in the study, 42 units agreed to participate and collectively distributed the survey to 743 personnel. The only criterion given to supervisors for selecting personnel was that respondents must either currently administer service contracts or must have done so in the recent past. Of the 743 potential participants, 252 individuals responded, yielding a 34% response rate, which is consistent with rates reported for web-based surveys (Dillman, 2000). Within these responses, 12 were later discarded due to missing, faulty, or inconsistent responses. Summary statistics from the remaining 240 usable responses can be found in Table 12.

Table 12. Summary Statistics

Variables (n=240)	Measure	Mean	Std. Dev.	Min.	Max.	Variables (n=240)	Measure	Mean	Std. Dev.	Min.	Max.
Service quality	SQa	5.38	1.34	2.00	7.00	Communication	REa	5.73	1.18	3.00	7.00
	SQb	5.55	1.29	1.00	7.00		REb	5.65	1.29	1.00	7.00
	SQc	5.77	1.17	2.00	7.00		REc	5.70	1.24	1.00	7.00
	SQd	5.70	1.18	3.00	7.00		REd	5.88	1.17	1.00	7.00
	SQe	5.47	1.33	1.00	7.00		REe	5.80	1.08	1.00	7.00
	SQf	5.62	1.17	1.00	7.00	Amount of surveillance	AT1a	5.29	1.49	1.00	7.00
	SQg	5.92	1.13	2.00	7.00		AT1b	5.28	1.52	1.00	7.00
	SQh	5.89	1.15	1.00	7.00		AT1c	5.34	1.53	1.00	7.00
	SQi	5.49	1.30	1.00	7.00		AT1d	5.44	1.48	1.00	7.00
	SQj	5.78	1.23	1.00	7.00						
	SQk	5.76	1.18	2.00	7.00	Internal customer commitment	ICCa	5.25	1.47	1.00	7.00
	SQl	5.79	1.23	1.00	7.00		ICCb	5.40	1.47	1.00	7.00
	SQm	5.71	1.25	1.00	7.00		ICCc	5.81	1.25	1.00	7.00
	SQn	5.38	1.23	1.00	7.00		ICCd	5.67	1.33	1.00	7.00
Regulatory and statutory compliance	RSCa	6.19	1.16	1.00	7.00	Procurement lead-time sufficiency	RBV1a	4.81	1.86	1.00	7.00
	RSCb	4.78	1.74	1.00	7.00		RBV1b	4.59	1.80	1.00	7.00
	RSCc	6.23	1.18	1.00	7.00		RBV1c	4.45	1.93	1.00	7.00
	RSCd	6.01	1.10	1.00	7.00		RBV1d	4.13	1.84	1.00	7.00
	RSCe	4.80	1.75	1.00	7.00		RBV1e	4.45	1.69	1.00	7.00
Requirement definition sufficiency	RD1a	5.31	1.49	1.00	7.00	Extent PBSA	AT2	5.60	1.63	1.00	7.00
	RD1b	5.25	1.45	1.00	7.00						
	RD1c	4.68	1.63	1.00	7.00	Turnover	RBV2	1.22	1.17	0.00	7.00
	RD1d	5.53	1.27	1.00	7.00	Buyer experience	CBV1	11.66	9.88	0.00	41.00
	RD1e	4.91	1.59	1.00	7.00	APDP level	CBV2	1.68	1.06	0.00	3.00
Extent contractor defined requirements	RD2	2.57	1.74	1.00	7.00	Education level	CBV3	1.98	0.98	0.00	4.00

C. SAMPLE DEMOGRAPHICS

From the 240 usable responses, the average respondent was 41.7 years old and had 11.7 years of federal contracting experience. The gender of respondents was nearly even, with males accounting for 51.9% of respondents and females accounting for 48.1% of respondents. Respondents had a diverse range of educational experience, with the highest level of education for 11.9% of respondents being a high school diploma or general equivalency diploma, the highest level of education for 12.3% of respondents being an associate's degree, the highest level of education for 43.2% of respondents being a bachelor's degree, and the highest level of education for 31.7% of respondents being a master's degree. Only two respondents, or 0.8%, held a doctoral or professional degree. When the respondents were asked about their Acquisition Professional Development Program (APDP) certification level in the area of contracting, 19.3% reported that they held no APDP contracting certification, 18.5% reported that they held a Level I APDP contracting certification, 36.6% reported that they held a Level II APDP contracting certification, and 25.5% reported that they held a Level III APDP contracting certification. Additionally, 37 respondents, or 15.4%, reported that they held a professional certification other than an APDP certification, such as those granted by the National Contracting Management Association or the Institute for Supply Management. Demographics for the education and certification levels of the respondents can be found in Table 13.

Table 13. Education and Certification Demographics

Education level	Percent of total	Certification level	Percent of total
High school diploma or GED	11.90%	No APDP certification	19.30%
Associate's degree	12.30%	APDP Level I	18.50%
Bachelor's degree	43.20%	APDP Level II	36.60%
Master's degree	31.70%	APDP Level III	25.50%
Doctoral or professional degree	00.80%	Other professional certification	15.40%

Respondents were asked to keep one specific service contract in mind while completing the survey. A diverse range of service types were reported (Table 14). Of the respondents, 84.4% reported their contract type as being fixed-price, and 9.1% of respondents reported their contract type as being hybrid, a combination of multiple contract types. Of the remainder, 1.7% respondents reported labor-hour contracts, 1.2% reported cost-reimbursement contracts, 0.8% reported time and materials contracts, and 2.9% reported *other*. Additionally, 78.2% of respondents reported that the service being acquired met the definition of a commercial service, as defined in the Federal Acquisition Regulation.

Table 14. Service Type Administered by Respondents

Service Type	Percent of total
Maintenance/repair	22.22
Professional, administrative and management support	17.70
Utilities and housekeeping	17.28
Medical	10.29
Education and training	4.53
Architect-engineering	3.29
Quality control, testing, and inspection	0.82
Research and development	0.82
Other	23.05

D. ASSUMPTIONS

1. Missing Data

Nine of the original 252 responses were discarded due to missing data. Three of the remaining responses did not include a properly reported age in the demographic field; these responses were not used when reporting age-related demographic information but were imputed for tests of non-response bias through mean substitution. An additional five responses included a plus symbol as a qualifier in a total of six data fields and two responses included the preposition *over* in a total of two data fields. In each of these cases, responses were assumed to be 1 plus the numerical response.

2. Outliers

Prior to performing tests for the detection of outliers, data were first assessed for faulty or inconsistent responses. The inclusion of four reverse-coded survey items (Churchill, 1979) allowed for the identification of firewalled responses (identical responses for all survey questions), where a firewalled response would likely also result in the identification of a case as a multivariate outlier. A total of three survey responses were identified as faulty due to an examination of the reverse-coded items and an assessment of the overall survey response, including any comments left by the respondent in the comment field. Each of these responses was discarded.

Next, the presence of univariate and multivariate outliers was assessed using PASW Statistics Version 18.0. To detect univariate outliers, responses for each variable were saved as standardized values and evaluated against a benchmark in which potential outliers had z-scores outside of ±3.00. Each potential case was reviewed individually; none appeared to be invalid or warranted removal from the data set.

An assessment for the presence of multivariate outliers was performed by computing Mahalanobis Distance using a multiple regression in PASW Statistic Version 18.0 in which the dependent variable was arbitrarily selected and all other variables were included as independent variables (Table 14); associated probabilities were calculated using the chi-square distribution. Byrne (2010) asserted that a case containing multivariate outliers is identifiable when the Mahalanobis D^2 stands distinctly apart from other D^2 values. A review of D^2 values in Table 15, which contains the highest 60 values, reveals a distribution in values from 61 to 142, with 12 cases exceeding a D^2 value of 100. All cases with a probability less than or equal to 0.001 were individually reviewed; none appeared to be invalid or warranted removal from the data set.

Table 15. Outlier Assessment

Record	Mahalanobis D-Squared	P-value	Record	Mahalanobis D-Squared	P-value	Record	Mahalanobis D-Squared	P-value
146	142.18	< 0.001	182	78.86	0.003	118	69.24	0.024
96	133.28	< 0.001	15	78.53	0.004	6	68.00	0.030
82	124.06	< 0.001	117	78.31	0.004	73	67.08	0.036
9	120.29	< 0.001	4	77.98	0.004	112	66.28	0.041
125	111.63	< 0.001	84	77.00	0.005	76	66.27	0.041
54	109.94	< 0.001	56	76.77	0.005	91	66.21	0.042
143	109.40	< 0.001	3	75.92	0.006	128	65.94	0.044
217	107.04	< 0.001	113	75.45	0.007	225	65.26	0.049
115	104.58	< 0.001	150	75.35	0.007	162	64.75	0.054
199	102.15	< 0.001	62	74.69	0.008	20	64.52	0.056
122	100.65	< 0.001	58	73.07	0.011	98	64.50	0.056
104	100.25	< 0.001	22	72.69	0.012	52	64.49	0.056
169	97.96	< 0.001	216	72.19	0.014	179	64.27	0.058
34	94.61	< 0.001	207	71.17	0.017	23	63.73	0.064
31	88.78	< 0.001	39	70.95	0.017	200	63.00	0.072
46	88.53	< 0.001	221	70.71	0.018	141	62.28	0.081
126	87.89	< 0.001	194	70.59	0.019	108	62.09	0.083
173	85.35	0.001	53	69.92	0.021	119	61.96	0.085
190	82.93	0.001	65	69.61	0.022	237	61.34	0.094
185	82.89	0.001	154	69.38	0.023	61	61.27	0.095

3. Normality

An assumption of normality is extremely important to the analysis of structural equation models (Arbuckle, 2007). The maximum likelihood method of estimation, the most commonly used method of estimation in SEM and the method that was used in this study, is considered to be robust against modest levels of non-normality (Chou & Bentler, 1995). Alternative methods of estimation, such as asymptotically distribution-free or generalized least squares, may be used when data depart substantially from normality, but these methods typically require samples of substantial size (Muthén & Kaplan, 1992).

Although normally distributed data take the form of a symmetrical bell curve, non-normally distributed data may exhibit a curve that is skewed in either direction or that is abnormally peaked, termed *kurtosis*. A distribution with too few cases in the tails of the curve (positive kurtosis) will exhibit a higher-than-normal peak. Alternatively, a distribution with too many cases in the tails of the curve (negative kurtosis) will exhibit a flatter-than-normal peak (DeCarlo, 1997).

Table 16 displays an assessment of normality that was produced using descriptive statistics in PASW Statistics Version 18.0. Using the benchmark of ± 2.0 for significant skewness (West, Finch, & Curran, 1995), a review of the values in the table does not reveal that distributions for any of the variables depart substantially from normality as a result of skew.

The assessment of normality also displays test statistics for kurtosis. In the analysis of kurtosis, normal distributions display a standardized kurtosis value (β_2) of 3.0, and rescaled distributions display a β_2 value of 0. West, Finch, and Curran (1995) - suggested that rescaled β_2 values greater than or equal to seven are indicative, to some extent, of non-normality. Since none of the β_2 values in the assessment exceed this threshold, it can be assumed that univariate kurtosis does not exist and that the assumption of normality is not violated.

Table 16. Normality Assessment

Variable	Min.	Max.	Skew	Cricital Region	Kurtosis (β_2)	Cricital Region	Variable	Min.	Max.	Skew	Cricital Region	Kurtosis (β_2)	Cricital Region
SQa	2.00	7.00	–0.53	–3.35	–0.64	–2.01	REa	3.00	7.00	–0.74	–4.69	–0.33	–1.05
SQb	1.00	7.00	–0.81	–5.12	0.37	1.16	REb	1.00	7.00	–1.00	–6.31	0.71	2.25
SQc	2.00	7.00	–0.78	–4.95	–0.18	–0.55	REc	1.00	7.00	–0.92	–5.81	0.72	2.29
SQd	3.00	7.00	–0.64	–4.05	–0.59	–1.88	REd	1.00	7.00	–1.66	–10.51	3.77	11.91
SQe	1.00	7.00	–0.70	–4.40	–0.07	–0.23	REe	1.00	7.00	–0.96	–6.06	1.23	3.89
SQf	1.00	7.00	–0.80	–5.04	0.72	2.28	AT1a	1.00	7.00	–0.87	–5.49	0.36	1.15
SQg	2.00	7.00	–0.97	–6.10	0.50	1.58	AT1b	1.00	7.00	–0.87	–5.47	0.25	0.79
SQh	1.00	7.00	–0.99	–6.25	0.76	2.39	AT1c	1.00	7.00	–0.88	–5.57	0.23	0.73
SQi	1.00	7.00	–0.84	–5.32	0.62	1.97	AT1d	1.00	7.00	–0.93	–5.87	0.44	1.40
SQj	1.00	7.00	–1.01	–6.39	0.62	1.97	ICCa	1.00	7.00	–0.73	–4.60	0.01	0.03
SQk	2.00	7.00	–0.77	–4.86	–0.09	–0.27	ICCb	1.00	7.00	–0.81	–5.11	0.39	1.22
SQl	1.00	7.00	–1.03	–6.52	0.82	2.59	ICCc	1.00	7.00	–1.04	–6.58	0.78	2.45
SQm	1.00	7.00	–0.93	–5.85	0.43	1.37	ICCd	1.00	7.00	–0.89	–5.62	0.10	0.31
SQn	1.00	7.00	–0.47	–2.95	–0.08	–0.26	RBV1a	1.00	7.00	–0.48	–3.01	–0.89	–2.81
RSCa	1.00	7.00	–1.82	–11.48	3.75	11.85	RBV1b	1.00	7.00	–0.32	–1.99	–0.84	–2.67
RSCb	1.00	7.00	–0.62	–3.91	–0.54	–1.72	RBV1c	1.00	7.00	–0.34	–2.16	–0.96	–3.04
RSCc	1.00	7.00	–1.95	–12.36	4.36	13.79	RBV1d	1.00	7.00	–0.03	–0.16	–0.94	–2.98
RSCd	1.00	7.00	–1.41	–8.89	2.41	7.63	RBV1e	1.00	7.00	–0.28	–1.80	–0.54	–1.72
RSCe	1.00	7.00	–0.38	–2.43	–0.93	–2.94	AT2	1.00	7.00	–1.28	–8.10	1.08	3.42
RD1a	1.00	7.00	–0.91	–5.76	0.34	1.06	RBV2	0.00	7.00	1.93	12.18	4.94	15.61
RD1b	1.00	7.00	–0.78	–4.91	0.07	0.22	CBV1	0.00	41.00	0.83	5.22	–0.37	–1.18
RD1c	1.00	7.00	–0.42	–2.68	–0.65	–2.05	CBV2	0.00	3.00	–0.33	–2.07	–1.10	–3.48
RD1d	1.00	7.00	–0.99	–6.27	0.83	2.61	CBV3	0.00	4.00	–0.68	–4.32	–0.31	–0.97
RD1e	1.00	7.00	–0.67	–4.24	–0.21	–0.67							
RD2	1.00	7.00	0.85	5.36	–0.34	–1.07							

4. Non-Response Bias

Non-response bias was estimated using extrapolation methods (Armstrong & Overton, 1977). The extrapolation method is a commonly used method to estimate bias when responses are received in successive waves after follow-up communications to non-respondents (Filion, 1976). Responses in this study were grouped into waves according to the order of arrival, with non-respondents belonging to an unobserved wave that most closely resembles the final wave of respondents (Armstrong & Overton, 1977). Since non-responders were least likely to resemble early responders and were most likely to resemble late responders, differences between early and late responders were explored to detect bias using tests of equality of means. When using extrapolation methods, if these tests do not produce sufficient statistical evidence to reject the null hypotheses that the means are equal, then it is not unreasonable to assert that the unobserved group of non-respondents has similar characteristics to those of the survey respondents and that non-respondents are missing at random.

As such, responses were categorized into three groups. Group 1 represented the first third of respondents to complete the survey; Group 2 represented the second third of respondents; and Group 3 represented the final third of respondents (i.e., the latest responders). A multivariate analysis of variance (MANOVA) was then conducted against age, years of contracting experience, and three latent variables in order to explore differences. The three latent variables—requirement definition sufficiency, regulatory and statutory compliance, and service quality—were computed using summations of scale items. Additionally, two categorical variables, gender and education level, were examined for differences in means between the waves using Pearson's chi-square test. Individual hypotheses are located in Table 17 and descriptive statistics for the variables tested can be found in Appendix D.

Table 17. Non-Response Bias Hypotheses

Variable	Hypothesis	Significance
Age	H_0: $\mu_{Age1} = \mu_{Age2} = \mu_{Age3}$	$\alpha = 0.05$
Gender	H_0: $\mu_{Gender1} = \mu_{Gender2} = \mu_{Gender3}$	$\alpha = 0.05$
Buyer experience	H_0: $\mu_{Experience1} = \mu_{Experience2} = \mu_{Experience3}$	$\alpha = 0.05$
Education level	H_0: $\mu_{Education1} = \mu_{Education2} = \mu_{Education3}$	$\alpha = 0.05$
Service quality	H_0: $\mu_{Quality1} = \mu_{Quality2} = \mu_{Quality3}$	$\alpha = 0.05$
Requirement definition	H_0: $\mu_{Definition1} = \mu_{Definition2} = \mu_{Definition3}$	$\alpha = 0.05$
Regulatory and statutory compliance	H_0: $\mu_{Compliance1} = \mu_{Compliance2} = \mu_{Compliance3}$	$\alpha = 0.05$

Homogeneity of variances is a critical underlying assumption to the analysis of variance (Kerlinger & Lee, 2000). If variances between groups are not equal, or *homoscedastic*, then correlation coefficients may reflect error. The following was hypothesized: given each variable *X*, $\sigma^2_{X1} = \sigma^2_{X2} = \sigma^2_{X3}$. Levene's test was applied to each variable and test statistics were calculated. Reviewing the results in Table 18, no statistic was significant at $\alpha = 0.05$, and none of the null hypotheses can be rejected. There is little evidence that the variances are not equal, and homogeneity of variances can be assumed for all seven variables.

A multivariate analysis of variance was conducted in PASW Statistics Version 18.0 to test the first five of the seven hypotheses; gender and education level were later tested. *F* tests for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root were performed; no *F* test statistics were significant. Additional results of the univariate *F* tests are presented in Table 19. An examination of the significance of the *F* test statistics reveals that none are significant at a level of 0.05. Therefore, there is insufficient statistical evidence to reject the null hypothesis that group means are equal in any of the five variables, and it can be assumed that no bias exists between survey responders and survey non-responders in these cases (Armstrong & Overton, 1977).

Table 18. Homogeneity of Variance

Variable	Levene statistic	df1	df2	Sig.
Age	0.727	2	237	0.485
Gender	0.298	2	237	0.742
Buyer experience	0.067	2	237	0.936
Education level	1.386	2	237	0.252
Sufficient requirement definition	0.230	2	237	0.795
Regulatory and statutory compliance	0.651	2	237	0.523
Service quality	0.117	2	237	0.890

Table 19. Univariate *F* Tests for Non-Response Bias

Variable		Sum of squares	df	Mean square	F	Sig.
Age	Between groups	259.65	2	129.83	0.88	0.41
	Within groups	34804.67	237	146.86		
	Total	35064.32	239			
Buyer experience	Between groups	183.66	2	91.83	0.93	0.40
	Within groups	23425.38	237	98.84		
	Total	23609.04	239			
Sufficient requirement definition	Between groups	14.70	2	7.35	0.19	0.83
	Within groups	9261.76	237	39.08		
	Total	9276.46	239			
Regulatory and statutory compliance	Between groups	24.93	2	12.46	0.47	0.63
	Within groups	6264.93	237	26.43		
	Total	6289.85	239			
Service quality	Between groups	331.86	2	165.93	0.78	0.46
	Within groups	50378.64	237	212.57		
	Total	50710.50	239			

The final two variables, gender and education level, were tested for non-response bias using Pearson's chi-square test. Crosstabs and test results for these two variables are located in Table 20 and Table 21. As seen in the tables, neither test was significant at an alpha level of 0.05; the null hypotheses stating that group means are equal cannot be rejected for either of the two variables.

Table 20. Chi-Square Test of Gender for Non-Response Bias

		Female	Male	Total
Response Wave	1	41	39	80
	2	35	45	80
	3	39	41	80
Total		115	125	240

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	0.935	2	0.627
Likelihood Ratio	0.936	2	0.626
N of Valid Cases	240		

Table 21. Chi-Square Test of Education Level for Non-Response Bias

		High School	Associate's Degree	Bachelor's Degree	Master's Degree	PhD / Pro Degree	Total
Response Wave	1	7	11	37	25	0	80
	2	13	8	30	28	1	80
	3	9	9	37	24	1	80
Total		29	28	104	77	2	240

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.711	8	0.788
Likelihood Ratio	5.313	8	0.724
N of Valid Cases	240		

In summary, seven variables were tested for potential effects due to the presence of non-response bias using multiple methods. The results of testing did not provide statistical evidence to reject the null hypotheses stating that the means of variables are equal between the first third, middle third, and final third of respondents. As such, it can be assumed that non-respondents are missing from the sample at random and that further statistical analysis will not yield biased estimates due to non-response.

5. Sample Size

The analysis of structural equations is often considered a large-sample technique (Ullman, 2006). Although the maximum likelihood method of estimation can provide stable and valid results under ideal conditions with sample sizes as low as 50, parameter estimates and the chi-square test of fit are known to be sensitive to the size of the sample (Hair et al., 2010). As a result, researchers have developed several rules of thumb regarding adequate sample sizes, in which many have advocated for a minimum sample size of 200 and others have recommended minimum sample sizes as low as 100 (Smith & Langfield-Smith, 2004). Hair et al. (2010) considered model complexity when recommending a minimum sample size, and they posited that a minimum of 150 samples is generally adequate for models with seven or fewer constructs, modest communalities, and no underdefined constructs; such is the case with this study. Because 240 responses are available for analysis, the sample size for this study exceeded the minimum recommended by most authors and was appropriately large when model complexity and the method of estimation are considered.

E. EXPLORATORY FACTOR ANALYSIS

As a preliminary step to establishing construct validity, scales were purified using exploratory factor analysis in PASW Statistics Version 18.0. Principle components factor analysis was first performed on a group consisting of all exogenous structures and then separately performed on a group consisting of all endogenous structures. Items were discarded if they presented low component-factor scores, significant cross-loadings on

other factors, or were detrimental to construct reliability. Combined, 42 items were reduced to 27 across seven constructs.

As expected, items for the four exogenous constructs extracted into four factors using Varimax rotation when minimum eigenvalues for factors were set at value of 1 (Table 22). Initial eigenvalues showed that the first factor explained 37% of the variance, the second factor 20% of the variance, the third factor 12% of the variance, and the final factor 10% of the variance. In total, the four factors explained 79% of the variance; a scree plot of eigenvalues by factor is located in Appendix E. All but one item displayed cross-loadings below the 0.300 limit recommended by Hair et al. (2010). This item, a measurement item from the communication scale, presented a cross-loading of 0.324 on the factor consisting of scale items for internal customer commitment; however, the item had a strong primary loading of 0.776 on its own factor and was therefore retained. All construct items loaded cleanly on their respective factors with factor loadings above the 0.400 benchmark. Descriptive statistics for the resultant factors are located in Table 23.

Table 22. Exogenous Construct Component Matrix

	Factor			
Item	**1**	**2**	**3**	**4**
AT1a	**0.922**	0.121	0.000	0.046
AT1c	**0.934**	0.145	0.030	0.100
AT1d	**0.946**	0.049	0.034	0.111
ICCa	0.134	**0.891**	0.121	0.191
ICCb	0.093	**0.898**	0.158	0.216
ICCd	0.109	**0.814**	0.218	0.153
RBV1c	–0.015	0.111	**0.766**	0.122
RBV1d	0.003	0.186	**0.850**	0.145
RBV1e	0.075	0.141	**0.871**	0.093
REa	0.112	0.290	0.205	**0.749**
REb	0.032	0.324	0.090	**0.776**
REd	0.109	0.014	0.105	**0.804**

Table 23. Descriptive Statistics for Exogenous Constructs

Summated construct	Items	Min.	Max.	*M (SD)*	Skewness	Kurtosis
Amount of surveillance *(AT1)*	3	3	21	16.08 *(4.25)*	–0.90	0.49
Internal customer Commitment *(ICC)*	3	5	21	16.32 *(3.81)*	–0.69	–0.05
Procurement lead-time sufficiency *(RBV1)*	3	3	21	13.03 *(4.63)*	–0.21	–0.35
Communication *(RE)*	3	8	21	17.27 *(2.99)*	–0.70	–0.09

Items for the three endogenous constructs extracted cleanly into three factors (Table 25). As before, Varimax rotation was selected and a minimum value of 1 was established for factor eigenvalues. Initial eigenvalues showed that the first factor explained 51% of the variance, the second factor 16% of the variance, and the third factor 10% of the variance. In total, these three factors explained 76% of the variance; a scree plot of eigenvalues by factor is located in Appendix F. As anticipated, scale items for all three service quality dimensions presented strong loadings on the same factor, indicating that these dimensions share a primary factor and evidencing construct validity. No scale items from any constructs displayed cross-loadings above the 0.300 recommended threshold and all construct items presented factor loadings greater than 0.400 on their respective factors. Descriptive statistics for the resultant factors are located in Table 24.

Table 24. Descriptive Statistics for Endogenous Constructs

Summated construct	Items	Min.	Max.	*M (SD)*	Skewness	Kurtosis
Service quality *(SQ)*	8	21	56	45.21 *(8.68)*	–0.65	–0.43
Regulatory and statutory compliance *(RSC)*	3	4	21	17.22 *(3.30)*	–1.01	1.13
Requirement definition sufficiency *(RD1)*	3	3	21	15.47 *(4.04)*	–0.63	–0.07

Table 25. Endogenous Construct Component Matrix

	Factor		
Item	**1**	**2**	**3**
SQa	**0.804**	0.265	0.055
SQc	**0.921**	0.140	0.079
SQd	**0.904**	0.142	0.098
SQf	**0.763**	0.113	0.081
SQi	**0.826**	0.174	0.093
SQj	**0.901**	0.148	0.105
SQk	**0.898**	0.184	0.071
SQm	**0.894**	0.183	0.078
RSCa	0.203	0.209	**0.853**
RSCc	0.155	0.115	**0.878**
RSCe	–0.038	0.093	**0.658**
RD1a	0.231	**0.866**	0.138
RD1b	0.220	**0.880**	0.153
RD1e	0.180	**0.811**	0.176

Finally, scale reliability was assessed using PASW Statistics Version 18.0. Cronbach's alpha is the most widely used measure of scale reliability and consistency (Hair et al., 2010), in which reliability coefficients range from 0.00 to 1.00 and scales with coefficients greater than 0.70 are generally considered to be reliable (Nunnally, 1978). As seen in Table 26, reliability coefficients for the seven constructs ranged from 0.70 to 0.96, with all scales exceeding the recommended minimum.

Table 26. Endogenous and Exogenous Construct Reliability

Latent structure	Title	Cronbach's alpha
η_1	Service quality	0.959
η_2	Regulatory and statutory compliance	0.702
η_3	Sufficient requirement definition	0.870
ξ_1	Communication	0.757
ξ_2	Amount of surveillance	0.939
ξ_3	Sufficient procurement lead-time	0.806
ξ_4	Internal customer commitment	0.901

F. CONFIRMATORY FACTOR ANALYSIS

1. Introduction

Confirmatory factor analysis (CFA) is a method of testing how well manifest variables represent their respective constructs. CFA differs from EFA in that CFA is a confirmatory test of *a priori* measurement theory, and EFA identifies factors solely on statistical results (Hair et al., 2010). In this respect, a primary objective of CFA is to assess construct validity and fit of measurement models prior to performing further analysis through the use of structural equation modeling or other statistical techniques.

Measurement models are CFA models that test measurement assumptions of latent variables, such as construct validity (Bagozzi, 1983), with no constraints on correlations between constructs. Mulaik and James (1995) asserted that researchers should not proceed to test a structural model if a measurement model exhibits poor fit. Generally, the fit of a model is the extent that the implied covariance matrix is equivalent to the observed population covariance matrix from which the sample is drawn (Hoyle, 1995). While the most common assessment of this equivalence is through the use of the chi-square test statistic, this test is known to penalize large samples and complex models; as a result, researchers have developed and adopted alternative measures of fit (Hu & Bentler, 1995). These measures of fit are often categorized into three groups: absolute fit indices (of which chi-square is a member), incremental fit indices, and parsimony fit

indices. Because no generally accepted guideline exists as to which fit indices researchers should report, multiple indices are often used with one or more fit indices coming from each category. The fit indices reported in this study conform to this prescription but are limited to those indices that are produced by the SEM software Mplus Version 6.0: chi-square (χ^2); relative chi-square (χ^2/df); the Comparative Fit Index (CFI); the Tucker-Lewis Index (TLI), which is also known as the Non-normed Fit Index (NNFI); the Root Mean Square Error of Approximation (RMSEA); and the Standardized Root Mean Square Residual (SRMR).

Hair et al. (2010) offered four rules of thumb for assessing construct validity. First, these authors recommended that standardized loading estimates should, ideally, be higher than 0.70 but generally higher than 0.50. Second, for convergent validity, average variance extracted (AVE) for latent constructs should be at least 0.50, meaning that at least 50% of variance is explained among the items of a construct. Third, for discriminant validity, AVE for any given construct should be higher than the square of the correlation between the construct and any other construct. Finally, for internal consistency, construct reliability coefficients should be 0.70 or higher. Because construct reliabilities were previously found to be adequate, with all Cronbach's alpha coefficients exceeding the guideline of 0.70, the three remaining elements, or rules of thumb, for assessing construct validity will be examined throughout this section.

For uniformity with EFA methods, CFA was performed separately on exogenous and endogenous constructs. However, CFA was first performed on a combined measurement model containing all exogenous and endogenous constructs (Appendix G) to assess nomological validity. Pearson correlation coefficients as well as directionality of correlations between constructs (endogenous or exogenous) and endogenous constructs were examined. Of these correlations, all were in the expected direction and were significant with a *p* value of less than 0.01, indicating acceptable evidence of nomological validity (Hair et al., 2010).

2. Exogenous Measurement Model

Exogenous structures were first examined for model fit and construct validity using confirmatory factor analysis with maximum likelihood estimation (MLE) in Mplus Version 6.0. In the path diagram of the measurement model (Figure 7), latent variable variances are held at 1, and regression weights between latent variables and their respective factors are free parameters. All latent variables were permitted to covary freely. Factor loadings that link factors to their respective latent constructs are labeled with the Greek letter *lambda* (λ), and exogenous constructs are represented by the Greek letter *ksi* (ξ). Measurement error of factors associated with exogenous constructs are labeled with the Greek letter *delta* (δ), and covariance estimates are represented by the Greek letter *phi* (φ). The model contains 12 observed variables, 78 sample moments, and 30 free parameters. It is, therefore, overidentified with 48 degrees of freedom.

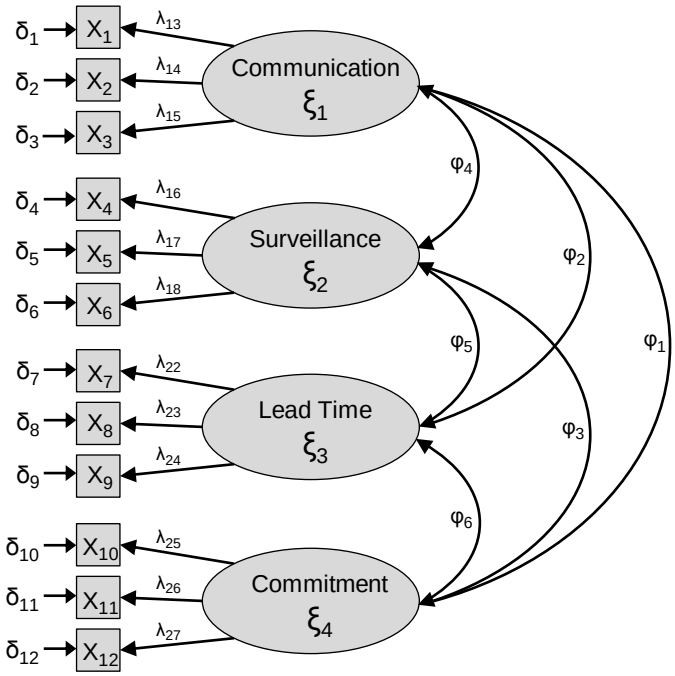

Figure 7. Path Diagram of the Exogenous Measurement Model

Fit of the measurement model (Table 27) was initially examined using the chi-square test statistic; the chi-square (χ^2) value of 52.72 was not significant with a *p* value of 0.30, suggesting good fit. The relative chi-square value (χ^2 divided by degrees

of freedom) of 1.10 also indicates good fit when assessed against the threshold of 3.0 recommended by Kline (1998). A global assessment of model fit was also accomplished using the other fit indices produced by Mplus Version 6.0. The CFI value of 1.00 and TLI value of 1.00 are both higher than the 0.95 minimums that were proposed by Hair et al. (2010), indicating good fit. Similarly, the RMSEA value of 0.02 and SRMR value of 0.03 indicate good fit and are less than the thresholds proposed by Hair et al. (2010), who recommended a maximum value of 0.08 for each. Overall, this assessment of fit indicates that the exogenous measurement model appears to fit well to the sample data.

Table 27. Exogenous Measurement Model Diagnostics

	χ^2/df	CFI	TLI	RMSEA	SRMR
Measurement model	1.10	1.00	1.00	0.02	0.03
Fitness criterion	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

An examination of factor loadings from the results of the confirmatory factor analysis (Table 28) revealed all standardized loadings to be above 0.50, the minimum loading recommended by Hair et al. (2010). Nearly all factor loadings from the exogenous measurement model also meet the authors' more rigorous guideline of 0.70, which they considered to be ideal. Furthermore, all constructs exceed the minimum 50% AVE also recommended by Hair et al. (2010), where AVE for each construct was calculated by summating the squared factor loadings for construct items and dividing the summation by the number items measuring the construct:

$$AVE = \frac{\sum_{i=1}^{n} L_i^2}{n} \quad (1)$$

Finally, the results of the estimation were examined for the presence of Heywood Cases, or instances of negative measurement error variance. A review of error variance, which can be found in Appendix I, does not reveal any such cases.

Table 28. Exogenous Construct Reliability and Convergent Validity

Construct	Items	Standardized factor loading	Significance (*p*)	Cronbach's alpha	AVE
Communication *(RE)*	REa	0.814	< 0.001	0.76	52%
	REb	0.771	< 0.001		
	REd	0.560	< 0.001		
Amount of surveillance *(AT1)*	AT1a	0.875	< 0.001	0.94	84%
	AT1c	0.938	< 0.001		
	AT1d	0.934	< 0.001		
Procurement lead-time sufficiency *(RBV1)*	RBV1c	0.612	< 0.001	0.81	61%
	RBV1d	0.862	< 0.001		
	RBV1e	0.839	< 0.001		
Internal customer commitment *(ICC)*	ICCa	0.909	< 0.001	0.90	76%
	ICCb	0.950	< 0.001		
	ICCd	0.752	< 0.001		

The final test for discriminant validity was conducted using a comparison of AVE against squared construct correlation coefficients. This is a rigorous test for discriminant validity (Hair et al., 2010), in which two constructs can be considered distinct from one another if the average variance extracted values for both constructs are higher than their squared correlation coefficient. An examination of the values in Table 29—in which correlations are above the diagonal, AVE values are on the diagonal and in bold, and squared correlations are below the diagonal—revealed that the exogenous constructs are indeed distinct; discriminant validity can therefore be assumed.

Table 29. Squared Exogenous Construct Correlation Matrix and AVE

Variables	(1)	(2)	(3)	(4)
(1) Communication	**0.52**	0.25	0.41	0.58
(2) Amount of surveillance	0.06	**0.84**	0.10	0.20
(3) Sufficiency of procurement lead-time	0.17	0.01	**0.61**	0.40
(4) Internal customer commitment	0.34	0.04	0.16	**0.76**

3. Endogenous Measurement Model

A second assessment of model fit and construct validity was conducted for the endogenous structures using CFA with MLE in Mplus Version 6.0. As before in the exogenous measurement model, the variances of latent constructs were held at 1, while regression weights between latent variables and their respective factors were free parameters, and all three latent variables were permitted to covary freely. In the path diagram of the endogenous measurement model (Figure 8), endogenous constructs are represented by the Greek letter *eta* (η), and measurement error of factors associated with endogenous constructs are labeled with the Greek letter *epsilon* (ε). The endogenous measurement model contains 14 observed variables, 105 sample moments, and 31 free parameters. It is therefore overidentified with 74 degrees of freedom.

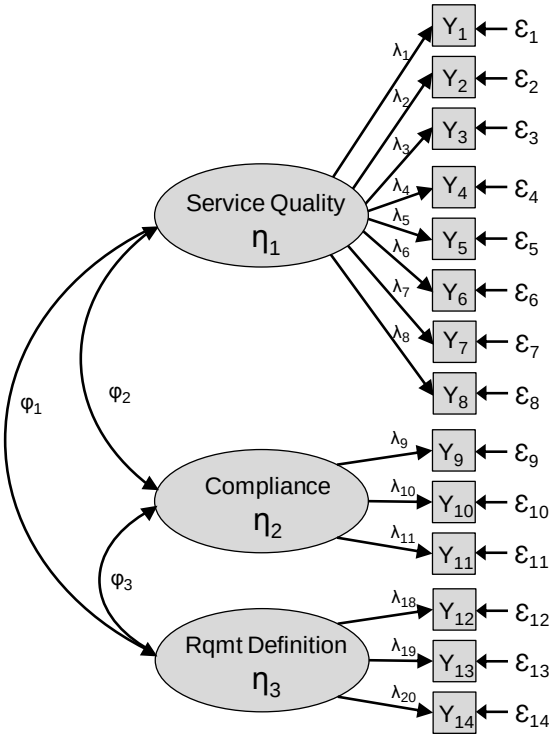

Figure 8. Path Diagram of the Endogenous Measurement Model

As before, fit of the measurement model (Table 30) was first examined using the chi-square test. The chi-square test statistic of 127.63 is significant with a *p* value of less than 0.001, indicating that fit may be less than adequate. Since the chi-square test is known to penalize complex models and large samples, a global assessment of model fit was performed using multiple fit indices. The relative chi-square value of 1.72 is less than the threshold of 3.0 recommended by Kline (1998), suggesting adequate fit. Additionally, CFI and NNFI are greater than the 0.95 minimums that were proposed by Hair et al. (2010), indicating good fit. Similarly, the RMSEA value of 0.06 and the SRMR value of 0.03 indicate good fit and are less than the thresholds of 0.08 proposed by Hair et al. (2010) for each.

Table 30. Endogenous Measurement Model Diagnostics

	χ^2/df	CFI	TLI	RMSEA	SRMR
Measurement model	1.72	0.98	0.98	0.06	0.03
Fitness criterion	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

An examination of factor loadings from confirmatory factor analysis (Table 31) revealed all loadings to be above 0.50, the minimum loading recommended by Hair et al. (2010), with the exception of one item from regulatory and statutory compliance construct, which presented a loading of 0.392. However, further analysis reveals that the loading is statistically significant, all constructs exceed the minimum construct reliability alpha of 0.70, and all constructs, including *regulatory and statutory compliance*, exceed the minimum 50% AVE also recommended by Hair et al. (2010). Furthermore, no instances of negative error variance are present (Appendix I).

Table 31. Endogenous Construct Reliability and Convergent Validity

Construct	Items	Standardized factor loadings	Significance (*p*)	Cronbach's alpha	AVE
Service quality *(SQ)*	SQa	0.812	< 0.001	0.96	76%
	SQc	0.933	< 0.001		
	SQd	0.912	< 0.001		
	SQf	0.726	< 0.001		
	SQi	0.810	< 0.001		
	SQj	0.909	< 0.001		
	SQk	0.919	< 0.001		
	SQm	0.908	< 0.001		
Regulatory and statutory compliance *(RSC)*	RSCa	0.951	< 0.001	0.70	58%
	RSCc	0.825	< 0.001		
	RSCe	0.391	< 0.001		
Sufficiency of the requirement definition *(RD1)*	RD1a	0.871	< 0.001	0.87	71%
	RD1b	0.917	< 0.001		
	RD1e	0.724	< 0.001		

As before, the test for discriminant validity of endogenous constructs was performed using a comparison of AVE against squared construct correlation coefficients. An examination of values in Table 32—in which correlations are above the diagonal, AVE values are on the diagonal and in bold, and squared correlations are below the diagonal—reveals that the exogenous constructs are indeed distinct, and discriminant validity can also be assumed for the endogenous structures.

Table 32. Squared Endogenous Construct Correlation Matrix and AVE

Variables	(1)	(2)	(3)
(1) Service quality	**0.76**	0.34	0.46
(2) Regulatory and statutory compliance	0.12	**0.58**	0.43
(3) Sufficiency of requirement definition	0.21	0.18	**0.71**

G. HYPOTHESIZED STRUCTURAL MODEL

Finally, the structural model (Figure 9)—containing all variables, factors, and paths for the testing of hypotheses—was analyzed using MLE in Mplus Version 6.0. In the path diagram, parameter estimates from exogenous variables to endogenous variables are represented by the Greek letter *gamma* (γ), and parameter estimates between endogenous variables are represented by the Greek letter *beta* (β). As is typical when modeling with structural equations, exogenous constructs were permitted to covary freely. The structural model contains 32 observed variables, 528 sample moments, and 125 free parameters and is therefore overidentified with 403 degrees of freedom. The following are structural equations for this model:

$$\eta_1 = \gamma_3\xi_1 + \gamma_5\xi_2 + \gamma_8\xi_3 + \gamma_6 X_{13} + \gamma_1 X_{14} + \gamma_9 X_{15} + \beta_1\eta_2 + \beta_2\eta_3 + \zeta_1 \quad (2)$$

$$\eta_2 = \gamma_4\xi_1 + \gamma_{10}\xi_3 + \gamma_{19}\xi_4 + \gamma_{11} X_{15} + \gamma_{13} X_{16} + \gamma_{15} X_{17} + \gamma_{17} X_{18} + \beta_3\eta_3 + \zeta_2 \quad (3)$$

$$\eta_3 = \gamma_7\xi_3 + \gamma_{18}\xi_4 + \gamma_2 X_{14} + \gamma_{12} X_{16} + \gamma_{14} X_{17} + \gamma_{16} X_{18} + \zeta_3 \quad (4)$$

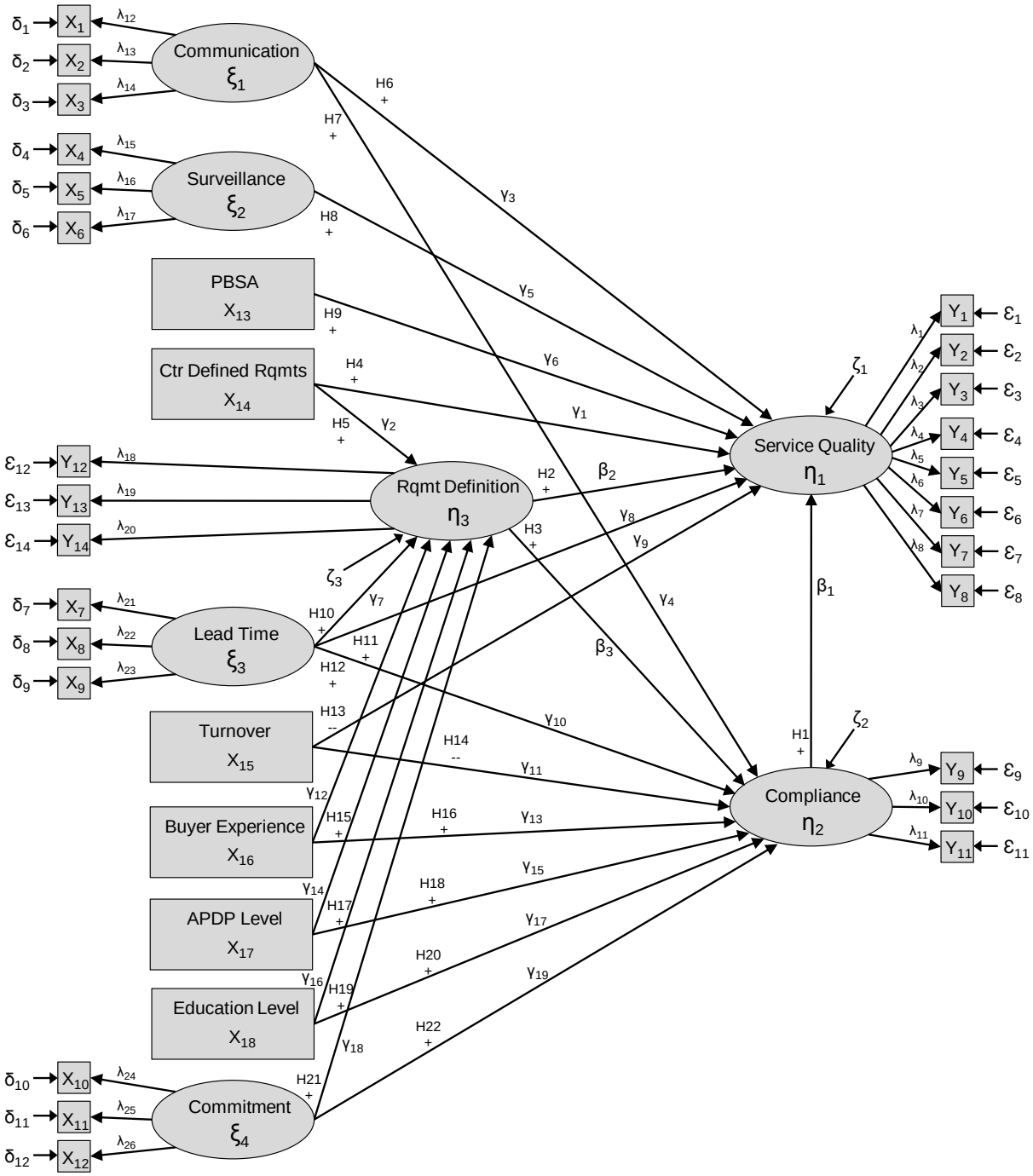

Figure 9. Path Diagram of the Hypothesized Structural Model

Fit of the structural model (Table 33) was assessed using the same criteria as those applied to the measurement models. The chi-square value of 532.26 is significant with a *p* value of less than 0.001, suggesting that fit may be less than adequate. However, the relative chi-square value of 1.32 is less than the 3.0 threshold recommended by Kline (1998), suggesting good fit. Since the chi-square test is not a representative measure for higher-order models (Fornell, 1983), other measures were again used. The values for CFI and TLI are both higher than the 0.95 minimums that were proposed by Hair et al. (2010), suggesting good fit. Similarly, the RMSEA and SRMR values of 0.04 and 0.05 are less than the thresholds proposed by Hair et al. (2010), who recommended maximum values of 0.08 for each. Overall, the structural model appears to exhibit good fit to the sample data.

Table 33. Structural Model Diagnostics

	χ^2/df	CFI	TLI	RMSEA	SRMR
Structural model	1.32	0.97	0.97	0.04	0.05
Fitness criterion	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

Table 34 displays the standardized loading estimates of construct items in the structural model. All items loaded above the 0.50 minimum recommended by Hair et al. (2010), with the exception of one item in the regulatory and statutory compliance construct. As previously discussed, the decision to retain this item was made based on a review of construct reliability and AVE, which exceeded the recommended minimums.

Standardized path estimates for the 22 hypothesized relationships are displayed in Table 35. In reviewing the table, several of the paths did not result in statistically significant estimates because of high *p* values and low critical ratios. Path γ_1, the hypothesized causal relationship from the constructs extent contractor defined requirements to service quality, has a high *p* value, indicating that the parameter estimate did not differ significantly from 0. Similarly, the hypothesized causal relationships between the two agency theory variables and service quality, represented by paths γ_5 and

γ_6, were not found to be statistically significant. Additional paths between sufficient procurement lead-time (γ_9) and internal customer commitment to regulatory and statutory compliance (γ_{19}) were also not found to be statistically significant, as were any of the paths stemming from the manifest competence-based view variables. A complete assessment of paths, including those effects occurring directly as a result of one causal path and those effects occurring indirectly through one or more mediating variables, can be found in Table 36. This table also displays the coefficient of determination (R^2) for each endogenous latent variable. For an endogenous (dependent or explained) variable, R^2 is a measure of the portion of variance about the mean that is explained by the exogenous (independent or explanatory) variables (Hair et al., 2010). R^2 for the endogenous variable service quality was relatively high at 0.655, indicating a high degree of explanatory power. R^2 was greater than 0.30 for the other two endogenous variables, regulatory and statutory compliance and requirement definition sufficiency, indicating a moderate degree of explanatory power.

Table 34. Structural Model Loading Estimates

Parameter			Model notation				Standardized estimate	S.E.	Critical ratio	*P* value
To		From	To		From	Path				
SQa	←	SQ	Y_1	←	η_1	λ_1	0.809	0.023	34.756	< 0.001
SQc	←	SQ	Y_2	←	η_1	λ_2	0.929	0.010	90.246	< 0.001
SQd	←	SQ	Y_3	←	η_1	λ_3	0.911	0.012	74.245	< 0.001
SQf	←	SQ	Y_4	←	η_1	λ_4	0.724	0.032	22.933	< 0.001
SQi	←	SQ	Y_5	←	η_1	λ_5	0.808	0.023	34.526	< 0.001
SQj	←	SQ	Y_6	←	η_1	λ_6	0.906	0.013	71.239	< 0.001
SQk	←	SQ	Y_7	←	η_1	λ_7	0.915	0.012	77.684	< 0.001
SQm	←	SQ	Y_8	←	η_1	λ_8	0.906	0.013	70.654	< 0.001
RSCa	←	RSC	Y_9	←	η_2	λ_9	0.966	0.030	31.801	< 0.001
RSCc	←	RSC	Y_1	←	η_2	λ_{10}	0.808	0.033	24.168	< 0.001
RSCe	←	RSC	Y_1	←	η_2	λ_{11}	0.381	0.059	6.491	< 0.001
REa	←	RE	X_1	←	ξ_1	λ_{12}	0.797	0.031	25.975	< 0.001
REb	←	RE	X_2	←	ξ_1	λ_{13}	0.803	0.030	26.436	< 0.001
REd	←	RE	X_3	←	ξ_1	λ_{14}	0.542	0.051	10.689	< 0.001
AT1a	←	AT1	X_4	←	ξ_2	λ_{15}	0.873	0.018	48.857	< 0.001
AT1c	←	AT1	X_5	←	ξ_2	λ_{16}	0.939	0.013	74.629	< 0.001
AT1d	←	AT1	X_6	←	ξ_2	λ_{17}	0.933	0.013	72.045	< 0.001
RD1a	←	RD1	Y_1	←	η_3	λ_{18}	0.871	0.023	38.322	< 0.001
RD1b	←	RD1	Y_1	←	η_3	λ_{19}	0.916	0.020	45.241	< 0.001
RD1e	←	RD1	Y_1	←	η_3	λ_{20}	0.727	0.059	21.094	< 0.001
RBV1c	←	RBV1	X_7	←	ξ_3	λ_{21}	0.622	0.046	13.601	< 0.001
RBV1d	←	RBV1	X_8	←	ξ_3	λ_{22}	0.843	0.031	27.643	< 0.001
RBV1e	←	RBV1	X_9	←	ξ_3	λ_{23}	0.849	0.030	28.030	< 0.001
ICCa	←	ICC	X_1	←	ξ_4	λ_{24}	0.914	0.016	57.963	< 0.001
ICCb	←	ICC	X_1	←	ξ_4	λ_{25}	0.942	0.014	66.622	< 0.001
ICCd	←	ICC	X_1	←	ξ_4	λ_{26}	0.756	0.030	24.973	< 0.001

Table 35. Structural Model Path Estimates

Parameter			Model notation				Standardized estimate	S.E.	Critical ratio	*P* value
To		From	To		From	Path				
SQ	←	RSC	η_1	←	η_2	$\boldsymbol{\beta_1}$	–0.252	0.074	–3.406	0.001
SQ	←	RD1	η_1	←	η_3	$\boldsymbol{\beta_2}$	0.181	0.066	2.716	0.007
RSC	←	RD1	η_2	←	η_3	$\boldsymbol{\beta_3}$	0.149	0.077	1.937	0.053
SQ	←	RD2	η_1	←	X_{14}	$\boldsymbol{\gamma_1}$	0.027	0.051	0.527	0.598
RD1	←	RD2	η_3	←	X_{14}	$\boldsymbol{\gamma_2}$	–0.110	0.058	–1.884	0.060
SQ	←	RE	η_1	←	ξ_1	$\boldsymbol{\gamma_3}$	0.930	0.079	11.773	< 0.001
RSC	←	RE	η_2	←	ξ_1	$\boldsymbol{\gamma_4}$	0.578	0.083	6.963	< 0.001
SQ	←	AT1	η_1	←	ξ_2	$\boldsymbol{\gamma_5}$	0.048	0.055	0.887	0.375
SQ	←	AT2	η_1	←	X_{13}	$\boldsymbol{\gamma_6}$	–0.044	0.053	–0.827	0.408
RD1	←	RBV1	η_3	←	ξ_3	$\boldsymbol{\gamma_7}$	0.317	0.071	4.454	< 0.001
SQ	←	RBV1	η_1	←	ξ_3	$\boldsymbol{\gamma_8}$	–0.204	0.068	–2.993	0.003
RSC	←	RBV1	η_2	←	ξ_3	$\boldsymbol{\gamma_9}$	–0.027	0.079	–0.341	0.733
SQ	←	RBV2	η_1	←	X_{15}	$\boldsymbol{\gamma_{10}}$	0.077	0.052	1.498	0.134
RSC	←	RBV2	η_2	←	X_{15}	$\boldsymbol{\gamma_{11}}$	–0.094	0.059	–1.599	0.110
RD1	←	CBV1	η_3	←	X_{16}	$\boldsymbol{\gamma_{12}}$	0.011	0.075	0.149	0.882
RSC	←	CBV1	η_2	←	X_{16}	$\boldsymbol{\gamma_{13}}$	0.038	0.071	0.537	0.591
RD1	←	CBV2	η_3	←	X_{17}	$\boldsymbol{\gamma_{14}}$	0.044	0.074	0.589	0.566
RSC	←	CBV2	η_2	←	X_{17}	$\boldsymbol{\gamma_{15}}$	–0.067	0.073	–0.925	0.355
RD1	←	CBV3	η_3	←	X_{18}	$\boldsymbol{\gamma_{16}}$	0.032	0.060	0.531	0.596
RSC	←	CBV3	η_2	←	X_{18}	$\boldsymbol{\gamma_{17}}$	0.051	0.057	0.901	0.367
RD1	←	ICC	η_3	←	ξ_4	$\boldsymbol{\gamma_{18}}$	0.377	0.065	5.780	< 0.001
RSC	←	ICC	η_2	←	ξ_4	$\boldsymbol{\gamma_{19}}$	–0.039	0.079	–0.494	0.621

Table 36. Standardized Direct, Indirect, and Total Effects

Dependent variable	Determinant	Direct effect	Sig.	Indirect effects	Sig.	Total effect	Sig.
Service quality (R^2 = 0.655)							
	Regulatory and statutory compliance	–0.252	0.001			–0.252	0.001
	Requirement definition sufficiency	0.181	0.007	–0.038	0.022	0.143	0.029
	Communication	0.930	< 0.001	–0.145	0.007	0.784	< 0.001
	Amount of surveillance	0.048	0.375			0.048	0.375
	Extent PBSA	–0.044	0.408			–0.044	0.408
	Extent contractor–defined requirements	0.027	0.598	–0.016	0.153	0.011	0.826
	Procurement lead–time sufficiency	–0.204	0.003	0.052	0.093	–0.152	0.017
	Turnover	0.077	0.134	0.024	0.147	0.101	0.043
Regulatory and statutory compliance (R^2 = 0.388)							
	Communication	0.578	< 0.001			0.578	< 0.001
	Requirement definition sufficiency	0.149	0.053			0.149	0.053
	Procurement lead–time sufficiency	–0.027	0.733	0.047	0.077	0.020	0.789
	Turnover	–0.094	0.110			–0.094	0.110
	Buyer experience	0.038	0.591	0.002	0.882	0.040	0.579
	Buyer APDP certification level	–0.067	0.355	0.007	0.573	–0.061	0.408
	Buyer education level	0.051	0.367	0.005	0.608	0.056	0.329
	Internal customer commitment	–0.039	0.621	0.056	0.067	0.017	0.828
Requirement definition sufficiency (R^2 = 0.337)							
	Extent contractor defined requirements	–0.110	0.060			–0.110	0.060
	Procurement lead–time sufficiency	0.317	< 0.001			0.317	< 0.001
	Buyer experience	0.011	0.882			0.011	0.882
	Buyer APDP certification level	0.044	0.556			0.044	0.556
	Buyer education level	0.032	0.596			0.032	0.596
	Internal customer commitment	0.377	< 0.001			0.377	< 0.001

Table 37. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Service quality	1.00												
(2) Regulatory and statutory compliance	0.32**	1.00											
(3) Communication	0.78**	0.62**	1.00										
(4) Surveillance	0.23**	0.21**	0.25**	1.00									
(5) PBSA	0.13*	0.17**	0.23**	0.25**	1.00								
(6) Contractor-defined requirements	0.07	0.02	0.06	0.06	–0.16*	1.00							
(7) Requirement definition	0.45**	0.41**	0.59**	0.14*	0.17*	–0.08	1.00						
(8) Procurement lead-time	0.19**	0.26**	0.41**	0.10	0.15*	–0.01	0.44**	1.00					
(9) Turnover	0.05	–0.13	–0.05	–0.05	–0.06	–0.07	–0.02	0.01	1.00				
(10) Buyer experience	0.10	0.02	0.01	0.00	0.02	–0.08	–0.02	–0.19**	0.01	1.00			
(11) APDP level	0.05	–0.04	0.04	0.07	0.03	–0.03	–0.04	–0.21**	0.12	0.60**	1.00		
(12) Education level	–0.05	0.02	–0.01	0.06	–0.01	–0.04	0.02	–0.11	0.04	–0.05	0.14*	1.00	
(13) Internal customer commitment	0.42**	0.36**	0.58**	0.26**	0.20**	0.09	0.48**	0.40**	–0.05	0.00	–0.10	0.02	1.00

Note. *p <0.05, **p <0.01.

H. TRIMMED STRUCTURAL MODEL

In the interest of achieving a more parsimonious model, paths with non-significant relationships were considered for potential trimming. This occurred in an iterative process in which paths presenting critical ratios of less than 1 were considered as candidates for removal. Similarly, variables and constructs were trimmed if they presented no statistically significant paths and, therefore, had little relevance to the model. Figure 10 presents a path diagram of this trimmed model; it contains 25 observed variables, 325 sample moments, and 69 free parameters and is therefore overidentified with 256 degrees of freedom.

$$\eta_1 = \gamma_3\xi_1 + \gamma_5\xi_2 + \gamma_8\xi_3 + \gamma_6 X_{13} + \gamma_1 X_{14} + \gamma_9 X_{15} + \beta_1\eta_2 + \beta_2\eta_3 + \zeta_1 \quad (5)$$

$$\eta_2 = \gamma_4\xi_1 + \gamma_{10}\xi_3 + \gamma_{19}\xi_4 + \gamma_{11} X_{15} + \gamma_{13} X_{16} + \gamma_{15} X_{17} + \gamma_{17} X_{18} + \beta_3\eta_3 + \zeta_2 \quad (6)$$

$$\eta_3 = \gamma_7\xi_3 + \gamma_{18}\xi_4 + \gamma_2 X_{14} + \gamma_{12} X_{16} + \gamma_{14} X_{17} + \gamma_{16} X_{18} + \zeta_3 \quad (7)$$

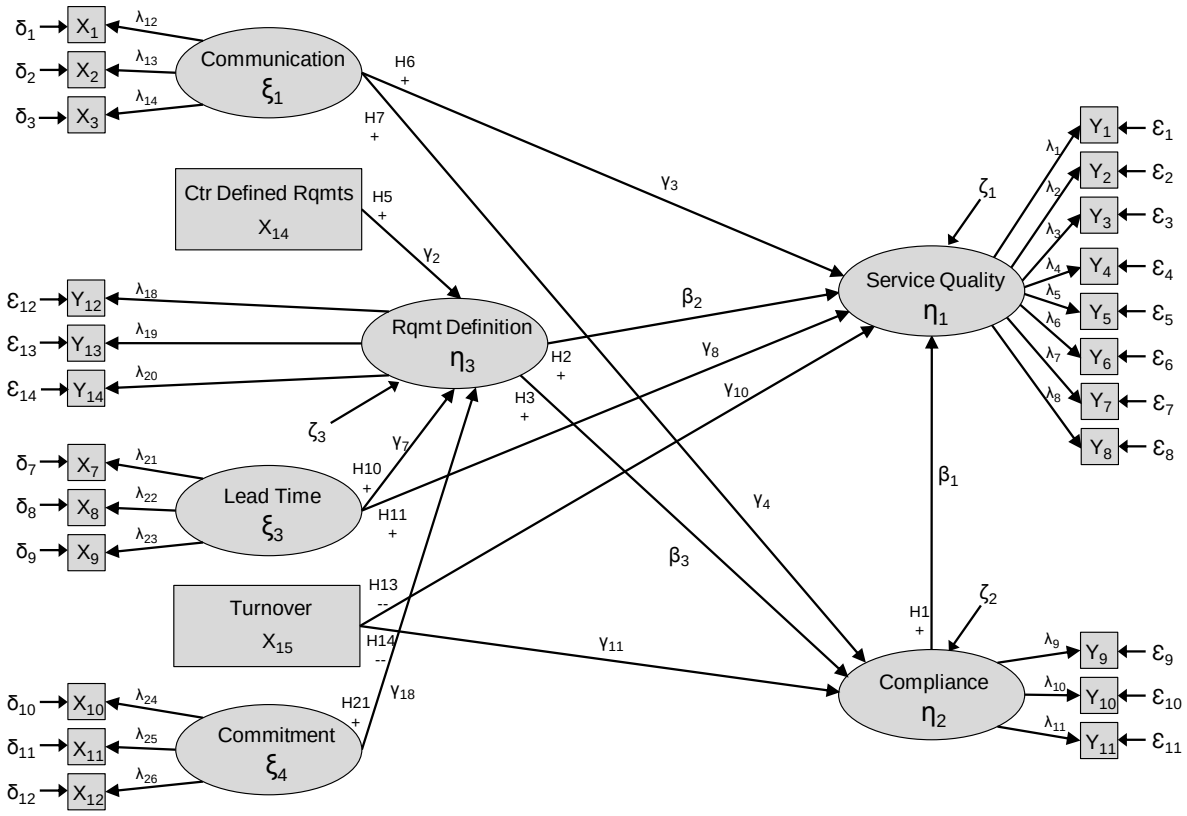

Figure 10. Path Diagram of the Trimmed Model

Fit of this respecified model (Table 38) was assessed using the same criteria as those applied to the previous measurement models and the hypothesized structural model. The chi-square value of 360.61 is significant with a *p* value of less than 0.001. While this suggests that fit may be less than adequate, the relative chi-square value is 1.41 and less than the 3.00 recommended threshold, indicating good fit to the sample data. As before, a global assessment of fit was also performed using CFI, TLI, RMSEA, and SRMR since the chi-square test is not representative of higher order models and tends to penalize for complexity and larger samples. The values for CFI and TLI are both higher than the 0.95 minimums that were proposed by Hair et al. (2010), suggesting good fit. Similarly, the RMSEA and SRMR values of 0.04 and 0.06 are less than the thresholds proposed by Hair et al. (2010), who recommended maximum values of 0.08 each. Overall, the trimmed structural model appears to fit well to the sample data.

Table 38. Trimmed Structural Model Diagnostics

	χ^2/df	CFI	TLI	RMSEA	SRMR
Structural model	1.41	0.98	0.98	0.04	0.06
Fitness criterion	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

A review of the standardized path and loading estimates in Table 39 reveals all loadings to be significant with *p* values less than 0.001. Additionally, path estimates for all hypothesized relationships are either significant with a *p* value of less than 0.05, marginally significant with a *p* value greater than 0.05 but less than 0.10, or meet the inclusion criteria of having a critical ratio greater than 1.0. Standardized direct, indirect, and total effects are again displayed (Table 40), where a total effect is the summation of the direct effect and any indirect effects. The coefficient of determination (R^2) for the endogenous variable service quality was relatively high, at 0.651, indicating a high degree of explanatory power. R^2 was greater than 0.30 for the other two endogenous variables, regulatory and statutory compliance and requirement definition sufficiency, indicating a moderate degree of explanatory power.

Table 39. Trimmed Structural Model Loading and Path Estimates

Parameter			Model notation				Standardized estimate	S.E.	Critical ratio	*P* value
To		From	To		From	Path				
SQa	←	SQ	Y_1	←	η_1	λ_1	0.809	0.023	34.783	< 0.001
SQc	←	SQ	Y_2	←	η_1	λ_2	0.929	0.010	90.137	< 0.001
SQd	←	SQ	Y_3	←	η_1	λ_3	0.911	0.012	74.099	< 0.001
SQf	←	SQ	Y_4	←	η_1	λ_4	0.723	0.032	22.923	< 0.001
SQi	←	SQ	Y_5	←	η_1	λ_5	0.808	0.023	34.476	< 0.001
SQj	←	SQ	Y_6	←	η_1	λ_6	0.906	0.013	70.980	< 0.001
SQk	←	SQ	Y_7	←	η_1	λ_7	0.915	0.012	77.652	< 0.001
SQm	←	SQ	Y_8	←	η_1	λ_8	0.906	0.013	70.703	< 0.001
RSCa	←	RSC	Y_9	←	η_2	λ_9	0.963	0.030	32.295	< 0.001
RSCc	←	RSC	Y_{10}	←	η_2	λ_{10}	0.811	0.033	24.634	< 0.001
RSCe	←	RSC	Y_{11}	←	η_2	λ_{11}	0.383	0.058	6.539	< 0.001
REa	←	RE	X_1	←	ξ_1	λ_{12}	0.797	0.031	25.962	< 0.001
REb	←	RE	X_2	←	ξ_1	λ_{13}	0.807	0.030	26.860	< 0.001
REd	←	RE	X_3	←	ξ_1	λ_{14}	0.537	0.051	10.527	< 0.001
RD1a	←	RD1	Y_{12}	←	η_3	λ_{18}	0.870	0.023	38.276	< 0.001
RD1b	←	RD1	Y_{13}	←	η_3	λ_{19}	0.916	0.020	45.370	< 0.001
RD1e	←	RD1	Y_{14}	←	η_3	λ_{20}	0.727	0.034	21.101	< 0.001
RBV1c	←	RBV1	X_7	←	ξ_3	λ_{21}	0.620	0.046	13.454	< 0.001
RBV1d	←	RBV1	X_8	←	ξ_3	λ_{22}	0.846	0.031	27.358	< 0.001
RBV1e	←	RBV1	X_9	←	ξ_3	λ_{23}	0.848	0.031	27.523	< 0.001
ICCa	←	ICC	X_{10}	←	ξ_4	λ_{24}	0.911	0.016	56.898	< 0.001
ICCb	←	ICC	X_{11}	←	ξ_4	λ_{25}	0.945	0.014	67.168	< 0.001
ICCd	←	ICC	X_{12}	←	ξ_4	λ_{26}	0.754	0.030	24.814	< 0.001
SQ	←	RSC	η_1	←	η_2	β_1	–0.240	0.072	–3.318	0.001
SQ	←	RD1	η_1	←	η_3	β_2	0.172	0.066	2.605	0.009
RSC	←	RD1	η_2	←	η_3	β_3	0.140	0.072	1.953	0.051
RD1	←	RD2	η_3	←	X_{14}	γ_2	–0.112	0.058	–1.934	0.053
SQ	←	RE	η_1	←	ξ_1	γ_3	0.930	0.072	12.919	< 0.001
RSC	←	RE	η_2	←	ξ_1	γ_4	0.539	0.067	8.062	< 0.001
RD1	←	RBV1	η_3	←	ξ_3	γ_7	0.299	0.068	4.378	< 0.001
SQ	←	RBV1	η_1	←	ξ_3	γ_8	–0.199	0.066	–3.007	0.003
SQ	←	RBV2	η_1	←	X_{15}	γ_{10}	0.078	0.051	1.511	0.131
RSC	←	RBV2	η_2	←	X_{15}	γ_{11}	–0.101	0.058	–1.743	0.081
RD1	←	ICC	η_3	←	ξ_4	γ_{18}	0.380	0.064	5.921	< 0.001

Table 40. Standardized Direct, Indirect, and Total Effects for Trimmed Model

Dependent variable	Determinant	Direct effect	Sig.	Indirect effects	Sig.	Total effect	Sig.
Service quality ($R^2 = 0.651$)							
	Regulatory and statutory compliance	–0.240	0.001			–0.240	0.001
	Requirement definition sufficiency	0.172	0.009	–0.034	0.071	0.138	0.033
	Communication	0.930	< 0.001	–0.130	0.006	0.800	< 0.001
	Procurement lead-time sufficiency	–0.199	0.003	0.041	0.062	–0.158	0.012
	Turnover	0.078	0.131	0.024	0.123	0.102	0.041
Regulatory and statutory compliance ($R^2 = 0.378$)							
	Communication	0.539	< 0.001			0.539	< 0.001
	Requirement definition sufficiency	0.140	0.051			0.140	0.051
	Turnover	–0.101	0.081			–0.101	0.081
Requirement definition sufficiency ($R^2 = 0.330$)							
	Extent contractor-defined requirements	–0.101	0.081			–0.101	0.081
	Procurement lead-time sufficiency	0.299	< 0.001			0.299	< 0.001
	Internal customer commitment	0.380	< 0.001			0.380	< 0.001

I. COMPARISON OF COMPETING MODELS

Although the trimmed structural model is more parsimonious than the hypothesized structural model and exhibits a similar goodness of fit, further empirical analysis is required to properly compare models and to determine the most preferred model. Competing models are typically categorized as either nested models or non-nested models. Models are considered to be to be nested when all of one model's free parameters are a subset of another model's free parameters (Hoyle & Panter, 1995). In such situations, Hoyle and Panter (1995) argued for comparison using absolute fit indices, which are based on chi-square differences. Alternatively, non-nested models have different numbers of total parameters, meaning that the number of free parameters, or those parameters being estimated, plus the number of constrained parameters differs between the models. In the comparison of non-nested models, the most appropriate statistics are the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). Both AIC and BIC provide an adjustment for the number of free parameters being estimated, while BIC penalizes more than AIC for model complexity (Byrne, 2010; Hu & Bentler, 1995). In both cases, the preferred model is the one with the lowest information criterion value.

The models presented in this study are considered to be non-nested because several latent and manifest exogenous variables have been removed from the hypothesized model. As such, it is appropriate to identify the best model through a comparison of AIC and BIC, which were obtained from the SEM output produced by Mplus Version 6.0. As seen in Table 41, the trimmed model presents lower values for both criteria and can therefore be considered the most preferred model of the two.

Table 41. Information Criteria for Competing Models

Structural Model	χ^2	P-value	df	AIC	BIC
Hypothesized	532.26	< 0.001	403	22702.24	23154.73
Trimmed	360.61	< 0.001	256	16781.71	17091.48

J. FURTHER ANALYSIS

Additional analysis of the relationships between variables can often provide further insight when previous analysis can be extended or when results can be more fully explored. This section will present results from further analytic research and will employ a variety of statistical methods, such as SEM, linear and non-linear regression analysis, analysis of variance (ANOVA), and multivariate analysis of variance (MANOVA). Additional tests involving personnel turnover, buyer experience, APDP level, and education level, as well as tests of the factors affecting the assignment of personnel to services acquisitions, are performed.

1. Turnover of Acquisition Personnel

Neither the hypothesized relationship between the turnover of acquisition personnel and service quality nor the hypothesized relationship between the turnover of acquisition personnel and compliance with regulations and statutes were found to be highly significant in the trimmed model; *p* values for both path coefficients were slightly greater than 0.05. To further analyze these relationships, three modifications were applied to the turnover variable, *RBV2*, which represented percent turnover as a ratio of the number of times acquisition personnel had turned over to the number of acquisition personnel assigned. First, an additional variable was created as a high-low binary variable, *PTbin*, where a cut in the data occurred about the median (1.00). Since the values of *RBV2* were calculated as ratios, responses were coded in *PTbin* with a value of 1 if the number of times that acquisition personnel turned over was greater than the median of 1.00 (n = 130). All other responses were coded with a value of 0 (n = 110). As such,

> *Proposition 1: The level of service quality and the amount of compliance with regulations and statues differ between acquisitions where turnover ratios are high and acquisitions where turnover ratios are low.*

Next, the ratio of personnel turnover was modified to represent the annualized percent turnover (*APT*) by accounting for the duration of the contract. As discussed in Chapter III, respondents were asked for the amount of time that had passed since contract award. While the previous SEM analysis assumed that effects due to personnel turnover were unrelated to time, this new variable considers that the relationships between turnover and contract outcomes were dependent on the duration in which the turnover occurred. Therefore,

> *Proposition 2: The higher the annualized percent turnover, the lesser the service quality and compliance with regulations and statutes.*

Similar to the previous binary transformation, *APT* was also modified as a high-low binary variable where a cut in the data occurred about *APT's* median (0.42). Within this new binary variable, *APTbin*, the cases in which APT was less than 42% were coded with a value of 0 (n = 122), and the cases in which APT was greater than or equal to 42% were coded with a value of 1 (n = 118). As such,

> *Proposition 3: The level of service quality and the amount of compliance with regulations and statues differ between acquisitions where annualized turnover ratios are high and acquisitions where annualized turnover ratios are low.*

Table 42 contains descriptive statistics for all measures of turnover that are used in this analysis. Additionally, values for service quality and compliance are treated in ANOVAs and regression analysis as summations of the scale items used in CFA and SEM for each. Descriptive statistics for these summated scales are also included in the table.

Table 42. Descriptive Statistics for Analysis of Personnel Turnover

Variable	N	Min.	Max.	Mean	Median	St. Dev.
Percent turnover (*RBV2*)	240	0.00	7.00	1.22	1.00	1.17
Binary percent turnover (*PTbin)*	240	0.00	1.00	0.54	1.00	0.50
Annualized percent turnover (*APT*)	240	0.00	12.00	0.68	0.42	1.09
Binary annualized percent turnover (*APTbin*)	240	0.00	1.00	0.49	1.00	0.50
Summated scale of service quality (*SQ*)	240	21.00	56.00	45.21	48.00	8.68
Summated scale of compliance (*RSC*)	240	4.00	21.00	17.22	18.00	3.30

Proposition 1 was tested first using a MANOVA in PASW Statistics 18.0 to compare the means of service quality and regulatory and statutory compliance between the two groups, low percent turnover and high percent turnover. Test statistics for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root were statistically significant with p values of less than 0.05. These results indicate that there is a significant effect of the high/low percent turnover variable on service quality and regulatory and statutory compliance when the two dependent variables are considered as a group. These group differences were further explored using univariate F tests. As seen in Table 43, there is a significant difference in the means between the two groups of regulatory and statutory compliance but no statistically significant difference in the means between the two groups of service quality. As such, additional testing using a linear regression analysis of regulator and statutory compliance on *PTbin* was appropriate to estimate the coefficient size and direction (Table 44). The resulting estimate was statistically significant with a standardized estimate of –0.175, indicating that compliance is less on those services acquisitions in which acquisition personnel turnover is greater than or equal to 100%.

Table 43. Univariate *F* Tests Between Groups by High-Low Turnover Ratios

Dependent variables		Sum of squares	df	Mean square	F	Sig.
RSC	Between groups	79.23	1	79.23	7.48	0.01
	Within groups	2522.07	238	10.60		
	Total	2601.30	239			
SQ	Between groups	27.36	1	27.36	0.36	0.55
	Within groups	17990.80	238	75.59		
	Total	18018.16	239			

Table 44. Regression of Compliance on High Percent Turnover

	Unstandardized coefficients		Standardized coefficients		
Variable	**B**	**S.E.**	**β**	***t***	**Sig.**
(Constant)	17.845	0.310		57.496	< 0.001
PTbin	–1.153	0.422	–0.175	–2.734	0.007

Note. Dependent Variable: RSC (R^2=0.03)

SEM analysis was performed in Mplus Version 6.0 to test Proposition 2, where *RBV2* was removed from the trimmed structural model and replaced with *APT* in an alternative model. As before, the model remains overidentified with 256 degrees of freedom. The results of this analysis can be found in Figure 11, which contains the path diagram and parameter coefficients, and in Table 45, which contains fit diagnostics and all parameter estimates. Although the model's chi-square value of 352.81 was significant with a *p* value of less than 0.001, a global assessment of fit measures once again indicated good fit. However, neither the path estimate from *APT* to service quality nor the path estimate from *APT* to regulatory and statutory compliance were statistically significant, indicating that a linear relationship did not exist between annualized percent turnover and contract outcomes.

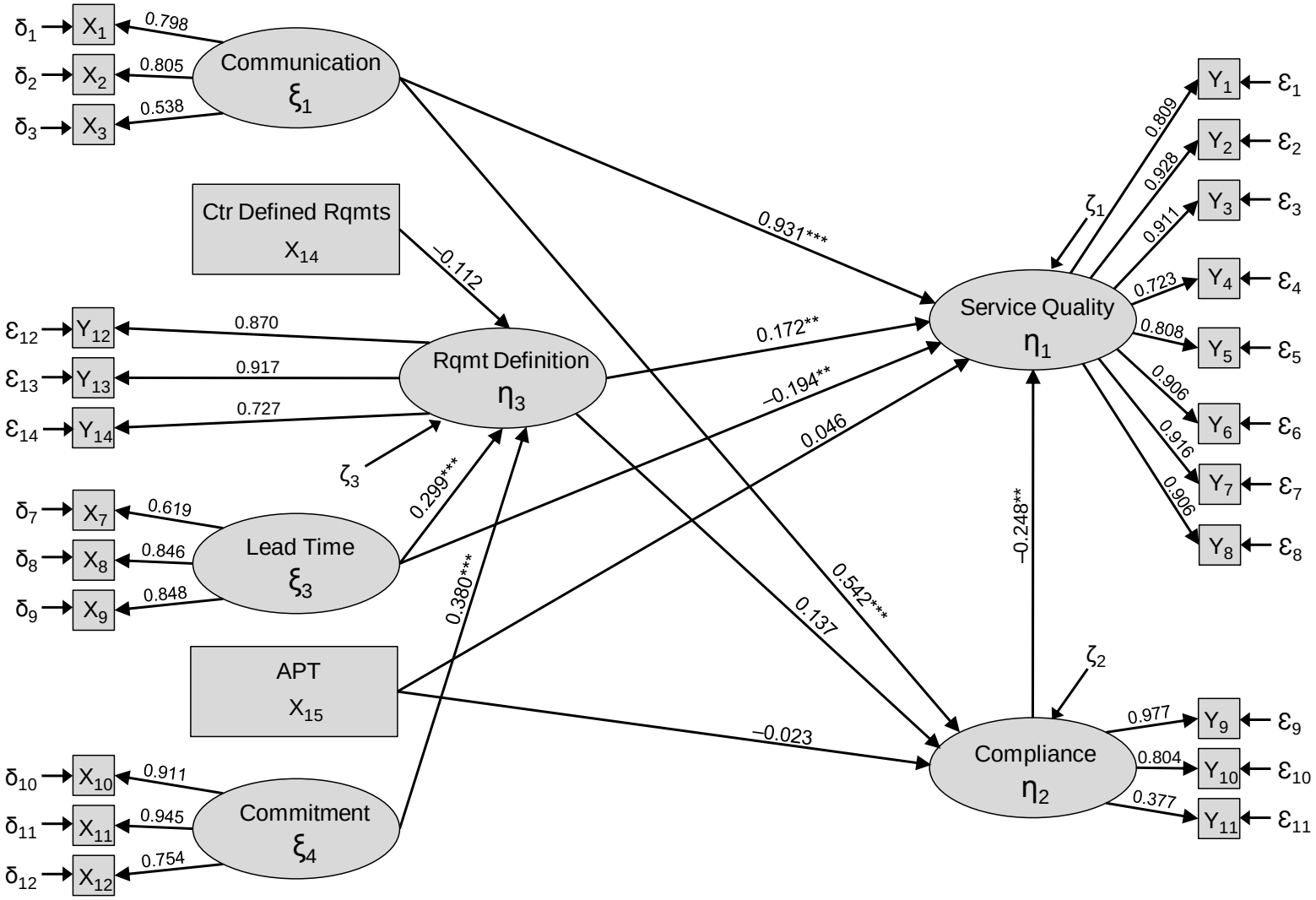

Figure 11. Path Diagram of the Alternative Model

Table 45. Alternative Model Fit Diagnostics and Parameter Estimates

	χ^2/df	CFI	TLI	RMSEA	SRMR
Exploratory model	1.38	0.98	0.97	0.04	0.06
Fitness criterion	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

Parameter			Model notation				Standardized estimate	S.E.	Critical ratio	*P* value
To		From	To		From	Path				
SQ	←	RSC	η_1	←	η_2	β_1	–0.248	0.071	–3.470	0.001
SQ	←	RD1	η_1	←	η_3	β_2	0.172	0.066	2.599	0.009
RSC	←	RD1	η_2	←	η_3	β_3	0.137	0.072	1.908	0.059
RD1	←	RD2	η_3	←	X_{14}	γ_2	–0.112	0.058	–1.938	0.053
SQ	←	RE	η_1	←	ξ_1	γ_3	0.931	0.072	12.979	< 0.001
RSC	←	RE	η_2	←	ξ_1	γ_4	0.542	0.067	8.070	< 0.001
RD1	←	RBV1	η_3	←	ξ_3	γ_7	0.299	0.068	4.373	< 0.001
SQ	←	RBV1	η_1	←	ξ_3	γ_8	–0.194	0.066	–2.913	0.004
SQ	←	APT	η_1	←	X_{15}	γ_{10}	0.046	0.051	0.904	0.366
RSC	←	APT	η_2	←	X_{15}	γ_{11}	–0.023	0.057	–0.414	0.679
RD1	←	ICC	η_3	←	ξ_4	γ_{18}	0.380	0.064	5.924	< 0.001
SQa	←	SQ	Y_1	←	η_1	λ_1	0.809	0.023	34.828	< 0.001
SQc	←	SQ	Y_2	←	η_1	λ_2	0.928	0.010	89.722	< 0.001
SQd	←	SQ	Y_3	←	η_1	λ_3	0.911	0.012	74.249	< 0.001
SQf	←	SQ	Y_4	←	η_1	λ_4	0.723	0.032	22.883	< 0.001
SQi	←	SQ	Y_5	←	η_1	λ_5	0.808	0.023	34.485	< 0.001
SQj	←	SQ	Y_6	←	η_1	λ_6	0.906	0.013	70.855	< 0.001
SQk	←	SQ	Y_7	←	η_1	λ_7	0.916	0.012	77.776	< 0.001
SQm	←	SQ	Y_8	←	η_1	λ_8	0.906	0.013	70.836	< 0.001
RSCa	←	RSC	Y_9	←	η_2	λ_9	0.972	0.030	32.338	< 0.001
RSCc	←	RSC	Y_{10}	←	η_2	λ_{10}	0.804	0.033	24.109	< 0.001
RSCe	←	RSC	Y_{11}	←	η_2	λ_{11}	0.377	0.059	6.435	< 0.001
REa	←	RE	X_1	←	ξ_1	λ_{12}	0.798	0.031	26.136	< 0.001
REb	←	RE	X_2	←	ξ_1	λ_{13}	0.805	0.030	26.752	< 0.001
REd	←	RE	X_3	←	ξ_1	λ_{14}	0.538	0.051	10.593	< 0.001
RD1a	←	RD1	Y_{12}	←	η_3	λ_{18}	0.870	0.023	38.264	< 0.001
RD1b	←	RD1	Y_{13}	←	η_3	λ_{19}	0.917	0.020	45.363	< 0.001
RD1e	←	RD1	Y_{14}	←	η_3	λ_{20}	0.727	0.034	21.095	< 0.001
RBV1c	←	RBV1	X_7	←	ξ_3	λ_{21}	0.619	0.046	13.426	< 0.001
RBV1d	←	RBV1	X_8	←	ξ_3	λ_{22}	0.846	0.031	27.300	< 0.001
RBV1e	←	RBV1	X_9	←	ξ_3	λ_{23}	0.848	0.031	27.471	< 0.001
ICCa	←	ICC	X_{10}	←	ξ_4	λ_{24}	0.911	0.016	57.091	< 0.001
ICCb	←	ICC	X_{11}	←	ξ_4	λ_{25}	0.945	0.014	67.398	< 0.001
ICCd	←	ICC	X_{12}	←	ξ_4	λ_{26}	0.754	0.031	24.818	< 0.001

Finally, Proposition 3 was tested using a MANOVA in PASW Statistics 18.0 to compare the means of service quality and regulatory and statutory compliance between the two groups, low annualized percent turnover and high annualized percent turnover. Test statistics for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root were statistically significant with *p* values of less than 0.05. These results indicate that there is a significant effect of the high-low annualized percent turnover variable on service quality and regulatory and statutory compliance when the two dependent variables are considered as a group. The group differences were explored further using univariate *F* tests. As seen in Table 46, there is a statistically significant difference in the means between the two groups of regulatory and statutory compliance but no statistically significant difference in the means between the two groups of service quality. As such, additional testing using a linear regression analysis of regulatory and statutory compliance on *PTbin* was appropriate to estimate the coefficient size and direction (Table 47). The resulting estimate was statistically significant with a standardized estimate of –0.190, indicating that compliance was lesser on those services acquisitions in which acquisition personnel turnover was greater than or equal to 42% annually.

Table 46. Univariate *F* Tests Between Groups by High/Low APT

Dependent variables		Sum of squares	df	Mean square	F	Sig.
RSC	Between groups	92.92	1	93.92	8.92	< 0.01
	Within groups	2507.37	238	10.54		
	Total	2601.30	239			
SQ	Between groups	17.15	1	17.15	0.23	0.63
	Within groups	18001.01	238	75.63		
	Total	18018.16	239			

Table 47. Regression of Compliance on High/Low APT

	Unstandardized coefficients		Standardized coefficients		
Variable	**B**	**S.E.**	**β**	***t***	**Sig.**
(Constant)	17.836	0.294		60.696	< 0.001
APTbin	–1.251	0.419	–0.190	–2.986	0.003

Note. Dependent Variable: RSC (R^2=0.04)

3. APDP Certification Level

In the hypothesized structural model, the exogenous variable representing the contract administrator's APDP certification level was trimmed because it did not produce significant path estimates to the variables representing requirement definition sufficiency or regulatory and statutory compliance. As such, further analysis using a MANOVA was warranted to test for differences in the means between groups. As mentioned in the literature review, contracting personnel can be awarded three different levels of APDP certification; however, not all personnel possess such certification. Therefore, four APDP categories are available: APDP Level I (n = 44), APDP Level II (n = 88), APDP Level III (n = 61), and no APDP Certification (n = 47). A MANOVA was first performed in PASW Statistics 18.0 to test for multivariate differences in group means. Test statistics for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root were statistically significant with *p* values of less than 0.05. These results indicate that there is a significant effect of buyer APDP level on requirement definition sufficiency and on regulatory and statutory compliance, when the two dependent variables are considered as a group. Possible group differences were explored further using univariate *F* tests on the two dependent variables between the four APDP groups. The analysis resulted in a significant *F* test statistic on requirement definition sufficiency and a marginally significant *F* test statistic on regulatory and statutory compliance, as seen in Table 48.

Table 48. Univariate *F* Tests of Outcomes Between Groups of APDP Level

Dependent variables		Sum of squares	df	Mean square	F	Sig.
RSC	Between groups	71.02	3	23.67	2.21	0.09
	Within groups	2530.28	236	10.72		
	Total	2601.30	239			
RD1	Between groups	223.99	3	74.66	4.79	< 0.01
	Within groups	3679.81	236	15.59		
	Total	3903.80	239			

Because the results of the *F* tests justified further investigation, and because the inclusion of more than two groups permitted post-hoc analysis, Scheffe's test was also performed. Post-hoc tests can isolate the groups that differ. Whereas there are many post-hoc tests available, the Scheffe test is appropriate when pairwise contrasts are not possible (i.e., group sizes differ) and there are more than three means. Kirk (1995) stated that this test "controls the Type I error rate at less than alpha for the infinite number of contrasts that can be performed" (p. 154), but sacrifices some statistical power to detect differences. In the test results (Table 49), Column I represents an APDP group of the dependent variable of which the mean is compared to other APDP groups in Column J. Only one statistically significant difference was found between means of APDP groups; the mean reported level of requirement definition sufficiency by APDP Level II contract administrators (16.63 on a summated scale using three 7-point items) was more than that reported by APDP Level III contract administrators (14.20), and the difference of 2.43 was statistically significant with a *p* value of less than 0.01.

Table 49. Scheffe's Test for Comparison of Means by APDP Level

Dependent variables	CBV2		Mean difference (I–J)	S.E.	Sig.	95% C.I.	
	(I)	(J)				Lower bound	Upper bound
RSC	0	1	1.15	0.69	0.43	–0.79	3.08
		2	–0.25	0.59	0.98	–1.92	1.41
		3	0.67	0.64	0.77	–1.11	2.46
	1	0	–1.15	0.69	0.43	–3.08	0.79
		2	–1.40	0.60	0.15	–3.10	0.30
		3	–0.47	0.65	0.91	–2.30	1.35
	2	0	0.25	0.59	0.98	–1.41	1.92
		1	1.40	0.60	0.15	–0.30	3.10
		3	0.93	0.55	0.41	–0.61	2.46
	3	0	–0.67	0.64	0.77	–2.46	1.11
		1	0.47	0.65	0.91	–1.35	2.30
		2	–0.93	0.55	0.41	–2.46	0.61
RD1	0	1	–0.26	0.83	0.99	–2.59	2.08
		2	–1.54	0.71	0.20	–3.55	0.47
		3	0.89	0.77	0.72	–1.27	3.05
	1	0	0.26	0.83	0.99	–2.08	2.59
		2	–1.28	0.73	0.38	–3.34	0.77
		3	1.14	0.78	0.54	–1.05	3.34
	2	0	1.54	0.71	0.20	–0.47	3.55
		1	1.28	0.73	0.38	–0.77	3.34
		3	2.43	0.66	< 0.01	0.58	4.28
	3	0	–0.89	0.77	0.72	–3.05	1.27
		1	–1.14	0.78	0.54	–3.34	1.05
		2	–2.43	0.66	< 0.01	–4.28	–0.58

4. Buyer Education Level

A similar approach to analysis was taken to explore differences in means by groups of varying buyer education level (*CBV3*), which did not produce significant path estimates in SEM and was trimmed from the hypothesized model. A MANOVA was performed on requirement definition sufficiency and regulatory and statutory compliance by groups of four education levels: high school or general equivalency diploma (n = 29), associate's degree (n = 104), bachelor's degree (n = 28), and master's

degree or higher (n = 79). None of the test statistics for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, or Roy's Largest Root were statistically significant, indicating that group means did not differ. Additional results from univariate *F* tests (Table 50) confirmed this finding; no statistically significant differences in means between groups were found for either dependent variable.

Table 50. Univariate *F* Tests Between Groups of Education Level

Dependent variables		Sum of squares	df	Mean square	F	Sig.
RSC	Between groups	2.37	3	0.79	0.07	0.98
	Within groups	2598.93	236	11.01		
	Total	2601.30	239			
RD1	Between groups	3.43	3	1.14	0.07	0.98
	Within groups	3900.37	236	16.53		
	Total	3903.70	239			

5. Buyer Experience

Further analysis was also performed to explore potential relationships between buyer experience and service quality, regulatory and statutory compliance, and requirement definition sufficiency. First, a MANOVA was performed on the latter three variables when grouped using a binary high-low measure of experience, where the cut in data occurred about the median of experience reported (8.5 years). In the high-low variable for buyer experience, the cases in which respondents had less than 8.5 years of experience were coded with a value of 1 (n = 120), and all other cases were coded with a value of 0 (n = 120). None of the test statistics for Pillai's Trace, Wilks' Lambda, Hotelling's Trace, or Roy's Largest Root were statistically significant, indicating that multivariate group means did not differ. However, although univariate *F* tests were also not significant for any of the dependent variables (Table 51), the test result for service quality indicated that additional analysis may be warranted based on the value of the *F* statistic.

Table 51. Univariate *F* Tests Between High and Low Groups of Experience

Dependent variables		Sum of squares	df	Mean square	F	Sig.
RSC	Between groups	1.20	1	1.20	0.11	0.74
	Within groups	2600.09	238	10.93		
	Total	2601.30	239			
RD1	Between groups	0.94	1	0.94	0.06	0.81
	Within groups	3902.86	238	16.40		
	Total	3903.80	239			
SQ	Between groups	97.54	1	97.54	1.30	0.26
	Within groups	17920.63	238	75.30		
	Total	18018.16	239			

As such, buyer experience responses were partitioned into three groups: low, medium, and high. Low-experience buyers were considered to be those respondents with five or less years of contract administration experience (n = 91). Medium-experience buyers were considered to be those respondents with between 5 and 15 years of experience (n = 76). Finally, high-experience buyers were those respondents with more than 15 years of experience (n = 73). Two binary variables were created, one for medium-experience and another for high-experience. Service quality, compliance, and requirement definition sufficiency were regressed individually on the two variables; regression results are located in Table 52. Only the regression of service quality exhibited any level of statistical significance; both binary variables were moderately significant with coefficient *p* values less than 0.10. However, the sizes of the estimates were nearly identical between the two variables, indicating that an additional high-low analysis might be appropriate with the medium and high responses combined. For ease of interpretation, this additional regression of service quality was only performed on a binary variable representing low experience, since medium and high experience would be effectively consolidated in the constant of the regression equation. This regression analysis (Table 53) resulted in the estimation of a statistically significant non-positive path coefficient for the binary variable representing low buyer experience. Therefore, it is concluded that low buyer experience (five years or less) is associated with lower levels of service quality.

Table 52. Regressions on Buyer Experience

	Unstandardized coefficients		Standardized coefficients		
Variable	**B**	**S.E.**	**β**	***t***	**Sig. (*p*)**
Regression of service quality ($R^2 = 0.02$)					
(Constant)	43.780	0.906		48.303	< 0.001
Experience_Mod.	2.299	1.344	0.123	1.711	0.088
Experience_High	2.316	1.359	0.123	1.705	0.090
Regression of compliance with regulations and statutes ($R^2 < 0.01$)					
(Constant)	17.000	0.347		49.048	< 0.001
Experience_Mod.	0.500	0.514	0.071	0.973	0.331
Experience_High	0.205	0.520	0.029	0.396	0.693
Regression of requirement definition sufficiency ($R^2 < 0.01$)					
(Constant)	15.516	0.425		36.481	< 0.001
Experience_Mod.	0.036	0.630	0.004	0.057	0.954
Experience_High	–0.188	0.638	–0.021	–0.294	0.769

Table 53. Regression of Service Quality on Low Buyer Experience

	Unstandardized Coefficients		Standardized Coefficients		
Variable	**B**	**S.E.**	**β**	***t***	**Sig. (*p*)**
(Constant)	46.087	0.707		65.202	< 0.001
Experience_Low	–2.307	1.148	–0.129	–2.010	0.046

Note: Dependent Variable: SQ ($R^2 = 0.01$)

6. Assignment of Contract Administration Personnel

Finally, the assignment of contract administration personnel to service acquisitions was explored to discern any links between the characteristics of procurements and buyer qualifications. Reed (2010) discussed some of the leading variables used by the U.S. Air Force in the assignment of contract administration manpower to contracting units, which included the complexity of acquisitions and the allowable time for the completion of contract actions, among other variables. Because

manpower is later assigned internally by unit management, it is warranted to also examine whether the manpower allocation variables—which are used broadly by the U.S. Air Force—are replicated in unit management's decisions to internally assign personnel to acquisitions. Although data on respondent pay grade were not collected, respondents can be readily grouped by years of experience and by levels of APDP certification and education. Using the variables provided by Reed (2010) as a general basis for the assignment of manpower, potential determinants for the assignment of administration personnel to acquisitions are the contract type, commerciality of the service, the sufficiency of lead-time available for the procurement, and the level of the internal customer's commitment to the acquisition, in which the level of the internal customer's commitment may be a proxy for the manager's perception of the importance of the acquisition. In the analysis, linear regression was used to examine assignment by experience—since buyer experience was represented as a continuous variable—and ordinal logistic regression was used in the regressions of APDP certification and buyer education—since the two variables are ordered categorical. For the regression of education level (Table 56), buyers were ordered into the following four categories: high school or general equivalency diploma, associate's degree, bachelor's degree, or master's degree or higher. Statistically significant coefficients were found for the linear regression on buyer experience (Table 54) and the ordinal logistic regression on APDP Level (Table 55). It cannot be inferred, based on the data, that managers consider buyer education level when assigning buyers to service acquisitions. Furthermore, there is no evidence that the level of commitment by the internal customer is a factor in the assignment of buyers to acquisitions. However, lower levels of buyer experience and lower buyer APDP levels were associated with commercial acquisitions, fixed-price acquisitions, and acquisitions with greater procurement lead-time.

Table 54. Linear Regression of Buyer Experience on Assignment Factors

	Unstandardized coefficients		Standardized coefficients		
Variable	**B**	**S.E.**	**β**	***t***	**Sig. (*p*)**
(Constant)	20.853	3.259		6.399	< 0.001
RBV1	–0.394	0.143	–0.185	–2.750	0.006
ICC	0.130	0.173	0.050	0.749	0.455
Fixed_Price	–3.757	1.774	–0.139	–2.118	0.035
Commercial	–3.844	1.582	–0.161	–2.430	0.016

Note. Dependent Variable: CBV1 (R^2= 0.10)

Table 55. Ordinal Logistic Regression of APDP Level on Assignment Factors

							95% C.I.	
		Estimate	**S.E.**	**Wald**	**df**	**Sig.**	**Lower bound**	**Upper bound**
Threshold	[APDP = 0]	–4.519	0.704	41.176	1.000	< 0.001	–5.900	–3.139
	[APDP = 1]	–3.532	0.686	26.500	1.000	< 0.001	–4.876	–2.187
	[APDP = 2]	–1.737	0.654	7.049	1.000	0.008	–3.019	–0.455
Location	RBV1	–0.050	0.028	3.192	1.000	0.074	–0.106	0.005
	ICC	–0.037	0.034	1.185	1.000	0.276	–0.103	0.029
	Fixed_Price	–0.616	0.355	3.010	1.000	0.083	–1.312	0.080
	Commercial	–1.482	0.327	20.535	1.000	< 0.001	–2.123	–0.841

Note. APDP Level III is reference category; Cox & Snell Pseudo R^2 = 0.16

Table 56. Ordinal Logistic Regression of Education Level on Assignment Factors

							95% C.I.	
		Estimate	**S.E.**	**Wald**	**df**	**Sig.**	**Lower bound**	**Upper bound**
Threshold	[EDUC = 0]	–2.669	0.667	15.999	1.000	< 0.001	–3.978	–1.361
	[EDUC = 1]	–1.842	0.653	7.944	1.000	0.005	–3.122	–0.561
	[EDUC = 2]	0.076	0.642	0.014	1.000	0.905	–1.181	1.334
Location	RBV1	–0.041	0.028	2.072	1.000	0.150	–0.096	0.015
	ICC	0.029	0.034	0.738	1.000	0.390	–0.037	0.096
	Fixed_Price	–0.404	0.352	1.318	1.000	0.251	–1.093	0.286
	Commercial	–0.327	0.312	1.098	1.000	0.295	–0.939	0.285

Note. Education Level 3 is reference category; Cox & Snell Pseudo R^2 = 0.03

7. Service Quality Scale

The scale that was proposed for measuring B2B service quality exhibited excellent consistency, with a reliability coefficient of 0.96 after purification in EFA. The resultant factor contained 8 of the original 14 scale items, including 3 from the proposed dimension responsiveness to requirements. Loadings from the latent variable service quality to each of these 3 items in CFA were high. Changes in the variance of the latent variable explained 83% of the variation in the first item, *SQj*; 85% of the variation of the second item, *SQk*; and 83% of the variation in the third item, *SQm*, as measured by the coefficient of determination, R^2. Table 57 presents measurement statistics for all items in the new dimension.

Table 57. Measurement Item Statistics for Responsiveness to Requirements

					Endogenous measurement model		
Item		**Mean**	**St. Dev.**	**EFA loading**	**Standardized loading estimate**	**R^2**	**Residual variance**
SQj	The contractor met the requirements of the contract.	5.78	1.23	0.901	0.909	0.826	0.174
SQk	The contractor satisfied our need.	5.76	1.18	0.898	0.919	0.845	0.155
SQl	The contractor performed the work we needed it to do.	5.79	1.23	———	Not used for measurement		———
SQm	The timeliness of the contractor's work.	5.71	1.25	0.894	0.908	0.824	0.175
SQn	The quality of the contractor's work.	5.38	1.23	———	Not used for measurement		———

K. CONCLUSION

In summary, this chapter reported the results from tests of the sample data using multiple methods. First, the 240 usable survey responses were analyzed to verify that SEM assumptions were met prior to testing. EFA was then performed to purify scales, in which a total of 26 measurement items were retained for 7 constructs, with all constructs being measured by no less than 3 items and exhibiting sufficient reliability coefficients. Construct validity was then assessed using CFA. Constructs met the four rules of thumb for construct validity that were proposed by Hair et al. (2010), and an assessment of fit indices revealed that measurement models exhibited good fit to the sample data. Finally, the hypothesized structural model was estimated using SEM, which fit well to the sample data but resulted in several non-significant path estimates. These paths were later trimmed from the structural model, along with manifest and latent variables where appropriate, resulting in a second structural model. This model also fit well to the sample data and was found to be the preferred model of the two, when competed using two popular information criterions. Additional testing was also performed, when appropriate, to further explore relationships. For ease of interpretation, a summary table containing the significance level of each hypothesis from the trimmed model can be found in Table 58.

Table 58. Summary of Support for Hypotheses in Trimmed Structural Model

	Hypotheses	Supported?
H1	The greater the compliance with regulations and statutes, the greater the service quality.	No[c]
H2	There will be a direct, positive relationship between the sufficiency of the requirement definition and service quality.	Yes[a]
H3	There will be a direct, positive relationship between the sufficiency of the requirement definition and regulatory and statutory compliance.	Yes[b]
H4	The greater the extent to which the contractor defines requirements, the greater the service quality.	No
H5	The greater the extent to which the contractor defines requirements, the greater the sufficiency of the requirement definition.	No[c]
H6	The greater the communication between the government and the contractor, the greater the service quality.	Yes[a]
H7	The greater the communication between the government and the contractor, the greater the regulatory and statutory compliance.	Yes[a]
H8	The greater the amount of government surveillance of contractor performance, the greater the service quality.	No
H9	The greater the extent to which performance-based services acquisition procedures are used, the greater the service quality.	No
H10	The greater the sufficiency of procurement lead-time, the greater the service quality.	No[c]
H11	The greater the sufficiency of procurement lead-time, the greater the compliance with regulations and statutes.	No
H12	The greater the sufficiency of procurement lead-time, the greater the sufficiency of the requirement definition.	Yes[a]
H13	The greater the turnover of government acquisition personnel, the lesser the service quality.	No[d]
H14	The greater the turnover of government acquisition personnel, the lesser the compliance with regulations and statutes.	Yes[b]
H15	There will be a direct, positive relationship between the amount of contract administrator experience and the sufficiency of the requirement definition.	No
H16	There will be a direct, positive relationship between the amount of contract administrator experience and regulatory and statutory compliance.	No
H17	The greater the contract administrator's APDP certification level, the greater the sufficiency of the requirement definition.	No
H18	The greater the contractor administrator's APDP certification level, the greater the regulatory and statutory compliance.	No
H19	The greater the contract administrator's education level, the greater the sufficiency of the requirement definition.	No
H20	The greater the contract administrator's education level, the greater the regulatory and statutory compliance.	No
H21	The greater the internal customer's commitment to the service acquisition, the greater the compliance with regulations and statutes.	No
H22	The greater the internal customer's commitment to the service acquisition, the greater the sufficiency of the requirement definition.	Yes[a]

Notes. [a]$p < 0.05$, [b]$p < 0.10$, [c]Significant but inverse estimate, [d]Nonsignificant but retained in trimmed model ($t > 1.00$).

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V. DISCUSSION AND RECOMMENDATIONS

A. INTRODUCTION

The objective of this research was to bridge a literature gap and to offer service contract practitioners within the U.S. Air Force a comprehensive model to better improve the acquisition of services while increasing compliance with federal, DoD, and service acquisition regulations. The study addressed the following three research questions:

> *Research Question 1: What are the determinants of services sourcing performance?*
>
> *Research Question 2: Which determinant(s) have the greatest impact on the key contract outcomes of service quality and regulatory and statutory compliance?*
>
> *Research Question 3: How can service quality be validly measured in a business-to-business context?*

A new gaps model was proposed that extended previous work by Parasuraman et al. (1985) and Kong and Mayo (1993) into the context of business-to-business (B2B) services in which service requirements are defined by the customer. This framework was also utilized to create a service quality measurement scale for B2B services in which two of the five SERVQUAL dimensions proposed by Parasuraman et al. (1988) were retained and a new dimension, responsiveness to requirements, was added. The scale exhibited an exceptionally high reliability coefficient, and further testing in exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) provided support for scale validity.

A structural model of the determinants of services sourcing performance was also tested and found to exhibit good fit to the sample data, which were collected from 240 U.S. Air Force contract administrators and analyzed using structural equation modeling (SEM). The model was later trimmed to achieve a greater degree of parsimony and to allow for a more precise and reliable replication in future research. This trimmed model was empirically found to be the preferred model of the two through an examination of the

trimmed model's goodness-of-fit to the sample data and a competition of both structural models using information criterion measures.

Finally, hypothesized causal paths within the two structural models were estimated using SEM to test 22 hypothesized relationships. Further analysis was also performed, when appropriate, through other statistical techniques such as analyses of variance and linear and non-linear regression. Many of the findings from these hypothesis tests have significant implications to the U.S. Air Force's and DoD's management of service acquisitions. Among them is a finding that the adequacy of government–contractor communication has the greatest impact on the level of service performance and also has an impact on the extent to which the contract is compliant with regulations and statutes. Further findings provide support for the importance of sufficiently defining service requirements and for establishing proper levels of commitment to acquisitions by internal customers. An analysis of acquisition personnel turnover resulted in two practical findings in which statistically significant differences in the levels of contract compliance (with regulation and statutes) were discovered between groups of contracts with high acquisition personnel turnover and groups of contracts with low acquisition personnel turnover. Finally, a negative association was found between the service outcomes of compliance with regulations and statutes and service quality—a finding that not only presents managerial implications but that may warrant further research to determine cause.

B. DISCUSSION AND IMPLICATIONS

This section presents a discussion of the research results as well as of the theoretical and managerial implications of the research. The results from the SEM analysis of the trimmed model are discussed when path estimates and their respective effect sizes and significance levels are referenced, as the trimmed model was found to be the most preferred model in the study. This model exhibited good fit to the sample data and provided support for seven of the hypotheses. Empirically, the SEM analysis resulted in statistically significant estimates for eight of the causal paths (Hypotheses 1, 2, 3, 6, 7, 10, 12, and 22), moderately significant estimates for two of the causal paths

(Hypotheses 5 and 14), and estimates with no statistical support for 12 of the causal paths (Hypotheses 4, 8, 9, 11, 13, and 15 through 21).

The order of the discussion in this section will coincide with the order of the sections within the literature review and with the numerical order of the 22 hypotheses. The proposed gaps model and the effectiveness of the proposed scale for the measurement of service quality in customer-defined B2B service acquisitions will be discussed first and will be followed by discussions of the results from hypothesis testing.

1. Gaps Model and Service Quality Scale

The primary theoretical implication of this study is the extension of service quality theory into B2B contexts. The previous work of Kong and Mayo (1993) attempted to do this but fell short because their framework was limited to interfirm account services and was not directly applicable to B2B purchasing; a flaw in the model did not allow for generalization to service acquisitions in which service specifications are defined by the customer and not the service supplier.

Furthermore, a scale for the measurement of B2B service quality was developed based on adaptations of Pasaruraman et al.'s (1988) SERVQUAL scale, in which two of the authors' five service quality dimensions were retained and a new dimension, responsiveness to requirements, was added. The scale performed well in EFA; all service quality measurement items loaded on one factor, once purified from 14 to 8 items, and exhibited an exceptionally high scale reliability coefficient (Cronbach's alpha of 0.96). Three of the eight measurement items retained after EFA were from the newly proposed dimension and each presented factor loadings greater than 0.89 on the primary factor, indicating that responsiveness to requirements successfully integrated with the two SERVQUAL dimensions that were retained. This new scale offers value to researchers. First, it can be used to guide future research in the context of B2B service acquisitions. There is an apparent need for further improvements in the management of services acquisitions; the necessary first step is to apply valid measures when quality is examined. Second, existing service quality scales were not directly applicable to B2B services since they emphasized the delivery of off-the-shelf services by suppliers and

assumed face-to-face contact between customers and suppliers. Previous findings based on these scales may need to be revisited since the measures that were used may not have been appropriate or valid in B2B contexts.

2. Regulatory and Statutory Compliance

Hypothesis 1: The greater the compliance with regulations and statutes, the greater the service quality.

The modeled path for Hypothesis 1 was found to be statistically significant with a moderate effect size. However, the data did not support the *a priori* positive path coefficient. Instead, the model estimated a statistically significant, non-positive coefficient that reflected the following relationship: the lesser the compliance with regulations and statutes, the greater the service quality. As such, service quality and compliance with regulations and statutes are somewhat mutually exclusive. Several potential explanations of this result are offered.

First, it is plausible that some of the regulations and statutes applicable to the U.S. Air Force's acquisitions of services are successful at achieving public policy objectives but are detrimental to achieving the expected levels of service quality. For example, competition requirements may force suppliers in highly competitive industries to lower the quantity or quality of service inputs to remain competitive in proposals, resulting in lower service levels. Or, contract administrators who do not comply with competition requirements and, instead, issue non-competitive awards may be predisposed to enter into sole-source negotiations with a preferred supplier. Alternatively, if competition does allow for the selection of higher-performing suppliers, the act of compliance with pre-solicitation policies, regulations, and statutes (e.g., synopsis requirements, approvals, and solicitation reviews) may limit the time available for competition. Coopers and Lybrand and The Analytical Sciences Corporation (1994) found that compliance with regulations and statutes drives an 18% cost premium to the DoD. It is plausible that the true cost of compliance to the DoD also includes a premium on performance.

A second possibility exists that the actions necessary to achieve compliance with the numerous regulations and statutes directly reduce the contract administrator's ability to adequately monitor and assess performance and to address deficiencies with the supplier. Compliance with labor law acts, such as the McNamara-O'Hara Service Contract Act or the Davis-Bacon Act, which require administrators to perform on-site interviews with contractor employees and to review payrolls, may unduly limit the administrator's available time to manage performance. As such, in some instances, the government's level of contract administration manpower may also be low enough that personnel are forced to tradeoff their available time between complying with statues and regulations and ensuring that the expected level of service performance is achieved. DoD leadership also seems to favor the possibility that certain policies unduly overburden the contracting workforce. For example, the USD(AT&L) recently issued guidance to reduce non-productive procurement processes through the elimination of non-value added regulations and statutes, among other steps (USD[AT&L], 2010b). The USD(AT&L) found that the DoD's compliance with internal and congressional procurement reporting requirements not only cost the Department an estimated $350 million annually but also took the acquisition workforce away from executing defense programs.

Finally, regulations and statutes or actions by the contractor to comply with regulations and statutes may directly detract from the contractor's ability to perform. As before, the actions necessary for the contractor to comply with labor laws may detract from the time available to maintain service levels. These laws may also prove to be a disincentive to the hiring of additional labor if the applicable prevailing wage rates are higher than the wages typically paid by the firm. Alternatively, the focus on compliance may regress the government–contractor relationship to that of a compliance orientation instead of a relationship built on the relational exchange norms.

3. Requirement Definition

Hypothesis 2: There will be a direct, positive relationship between the sufficiency of the requirement definition and service quality.

Hypothesis 2 was supported in the model, with a statistically significant parameter estimate approaching a moderate effect size. This finding supports non-empirical claims of other authors who have argued that sufficiently defining performance requirements is critical to obtaining desired levels of service. It also provides empirical support for the proposed gaps model, in which end-user needs are translated into quality specifications and the difference between service expectation and perceptions is dependent on the sufficiency of the requirements documents. Furthermore, this result bolsters the need to address the requirements creep caused by poorly defined service specifications, as recently discussed in a USD(AT&L) guidance memorandum (USD[AT&L], 2010b).

Hypothesis 3: There will be a direct, positive relationship between the sufficiency of the requirement definition and regulatory and statutory compliance.

The trimmed model offered moderate support for Hypothesis 3 and the associated argument that a well-defined requirement definition should also adequately define those actions required of the contractor to ensure compliance with regulations and statutes. A wide variety of service types, contract types, and award amounts were represented by survey respondents in this study. Since compliance-related actions required by the contractor are also likely to vary based on these factors, the level of significance and the small effect size obtained from the SEM analysis are not surprising. For example, requirements documents for a firm-fixed-price acquisition of custodial services would likely contain far fewer compliance-related requirements for the supplier than a cost-plus-award-fee contract for research and development. As such, the proper estimation of this path may require the inclusion of moderating effects (i.e., interactions) due to contract complexity or other effects. Nonetheless, it can be concluded that

sufficiently defining the service requirement is a critically important task because it affects both service quality and the amount of compliance with regulations and statutes. As such, managers must make certain that performance requirements and compliance-related requirements are well defined in requirements documents to achieve desired acquisition outcomes.

> *Hypothesis 4: The greater the extent to which the contractor defines requirements, the greater the service quality.*

The SEM analysis did not provide support for Hypothesis 4. At first glance, this result seems to indicate that early integration of suppliers into the planning and solicitation phases of acquisitions has no direct, significant effect on service quality, which is counter to the findings of other authors who have argued for the effectiveness of early supplier integration (see, for example, Briscoe et al., 2004). However, the lack of support for this hypothesis does not mean that early integration has no effect on service levels since the scale used in this study to measure service quality is based on gaps between expectations and actual observations of service levels and since the model path also included a mediating variable. Because the hypothesized relationship has a direct effect on service quality (excluding the indirect effect in which requirement definition sufficiency is a mediating variable), the causal path only represents direct effects on changes to expectations and/or observations of service levels; effects due to changes in the sufficiency of the requirement definition are accounted for elsewhere in the model. Therefore, supposing that the expected service level prior to award is defined as E, the supplier involvement in the definition of requirements results in a change in expectations, or ΔE, and the government expectation of the service level after pre-award interaction with the contractor is E', where $E' = E + \Delta E$. If the observed level of service (O), is commensurate with the buyer's expected level of service, as communicated in the requirements documents, then $O = E$, $O' = E'$, and ΔO must equal ΔE. In reality, it would be unreasonable to expect that the observed service level always equals the expected service level ($O = E$); however, it is reasonable to expect that a prudent supplier would adequately perform the portion of the service that represents the change in

expectations due to the supplier's recommendations. As such, it can still be expected that the change in the observed service level equals the change in the expected service level (ΔO is still equal to ΔE), and the estimate of the causal path from extent contractor defined requirements to service quality would not be expected to differ significantly from 0. Therefore, this non-significant finding should not be interpreted to mean that the early integration of suppliers has no effect on service levels, but rather that any increases or decreases in observed service levels due to early integration were likely offset by similar increases or decreases in expectations; when government–contractor communications prior to contract award changed the government's expected service level, the contractor adequately performed to the change if the change in expected service level was not formalized in the requirements documents.

> *Hypothesis 5: The greater the extent to which the contractor defines requirements, the greater the sufficiency of the requirement definition.*

Under ideal conditions, the contractor's overall level of service performance would be the same as the level of performance specified in the requirements documents, and these documents would accurately reflect government expectations, such that the expected service level would equal the observed service level. However, in reality and in the sample used in this study, it is atypical for requirements documents to fully and accurately communicate the government's expectations for performance of the service. As such, it seems reasonable that supplier interactions in defining requirements would also change how sufficiently the requirement definition describes the government's service requirements. The model estimated a small and non-positive relationship between the extent to which the contractor defined requirements and the sufficiency of the requirement definition, implying that greater involvement by the contractor in defining service requirements leads to a less sufficient definition of those requirements—perhaps due to a greater gap between the contractor's version of the work and the government's true need.

The results of Hypothesis 4 and Hypothesis 5 suggest that early integration of suppliers into procurement planning may be productive, or at least not detrimental, in aligning government expectations with contractor capabilities and industry standards. However, the government's acquisition objectives may be at risk when potential suppliers directly influence how these objectives are communicated in the solicitation and contract. Additionally, it is important to note that the survey used a single-item scale to measure the extent to which the contractor defined requirements. Because this extent cannot be readily observed, a multi-item scale may have been more appropriate for reliable measurement and would have allowed the model to account for any measurement error in the variables.

4. Relational Exchange

Hypothesis 6: The greater the communication between the government and the contractor, the greater the service quality.

Hypothesis 7: The greater the communication between the government and the contractor, the greater the regulatory and statutory compliance.

Hypotheses 6 and 7 were both found to be supported by the sample data and presented the largest effect sizes on the key sourcing outcomes of service quality and regulatory and statutory compliance. It is interesting that an aspect of relational exchange —communication—has a greater effect on key service outcomes than do any transactional processes (e.g., requirements definition), resources (e.g., time), or characteristics of the involved personnel (e.g., experience). This finding is in stark contrast to the way acquisition personnel are trained, educated, and developed. Nowhere in their development are these valuable soft skills taught. Perhaps more time should be devoted to the development and sustainment of relational norms such as solidarity, mutuality, flexibility, reciprocity, trust, commitment, and harmonization of conflict.

5. Agency Theory

Hypothesis 8: The greater the amount of government surveillance of contractor performance, the greater the service quality.

Hypothesis 8, the relationship between the amount of government surveillance and service quality, was not supported in the model. It is possible that many of the service contractors are capable of policing their own performance or that government–contractor communication and trust were sufficient enough to eliminate the type of asymmetric information that might be obtained through surveillance of performance. Gundlach and Cannon (2009) also arrived at a similar conclusion that surveillance does not impact quality; they determined that information exchange was the most effective verification strategy in medium- and high-trust relationships and that corroboration with external sources may be the most effective strategy in low-trust relationships. Such a finding as this may indicate that the continuous calls for the DoD to improve its oversight of contractors, such as those calls by the GAO, may be unwarranted, at least within the U.S. Rather than investing contract management resources into increased supplier monitoring, contract administrators may be better served by increasing communications. As such, relational exchange seems to better account for supplier performance than do the precepts of transaction cost economics or agency theory.

Hypothesis 9: The greater the extent to which performance-based services acquisition procedures are used, the greater the service quality.

Hypothesis 9 was also found to be non-significant, indicating that no significant, direct relationship exists between the extent that PBSA procedures are used and service quality. This is especially surprising considering that the benefits from using outcome-oriented requirements definitions had been well-supported by literature. However, the survey used a single-item scale to measure the extent that PBSA procedures were integrated into the acquisition. Because this extent cannot be readily observed, a multi-item scale may have been more appropriate for reliable measurement and to

account for measurement error. Similarly, the subjective assessments by respondents as to the extent that PBSA procedures were used may have varied greatly with respect to interpretations of what constitutes a PBSA contract. More than 78% of respondents reported that the extent that PBSA procedures were used was 5 or greater on a 7-point scale, with a mean reported value of 5.6. As such, a subjective measure may not have been effective if, in reality, the majority of service acquisitions were not highly performance based.

6. Resource-Based View of the Firm

Hypothesis 10: The greater the sufficiency of procurement lead-time, the greater the service quality.

Hypothesis 11: The greater the sufficiency of procurement lead-time, the greater the compliance with regulations and statutes.

Hypothesis 12: The greater the sufficiency of procurement lead-time, the greater the sufficiency of the requirement definition.

Of Hypotheses 10, 11, and 12, only Hypothesis 12 was supported in the model as hypothesized; the analysis produced a moderately-sized effect for this hypothesized path. The model estimated a small and negative path coefficient for Hypothesis 10 that was statistically significant, supporting an alternative argument that service quality decreases as the sufficiency of procurement lead-time increases. No support was provided in the model for Hypothesis 11.

Prior to considering the potential causes of the negative relationship that was estimated between procurement lead-time sufficiency and service quality, it is most appropriate to focus away from factors that are explained elsewhere in the model. For example, in the context of DoD service acquisitions, one might normally expect that quality would increase when lead-time increases since the buyer(s) would have more time to perform critical pre-award tasks (such as performing market research, ensuring the adequacy of the SOW/PWS, completing contract reviews, issuing a synopsis and

solicitation, and evaluating offers). However, most of these factors were already accounted for elsewhere in the model. For instance, requirement definition sufficiency was found to be positively related with the procurement lead-time sufficiency in Hypothesis 12. In fact, a positive, indirect effect from procurement lead-time sufficiency to service quality exists through requirement definition sufficiency as a mediating variable.

However, the path estimate from procurement lead-time sufficiency to regulatory and statutory compliance was not significant, indicating that buyers may be resilient against insufficient procurement lead-times when it comes to compliance with regulations and statutes. As such, the negative path estimate from Hypothesis 10 is a result of factors that are external to regulatory and statutory compliance, requirement definition sufficiency, and impacts on service quality that are due to these regulations and statutes or to the sufficiency of the requirement definition.

One such external factor was examined in this study using regression analysis, and it was found that the greater the sufficiency of the procurement lead-time, the lesser the experience and APDP level of the buyer assigned to the acquisition. To further explore the impacts on such an assignment of buyers, it is helpful to first step back and view how pre-award contract actions that occur during the period designated as procurement lead-time can affect performance outcomes.

The measurement of service quality is based on differences between the expectations and perceptions of service levels over the life of the contract—after the contract has been awarded and performance has begun. By definition, the sufficiency of procurement lead-time has immediate and direct impacts on actions that occur during pre-award stages of the acquisition. After contract award, it is possible to correct some, but not all, pre-award mistakes that affect service delivery through the use of contract modifications. As an example, if the service requested was sufficiently defined by the requirements documents but did not meet actual demand, as was the case with the Department of Homeland Security's acquisition of cruise ship berthing during Hurricane Katrina (see, for example, Snider & Rendon, 2008), then sourcing outcomes could be negatively affected but could also be corrected through contract modification. Other

performance issues that are caused prior to award, such as when supplier evaluations result in an award to a low-performing supplier (i.e., adverse selection), may not be as easily corrected. In this scenario, evaluation criteria in the solicitation may have been sufficient enough to meet regulatory requirements but not sufficient enough to select the best supplier, potentially due to the assignment of an inexperienced buyer. Additional pre-award errors that might contribute to decreased service quality throughout the life of an acquisition are the selection of the wrong contract type or instrument, the misapplication of contract incentives, and the misuse of certain procedures, such as commercial-item acquisition procedures or simplified acquisition procedures. The misuse of these procedures could prove detrimental to ensuring the government's interest post-award because of limitations on the use of contract clauses, limitations on requiring cost or pricing data, or limitations on the government's ability to oversee contractor performance. If errors such as these are made by inexperienced buyers, long-term acquisition outcomes would likely be affected. This also seems to be supported by regression results in this study in which acquisitions that were administered by personnel with five or less years of experienced were found to have lower levels of service quality than acquisitions administered by more experienced personnel.

Overall, the SEM results show that procurement lead-time improves the sufficiency of the requirement definition, which, in turn, improves service quality and compliance with regulations and statutes. However, it seems that requirements with sufficient lead-time (i.e., little pressure to award a contract) are not viewed to be as important to the internal customer or to contracting personnel; thus, perhaps less attention is afforded to the requirement, and the buyer's source selection process is also less rigorous, directly decreasing service quality.

Hypothesis 13: The greater the turnover of government acquisition personnel, the lesser the service quality.

Hypothesis 14: The greater the turnover of government acquisition personnel, the lesser the compliance with regulations and statutes.

Neither Hypothesis 13 nor Hypothesis 14 was fully supported in the SEM model. However, two highly significant regression results provided support for Hypothesis 14.

In the first supporting regression, turnover was calculated as a ratio (percent) and modified to a binary variable about the median of 1.00 (100%). A small, but highly significant, coefficient was estimated, indicating that compliance with regulations and statutes was significantly less on services acquisitions in which, over the life of the contract, more personnel had turned over than were assigned. Such a result has strong implications for managers of contracting organizations within which it appears likely that the continuity of tasks necessary for compliance breaks down as turnover approaches 100%. Furthermore, survey responses indicated that personnel turnover is not adequately managed and, in many cases, is highly excessive (possibly due to deployments, reassignments, cannibalization of skilled personnel by other agencies that have recently increased hiring, retirements due to an aged workforce, and normal attrition). In the sample data, the mean respondent was assigned to a contract in which turnover was in excess of 120%. Nearly 25% of respondents were assigned contracts in which turnover was at least 200% and 7.5% of respondents were assigned to contracts in which turnover was at least 300%. Alternatively, only 27.5% of respondents were assigned to contracts in which turnover was less than 50%, and less than 16% of respondents were assigned to contracts with less than 25% turnover. Figure 12 presents a histogram of percent turnover from the sample.

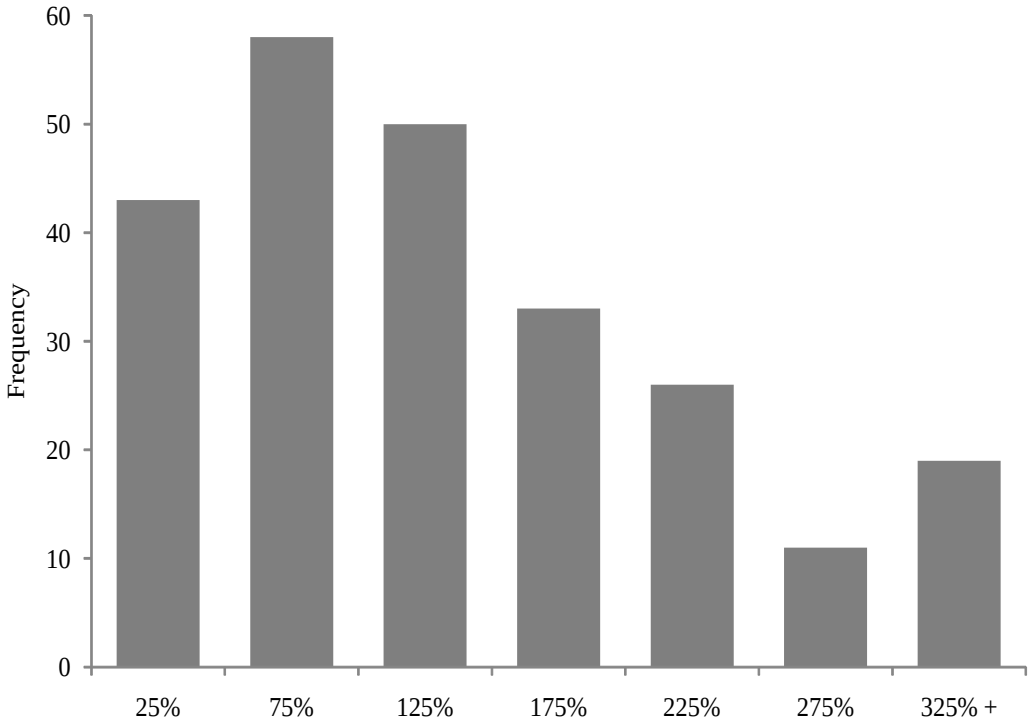

Figure 12. Histogram of Percent Turnover of Acquisition Personnel

This result was further developed when the length of time after the contract was awarded was also considered and percent turnover was recalculated as an annualized percentage. Once again, the measure was modified into a binary variable with a cut about the median, where median annualized turnover was 42%. Similar to the previous regression result, this relationship from turnover to compliance with regulations and statutes was found to be highly significant, approaching a moderate effect size. The results indicate that service acquisitions with more than 42% annual turnover are significantly less compliant with regulations and statutes than those service acquisitions with less than 42% annual turnover. As before, the rates of turnover are alarming. The mean respondent sampled was assigned to a contract in which personnel had turned over in excess of 65% annually. Nearly 19% of respondents were assigned to contracts in which acquisition personnel turned over at least once annually, and less than 16% were assigned to contracts in which personnel turned over less than 10% annually. Figure 13 displays the sampling results as a histogram.

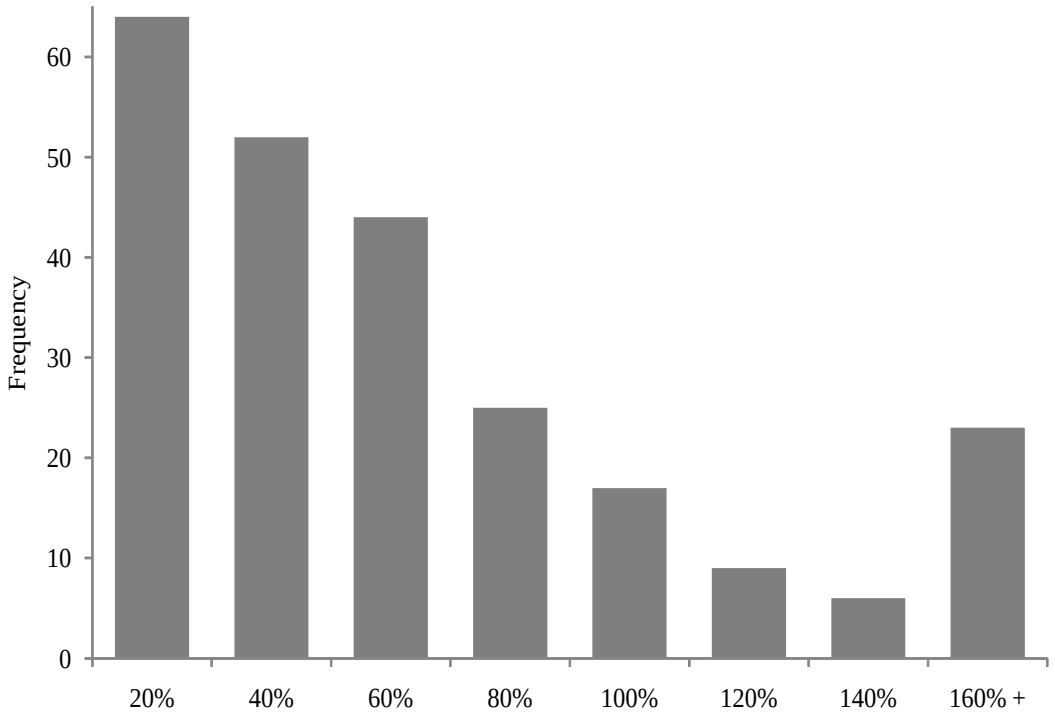

Figure 13. Histogram of Annualized Percent Turnover of Acquisition Personnel

The results of testing Hypothesis 14 and the demographics of the data collected paint a dismal picture of the state of personnel turnover in the acquisition workforce. To properly achieve acquisition objectives, specifically that of compliance with acquisition regulations and statutes, managers must drastically reduce the current levels of turnover. First, managers should avoid assigning temporary employees or those employees due to rotate, deploy, separate, or retire to manage service contracts and instead should assign those personnel who are expected to be retained throughout the life of the contract. Furthermore, agencies should consider establishing goals and procedures to reduce personnel turnover and should direct that units report turnover metrics periodically. These metrics should be used to track agency-level trends and to identify and stabilize those units that exhibit levels of personnel turnover greater than 100% over the life of service contracts, or 42% annually.

7. Competence-Based View of the Firm

Hypothesis 15: There will be a direct, positive relationship between the amount of contract administrator experience and the sufficiency of the requirement definition.

Hypothesis 16: There will be a direct, positive relationship between the amount of contract administrator experience and regulatory and statutory compliance.

Hypothesis 17: The greater the contract administrator's APDP certification level, the greater the sufficiency of the requirement definition.

Hypothesis 18: The greater the contract administrator's APDP certification level, the greater the regulatory and statutory compliance.

Hypothesis 19: The greater the contract administrator's education level, the greater the sufficiency of the requirement definition.

Hypothesis 20: The greater the contract administrator's education level, the greater the regulatory and statutory compliance.

None of these six hypotheses stemming from theory on the competence-based view of the firm were found to be statistically significant in the SEM model. However, several plausible explanations may exist for why this is the case.

First, it may be that the government contract administrator's interaction in the development of requirements documents is not significant enough to greatly impact the sufficiency of requirements documents or the customer's ability to communicate service expectations. In practice, contract administrators are likely to perform reviews of requirements documents to ensure adequacy (FAR, 2005), but administrators are unlikely to have an in-depth understanding of how services should be performed or the level of performance that internal customers require. This may be especially true when

acquisitions are for highly technical services such as medical services, research and development, or information technology services.

Second, it is important to note that less experienced personnel, who will have a lower APDP certification level and are less likely to have attained higher levels of education, may be assigned to administer simpler service contracts that are less burdened with regulations, such as those acquired using simplified acquisition procedures. Achieving full compliance on such an acquisition may be more feasible for an inexperienced buyer than doing so on a large, complex service acquisition that may employ cost-type line-items or undefinitized contractual actions. This theory may be substantiated, to some degree, by the finding that a statistically significant difference in means of requirement definition sufficiency existed between APDP Level II and APDP Level III personnel, in which the average Level II respondent reported a higher level of requirement definition sufficiency. This finding indicates that more qualified personnel may typically be assigned to more complex acquisitions in which contract outcomes and performance measures, such as those that would be communicated in requirements documents, are harder to define. Applying this relationship—that personnel who possess the least experience and knowledge in the area of contract compliance are assigned to the simplest service contracts and those personnel with the greatest experience and knowledge are assigned to the most complex service contracts—all personnel may be challenged equally.

Third, it should be considered that multiple contract administration personnel are often assigned to services acquisitions, even on common acquisitions such as base support services. For situations in which multiple administrators are assigned, the measurement of experience is only an indicator of the respondent's experience and not an adequate representation of experience for all contract administration personnel assigned to the service acquisition.

Finally, it is quite possible that the contract administrator who responded to the survey is not the same individual who awarded the contract, as evidenced by the high levels of turnover that were previously discussed. As such, the effects from buyer

experience, training, and education at all stages in the procurement may not be properly accounted for in the sample data.

8. Internal Customer Commitment

Hypothesis 21: The greater the internal customer's commitment to the service acquisition, the greater the compliance with regulations and statutes.

No support was provided for a direct effect from internal customer commitment to regulatory and statutory compliance, although a significant indirect effect was found through the mediating variable requirement definition sufficiency. The absence of a direct effect is not surprising when consideration is given to the types of regulations and statutes that are applicable to the acquisition of services; many are central to contracting as a function and require compliance by the contracting office, or at least require significant interaction by contracting personnel. As such, the contract administrator may often become the overseer of regulatory and statutory requirements while the internal customer focuses on contractor surveillance and issues that may arise during service delivery, at least in relatively small service contracts for operational support.

Hypothesis 22: The greater the internal customer's commitment to the service acquisition, the greater the sufficiency of the requirement definition.

The model did support Hypothesis 22, estimating a moderately sized effect that greater commitment to the service acquisition by the internal customer results in a greater sufficiency of the requirement definition. A review of the results from the trimmed structural model reveals that the level of internal customer commitment is, in fact, the largest determinant of the sufficiency of the requirement definition. Because the requirement definition impacts both service quality and regulatory and statutory compliance, the adequacy of commitment from the internal customer also has second-

order effects on service outcomes. Thus, managers should assess commitment and assign only committed employees to manage service contracts.

C. ANSWERS TO RESEARCH QUESTIONS

Research Question 1: What are the determinants of services sourcing performance?

In the final structural model, service quality was directly dependent on five variables: compliance with statutes and regulations, communication between the government and contractor, sufficiency of the requirement definition, sufficiency of procurement lead-time, and the amount of turnover of acquisition personnel. The other sourcing performance outcome, compliance with regulations and statutes, was directly dependent on three variables: communication between the government and contractor, the sufficiency of the requirement definition, and the amount of turnover of acquisition personnel. Additional analysis also uncovered a significant relationship between the contract manager's experience (years) and the quality of the service.

Research Question 2: Which determinant(s) have the greatest impact on the key contract outcomes of service quality and regulatory and statutory compliance?

The extent of communication between the government and the contractor appears to have the greatest impact on both outcomes, exhibiting highly significant path estimates with large effect sizes to these outcome variables. The amount of compliance with regulations and statutes exhibited a significant but negative and moderately sized effect on service quality. Effect sizes for all other path estimates leading to the contract outcomes were small and varied in the level of significance; notable second-order effects came from the sufficiency of procurement lead-time and the level of commitment to the acquisition by the internal customer.

Research Question 3: How can service quality be validly measured in a business-to-business context?

A 14-item scale was proposed in Chapter III for the measurement of service quality in business-to-business applications that was found to exhibit excellent reliability, as measured by Cronbach's coefficient alpha. This scale was based on a five-dimension SERVQUAL scale that was developed by Parasuraman et al. (1988), in which two of the original dimensions were retained and a new dimension, responsiveness to requirements, was added. This new dimension is comprised of five items and addresses a literary gap in the measurement of service quality in contractual and business relationships in which service requirements and performance standards are established by the purchasing organization and not the service supplier.

D. RECOMMENDATIONS

Recommendation 1: Limit the turnover of acquisition personnel to no more than 100% over the life of contracts and 42% annually.

Increased levels of turnover were found to be detrimental to the contracting officer's ability to ensure compliance with acquisition regulations and statutes. In particular, the results from regression analysis indicate that acquisitions are substantially less compliant with regulations and statutes once turnover reaches critical thresholds of 100% over the life of the contract, or 42% annually. At or above these levels, it seems that continuity is lost in the contract administration process and personnel are forced to focus resources away from compliance and toward other elements of administration in order to ensure an adequate level of performance. Although a certain level of personnel turnover may be unavoidable due to deployments, retirements, and regular rotations, managers should avoid assigning temporary personnel to manage service acquisitions and, instead, should assign those personnel who the manager best anticipates retaining throughout the life of the contract.

Furthermore, agencies should develop metrics to track the rates of acquisition personnel turnover according to contract type. Table 59 presents an example of several

appropriate metrics that have been completed using the data acquired in this study. Turnover metrics should not only be used by agencies to identify turnover-related risks in classes of services but also should be reported to the Office of the Secretary of Defense (OSD) so that DoD-wide trends and areas for improvement can be identified. Additionally, data gathered by agencies and the OSD should be used to concentrate contract reviews and inspections on classes of services acquisitions that are at the highest risk of being non-compliant with acquisition regulations and statutes due to excessive levels of personnel turnover.

Table 59. Sample Turnover Reporting Metrics

Service Type	Mean turnover	Mean annualized turnover	Mean dollars per acquisition personnel	Mean acquisition personnel per dollar
Maintenance/repair	120.19%	57.14%	$4,946,596.58	1.81E-05
Professional, administrative and management support	103.54%	66.56%	$5,211,690.23	8.68E-06
Utilities and housekeeping	118.42%	62.06%	$3,036,980.78	1.02E-05
Medical	98.87%	99.08%	$2,628,672.47	1.77E-05
Education and training	195.89%	87.23%	$3,597,922.50	4.88E-06
Architect-engineering	101.56%	65.31%	$2,351,853.94	9.48E-06
Quality control, testing, and inspection	75.00%	45.94%	$719,448.75	4.94E-06
Research and development	45.83%	12.83%	$1,354,166.67	1.31E-06
Other	136.29%	72.35%	$7,203,481.92	6.59E-06

Recommendation 2: Establish buyer–supplier relationship management skills as a core competency of the acquisition workforce through the incorporation of skills training into acquisition curriculums at all levels.

The extent of communication between the government and contractor was found to have the greatest impact on contract outcomes. As Gundlach and Cannon (2009)

asserted, it is reasonable that information exchanges and the development of relational norms, particularly of trust between the contractual parties, enhance performance and may be more appropriate methods of verification than surveillance and formal evaluation, at least in the case of some procurements in which low levels of trust are not present. DoD acquisition training programs do not currently focus on the development of buyer–supplier relationship management skills. For example, nowhere does the Defense Acquisition University or on-the-job training teach the strategic segmentation of spend (see, for example, Kraljic, 1983). This is a prerequisite for not only sourcing strategy but also for supplier management because it determines the appropriate relationship—transaction or collaborative. In reality, many strategic suppliers are treated as transactional, and far too many resources are utilized on other spend that is truly transactional (e.g., the procurement of furniture). Acquisition training programs should capitalize on opportunities to increase buyer–supplier relationship management skills such as communication; acquisition personnel need to know how to effectively communicate expectations for performance, keep all parties informed of new developments, provide information that helps both parties achieve acquisition objectives, effectively communicate the government's needs, and listen carefully to communications from the contractor and other acquisition team members.

Recommendation 3: Ensure that assigned internal customers are fully committed to services acquisitions prior to engaging in procurement processes.

The results of the SEM analysis in this study indicate that a high level of commitment from the internal customer is necessary to sufficiently define acquisition requirements and ultimately procure high-quality services. The internal customers of service acquisitions need to devote the manpower necessary to adequately communicate requirements to prospective contractors; to develop evaluation criteria and participate in source selections; to assess and manage contractor performance through surveillance, information exchanges, or other verification methods; to manage changes to service requirements; and to communicate with suppliers during performance. Furthermore, internal customers must commit to assigning their best talent to managing services

contracts, as Ellram et al. (2007) asserted. Specifically, managers should identify and assign those personnel who exhibit traits similar to those measured in the internal customer commitment scale: pride in membership of the service acquisition team, a sense of purpose when acquisition objectives are achieved, care for the long-term success of the acquisition, and dedication to ensuring the acquisition meets requirements. Although these traits are subjective in nature, feedback from supervisors and all members of the acquisition team may allow for the identification of the most suitable personnel as well as for the identification of those personnel who may be less qualified, or less appropriate, for an assignment to managing a service acquisition.

Furthermore, the manpower standards of internal customers may need to be reviewed to determine whether units are being adequately staffed to handle service contracts. For example, many of the U.S. Air Force's common installation-level service contract requirements are generated by civil engineering (CE) units and are managed, in part, by the CE operations flight. The Air Force Manpower Standard (AFMS) 44EO is used to determine the appropriate level of manning for this flight, in conjunction with Air Force Instruction 63-124 (U.S. Air Force, 2005), but does not specify how units should assign personnel for the management of service acquisitions or the appropriate level of manning for acquisition-related tasks such as performing quality assurance functions (U.S. Air Force, 2000). Organizations such as CE that lack a methodology for determining manning levels for service contract management may consider adopting some of the standards used by the U.S. Air Force contracting community, which considers acquisition type and value, among other factors, when determining adequate unit manning (U.S. Air Force, 2001).

> *Recommendation 4: Pursue initiatives to better educate customers on methods to effectively develop requirements documents; develop high-quality requirements documents templates for commonly acquired services.*

The government's ability to write sufficiently defined requirements is paramount to achieving service levels that meet customer expectations. However, few enterprise-level training programs exist that instruct customers how to best define their

organization's requirements. Similarly, no APDP certification standard is established for such personnel, who may have few or no resources to rely on when tasked with the planning of service procurements. Instituting certification programs for internal customers will not only increase the sufficiency of requirement definitions but also may increase personnel efficiency, increase procurement lead-times, and decrease post-award modifications to customer requirements. Similarly, agencies should mandate monthly contracting stand-down days for contract managers, contracting officers, internal customers, and program managers. In these sessions, expert trainers should provide live continuous learning over the Internet via a centralized training platform and should provide personnel with updates on best practices, acquisition tools, and policy changes.

Furthermore, offering high-quality templates of requirements documents for the most commonly acquired services may increase the quality of those services, promote greater compliance with regulations and statutes such as the acquisition of commercial services and the use of PBSA procedures, facilitate strategic sourcing, increase lead-times, and increase the availability of internal customer manpower to prepare for source selection and post-award functions. As such, agencies should consider establishing an electronic repository of work statements for commonly acquired commercial services, such as custodial services and refuse services. Such a system would allow for the sharing of high-quality work statements and would permit agencies to track and report the number of different requirements documents that are in use for each commercial service. Agencies should also establish goals for the standardization of work statements for certain acquisitions and should use metrics from the repository to track status by organization.

Finally, agencies should consider requiring that units provide monthly reports of the number of contract changes and contractor claims that result from poor specifications and insufficiently defined requirements. These metrics should be included in the criteria for unit awards and be a mandatory input to annual performance reports of unit directors and commanders of contracting units as well as to those of internal customers. Furthermore, these metrics should be used to identify trends in the sufficiency of

requirements documents for commonly procured services and to evaluate improvements gained by the standardization of work statements.

> *Recommendation 5: Revise or remove non-value added regulations and statutes; investigate which regulations and statutes are detrimental to acquisition outcomes.*

A non-positive relationship was found between the extent of compliance with regulations and statutes and service quality. This result suggests that the effects of regulations and statutes should be analyzed to assess whether any are directly detrimental to service quality or whether the individual act of compliance with a regulation or statute or the collective act of compliance with all overburdens contract administrators to the point that resources are insufficiently allocated to the management of contractor performance. Additional analysis should also be performed at the unit level to ensure that compliance is equal among all contracts and that contracts with high-performing suppliers are not overlooked or filed away.

> *Recommendation 6: Implement a performance-evaluation system for service contracts using the service quality scale.*

Agencies should integrate the service quality scale into a supplier performance-evaluation system to assess and rate the performance of service suppliers throughout the life of acquisitions. Simpson, Siguaw, and White (2002) argued for the importance of regular feedback between buyers and suppliers. With regular and continuous feedback, suppliers can concentrate resources on improving those dimensions of service delivery that are most important to the buyer. However, the DoD's current method of rating contractor performance, the contractor performance assessment reporting system (CPARS), with few exceptions, only assesses performance annually and is more appropriate for use as past performance information (i.e., used to inform source selection decisions) than as a means of continuous supplier improvement (Straight, 1999). Periodic ratings using a service quality scale could address this deficiency and could also be used to rank-order suppliers based on performance, to segment services spend by high-

and low-performing suppliers, and to assess the performance of individual buying activities. As such, rather than focusing on compliance as recommended by the GAO (e.g., more oversight), agencies could focus directly on improving the performance of service suppliers and the ultimate quality of those services acquired. Finally, through the implementation of a supplier performance-evaluation system based on a service quality scale and the implementation of the electronic submittal and aggregation of ratings, agencies could regularly assess the quality of acquired services at an enterprise level by using a services quality barometer or quality index (see, for example, Fornell, 1992). Such an assessment would allow for the identification of macro-level performance trends by service type or by top suppliers, or even allow for the evaluation of overall trends resulting from policy changes or external factors.

E. LIMITATIONS OF THE STUDY

This study was limited in several areas. First, research was performed using a representative sample from a population. Because this sample came solely from the U.S. Air Force, the study findings may not generalize to the DoD, other federal agencies, or the private sector. Additionally, a convenience sample rather than a random sample was used. Convenience samples may introduce bias in respondents. Second, service contract administrators were asked to respond directly to questions that were indicators of the key contract outcomes, service quality, and regulatory and statutory compliance. In some circumstances, the contract administrator may not have had a complete and accurate understanding of the contractor's performance because this individual may not have been an end user of the service and may not have typically performed quality assurance functions. When answering questions regarding contract compliance, contract administrators also may not have responded in a manner that reflected the true level of contract compliance if they were not genuinely aware of all of the regulations and statutes applicable to the acquisition. For example, an administrator who was unaware that competition requirements applied to an acquisition would not have considered the acquisition's level of compliance with competition requirements when responding to the survey. Additionally, some degree of socially desirable response bias may be present for

cases in which respondents were reluctant to tell the truth regarding sensitive or vulnerable areas (e.g., contract compliance). Finally, the data in this study represent the self-reported perceptions of contracting professionals. As with all self-reported data, there is a potential for common method bias (Podsakoff & Organ, 1986).

F. AREAS FOR FURTHER RESEARCH

This study primarily focused on the contract outcomes of service quality and compliance with regulations and statutes. However, the desired outcomes of public policy, such as those implemented in the FAR, typically differ from those of corporate policies in that the goals of public policies are numerous and occasionally conflict. For example, corporate policies for purchasing within a private organization may only focus on achieving an optimal mix of price (or total ownership costs) and quality. The outcomes of public procurement policy, especially policy at the federal level, also include maximizing competition, furthering socioeconomic goals, and ensuring transparency and fairness in the procurement process. The determinants of each of these outcomes and their interactions could be further explored.

Furthermore, this study only examined the determinants of services sourcing performance within the U.S. Air Force. This population could be extended in future research through the application of the model to other federal populations, such as another DoD Service, the DoD as a whole, or other federal agencies. If properly executed, the results of these studies could be compared in an SEM package using multi-group analysis to evaluate the relative effectiveness of organizational policies. Alternatively, the survey could be redeployed, with some modification, to procurement officers in the private sector. Such an approach would allow for a broader interpretation of the model and would allow for a comparative approach between public- and private-sector sourcing of B2B services.

Finally, future research could address the need to better measure variables that were measured in this study using single-item scales—the extent that the contractor defined requirements and the extent that PBSA procedures were used. Future studies

may either attempt to use a multiple-item scale to account for measurement error or to assess these extents using objective measures.

G. SUMMARY

In conclusion, this study examined the determinants of services sourcing performance through a quantitative analysis of survey responses from 240 U.S. Air Force contract administrators, bridged a literature gap in the measurement of customer-defined B2B services, and offered service contract practitioners within the U.S. Air Force a comprehensive model to better improve the outcomes of service acquisitions. In brief, service outcomes were found to be most highly dependent on government–contractor communication and on sufficiently defined requirements. Additional analysis revealed effects on outcomes from buyer experience and the turnover of acquisition personnel. Significant second-order effects were also found leading from the level of commitment to the acquisition by internal customers and to the sufficiency of procurement lead-time. Finally, a non-positive relationship was found between the level of compliance with regulations and statutes and service quality.

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APPENDIX A. SURVEY INSTRUMENT

Exploring USAF Services Contracting

Purpose

Responses to this questionnaire will be used to analyze factors affecting service contract outcomes. **Your response is requested no later than 15 June 2010.**

This DoD-funded research is being conducted through the Naval Postgraduate School's Graduate School of Business and Public Policy. Participation from professionals, such as you, is very important for the success of this research. First, you will be helping a fellow USAF Contracting Officer complete a rigorous MBA program. More importantly, your response will help the researchers analyze service contract outcomes. The results of this study will generate recommendations for further improvements to how the DoD can better manage services acquisitions.

Procedures. Your extent of participation in this research involves only the completion of this questionnaire.

Synopsis. This is both an anonymous and voluntary questionnaire. (Please note, in order to obtain consistent and usable results, it is important that you answer all questions). It will take most respondents approximately 15 to 25 minutes to complete the questionnaire.

Risks and Benefits. Your participation in this research poses no known risk. There will be no personal benefits beyond having contributed your expertise to this important research. If desired, you may contact the researcher below if you would like to receive a report of the results of the study.

Confidentiality & Privacy Act. All records of this study will be kept confidential and, since responses are anonymous, your privacy will not be at risk. No information will be publicly accessible which could identify you as a participant. Responses will be maintained by NPS for five years, after which they will be destroyed.

Points of Contact. Should you have any questions or comments regarding this survey, please contact the Principal Investigators: Captain William Muir, USAF, (831) 236-1179, wamuir@nps.edu, Lieutenant Colonel Tim Hawkins, USAF, (831) 656-7647, DSN 756-7647, tghawkin@nps.edu, or Dr. Gregory Hildebrandt, gghildeb@nps.edu. Any other questions or concerns may be addressed to the IRB Chair, Dr. Angela O'Dea, (831) 656-3966, DSN 756-3966, alodea@nps.edu. This survey was reviewed and approved by the Air Force Survey Office (survey control number 10-063, expires 15 June 2010).

Thank you for your time and your participation in this effort. Individuals such as you help researchers to advance both the theory and practice of contract management.

Exploring USAF Services Contracting

Instructions and Consent

A) Please answer the questions honestly in your best judgment to the best of your knowledge. Answers are nonattributional; no personal information will be asked or recorded in the resulting research report. In your responses, please do not include personal identifying information or information restricted under operational security.

B) Throughout the survey, you will be required to select one answer per row only. Where there are exceptions to this rule and multiple answers are acceptable, the questions' instructions will include a specific instruction to "select all that apply".

C) You can jump back and forth through the questions if you need to change an answer or want to review your answers.

D) Your answers will be saved as soon as you select them, but they will not be locked until you reach the last page and click the "done" button.

*** 1. By clicking on the "Proceed" button, I am acknowledging that I have read and understand this information, that I understand the nature and purpose of this study – including its risks and benefits, and that I agree to voluntarily participate in this online survey. I also understand that I may discontinue at any time simply by exiting this website.**

□ Proceed □ Exit

Exploring USAF Services Contracting

Section 1

INSTRUCTIONS:
For the remainder of this survey, please choose a single, specific service contract that you currently administer or have administered in the past 12 months and answer all of the questions with respect to that contract. Note: you may choose a contract, blanket purchase agreement, purchase order, or delivery/task order (or any other contractual instrument excluding the government purchase card or imprest funds) that has been awarded for the acquisition of services. Preferably, choose a multi-year contract, but if your experience is limited to another type of instrument (per above), that is sufficient.

*** 1. What type of service is the contractor performing?**

□ Research and Development □ Architect-Engineering □ Maintenance / Repair

□ Modification of Equipment □ Medical Services □ Utilities and Housekeeping

□ Quality Control, Testing, and Inspection □ Education and Training

□ Professional, Administrative & Management Support Services □ Other: _____

*** 2. What is the contract type?**

□ Fixed Price □ Cost Reimbursement □ Time and Materials □ Labor Hour

□ Hybrid □ Other: _____

*** 3. What letter is in the ninth position of the contract number?** This letter indicates the type of contract instrument used. For example, if the contract number is N00023-90-D-0009 then you would enter the letter D.

_____

*** 4. Do the services being performed meet the definition of a commercial item, as defined in FAR Part 2? Select "Yes" only if your contract included the clause FAR 52.212-4.**

□ Yes □ No

Section 2

*** 5. What type of incentive(s)/disincentives(s) does this contract contain – if any? (Check all that apply)**

□ Award Fee □ Incentive Fee □ Award Term □ Performance-Based Payments

□ Performance Incentive □ Delivery Incentive □ Liquidated Damages clause

□ This Contract Does Not Contain any Incentives / Disincentives □ Other: _____

*** 6. What is the total dollar value of financial incentives available in this contract? Enter 0 if you did not identify any incentives in the previous question.** (Examples: amount of award fee pool, maximum incentive fee available, potential revenue if an award term is awarded)

_____

*** 7. Please fill in answers to the following questions.**

a. How many acquisition personnel (contracting officers + contract specialists + contracting officer representatives + quality assurance evaluators/personnel + inspectors + program/project manager or other active representative of the user) are currently assigned to this contract? Include only those individuals who actively, routinely help manage the contract.

_____

b. Over the life of this contract, how many different times have personnel turned over? Consider all Contract Administrators, Contract Specialists, Contracting Officers, Contracting Officer's Representatives, and Quality Assurance Personnel who actively, routinely helped manage the contract. (For example, if the Contract Administrator changed twice, the Contracting Officer changed once, and Quality Assurance Personnel changed three times hen the answer would be six)

_____

c. How long has this contract been in effect? Please answer in months.

_____

d. What is the total dollar value of this contract, including all option periods?

_____

Section 3

*** 8. Please fill in the number of days it took to award this contract – (i.e., from the first day that your internal customer requested the service contract to the day that you awarded the contract)**

_____

*** 9. When only considering the period of time during which you were assigned to this contract, on average, how many contract actions were you working per day?** (A contract action is defined herein as a justification & approval, determination & finding, market research report, solicitation, award, modification, meeting with the contractor, meeting with internal/Government stakeholder(s), site visit, negotiation, ratification, quality deficiency report, award fee determination, consultation with Legal, payment, contractor performance assessment report, claim, bid protest, termination, or closeout of a contractual instrument)

_____

*** 10. On a scale of 1 to 7, where 1 represents "None" and 7 represents "substantial," to what extent, if any, did the contractor help define the requirements prior to contract award?** The contractor's help defining requirements includes questions before and after the issuance of the solicitation, participation in industry days, responses to requests for information, responses to draft RFQ/RFP, and any other dialogue with the contracting officer or specialist.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

Section 4

*** 11. On a scale of 1 to 7, where 1 represents "Much Worse than I Expected" and 7 represents "Much Better than I Expected", rate the following:**

a. The quality of the contractor's work.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

b. When the contractor's management promises to do something by a certain time, it does so.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

c. How polite the contractor's employees are.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

d. How much you feel safe in your interactions with the contractor's employees.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

e. How much you can trust employees of the contractor.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

f. The contractor satisfied our need.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

g. The contractor's dependability.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

h. The contractor performed the work we needed it to do.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

i. The contractor's keeping of its records accurately.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

j. The timeliness of the contractor's work.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

k. The contractor met the requirements of the contract.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

l. When you have problems, the contractor's management is sympathetic and reassuring.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

m. The contractor provides its services at the time it promises to do so.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

n. The adequacy of the support the contractor's employees receive from their company to do their jobs well.
□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

Section 5

*** 12. On a scale of 1 to 7, where 1 represents "Strongly Disagree" and 7 represents "Strongly Agree", rate the following:**

a. In our relationship, the government and contractor effectively communicate expectations for each other's performance.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

b. I did not have enough time to award a quality contract.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

c. The milestones for awarding this contract were too aggressive.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

d. My leadership or my customer wanted this contract awarded too fast.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

e. This contract is compliant with all applicable policy letters, the Federal Acquisition Regulation and its Supplements, and procurement law.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

f. In our relationship, the government and the contractor keep each other informed of new developments.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

g. There is nothing wrong with this contract.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

h. This contract does not violate applicable requirements of policy letters, the Federal Acquisition Regulation (FAR), FAR Supplements, or procurement law.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

i. This contractor listens carefully to my requests.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

j. I was not rushed to award this contract.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

Section 6

*** 13. On a scale of 1 to 7, where 1 represents "Strongly Disagree" and 7 represents "Strongly Agree", rate the following:**

a. The requirement was very well defined in the contract.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

b. The contract (including the statement of work, performance work statement, specification, drawings, etc.) defined the requirement very well.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

c. If this contract were to be inspected by an independent organization, it would be deemed compliant.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

d. In our relationship, the government and contractor provide each other with information that helps both parties.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

e. There were no flaws or omissions in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.).

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

f. There are aspects of this contract that, if changed, would make it more compliant with policy, laws, or regulations.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

g. I am able to communicate my needs effectively to this contractor.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

h. The requirement, as defined in the contract, expressed to the contractor exactly what we needed.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

i. There were no ambiguities in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.).

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

j. I had sufficient time to get this contract awarded.

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

Section 7

*** 14. On a scale of 1 to 7, where 1 represents "Not at all" and 7 represents "Great extent", rate the extent to which this service contract is performance based.** (In Performance Based Services Acquisition, requirements are defined in terms of results to be achieved rather than the manner of performing the work.)

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

*** 15. On a scale of 1 to 7, where 1 represents "No Monitoring of Supplier" and 7 represents "Extensive Monitoring of Supplier", rate the <u>amount of government surveillance</u> of the contractor's performance in the following areas:**

a. Service Quality

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

b. Timeliness of Performance

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

c. Fulfillment of Performance Requirements in the Statement of Work/Performance Work Statement

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

d. Compliance With Contract Terms & Conditions

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

*** 16. The government uses the following method(s) to perform surveillance of the contractor's performance: (select all that apply)**

□ Customer Complaint □ Periodic Inspection □ 100-Percent Inspection

□ Other: _____

*** 17. If the means of surveillance involves inspections other than customer complaints, what is the total number of inspections that occur on this contract per year?** (If surveillance is only accomplished by customer complaint then enter "0" into the box provided)

_____

Section 8

*** 18. Considering all of the quality assurance personnel who are assigned to this contract, how many total years of work experience does the government's quality assurance team have in the technical area of performance applicable to this contract?** (For example, if there are three quality assurance personnel assigned to monitor a contract for aircraft maintenance services, and their years of experience of inspecting and conducting aircraft maintenance are five, four, and nine years, then the total years of experience for the team would be 18)

_____

*** 19. Do third-party, contracted personnel perform any function of the government's contract management or quality assurance on this contract?** (For example, if the government contracted with Contractor A to perform quality assurance on a service contract performed by Contractor B then the answer would be "Yes")

□ Yes □ No

*** 20. Please indicate the total number of formal communications to the contractor concerning issue(s) with satisfying contract requirements.** Communications include**:** quality deficiency reports, corrective action requests, requests for reperformance, letters of concern, and show cause notices.

_____

*** 21. On a scale of 1 to 7, where 1 represents "Not at All" and 7 represents "Great Extent", rate the following:**

a. To what extent is your primary internal customer proud to be a member of this service acquisition team?

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

b. To what extent does your primary internal customer feel a sense of purpose when the team achieves specific acquisition objectives?

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

c. To what extent does your primary internal customer care about the long-term success of this acquisition?

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

d. To what extent is your primary internal customer dedicated to ensuring the acquisition meets requirements?

□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7

Exploring USAF Services Contracting

Section 9

*** 22. By which agency are you employed?**

□ United States Air Force □ United States Army □ United States Navy

□ Other: _____

*** 23. At the time you started working on this service contract, what was the highest level of Acquisition Professional Development Program (APDP) certification that you held in the area of Contracting?**

□ APDP Level 1 □ APDP Level 2 □ APDP Level 3 □ No Contracting APDP Certification

*** 24. What is the highest level of education that you have attained?**

□ High School Diploma / GED □ Associates □ Bachelors

□ Masters □ Doctoral / Professional

*** 25. Besides Acquisition Profession Development Program certifications, do you hold any other professional certifications (such as those granted by the National Contract Management Association, the Institute for Supply Management, or other professional associations)?**

□ Yes □ No

*** 26. How many years of experience do you have in contracting?**

_____

*** 27. What is your age?**

_____

*** 28. What is your gender?**

□ Male □ Female

*** 29. We appreciate any comments or feedback you can provide on the topic of services acquisition.**

_____

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APPENDIX B. INVITATION TO PARTICIPANTS

Good Afternoon Squadron Commanders,

To support services acquisition research sponsored by Mr. Roger Correll (SAF/AQC) and Brig Gen Masiello (AFPEO/CM)—**see attached letter**, we respectfully request your assistance to complete the web-based survey located at the hyperlink below. The survey uses quantitative methods to study the determinants of sourcing performance for services acquisition. Unit participation is voluntary; however, responses are vital to research on the management of service acquisitions within the Air Force. Additionally, this research is part of a student thesis project at the Naval Postgraduate School. **For your convenience, a hard copy of the survey is attached.**

Please take the following steps:

1. Forward Survey Link: Exploring DoD Services Contracting to military and civilian personnel in your unit who currently administer services contracts or have administered service contracts in the recent past. The desired level of response is ten (10) personnel per unit.

2. Once forwarded, please reply via e-mail to william.muir@us.af.mil with a count of the number of personnel you forwarded the survey to. This information is critical to determine the total response rate for the study. Without it, the statistical significant of the research could be in question.

Please ask personnel to complete the survey no later than 15 June 2010. The survey should take between 15 and 25 minutes to accomplish. If you have any questions, please contact Capt William Muir by email to william.muir@us.af.mil or at (831) 236-1179. The time and effort of you and your unit personnel are greatly appreciated.

Very Respectfully,

WILLIAM A. MUIR, Capt, USAF
Student, Naval Postgraduate School
(c) 831-236-1179

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APPENDIX C. SAF/AQC AND AF PEO/CM LETTER OF SUPPORT

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

APR 23 2010

MEMORANDUM FOR ALMAJCOM-FOA-DRU (CONTRACTING)

SUBJECT: Survey of Air Force Services Contract Administrators

In supporting services acquisition research, my office is sponsoring a Naval Postgraduate School project to study the determinants of services sourcing performance. The survey is internet-based, completed online, and does not involve any physical copies or mailings. This survey should take less than thirty (30) minutes to complete and will provide insight into the relationships between service performance, contracting compliance, and the following topics:

- Financial Incentives
- Surveillance Methods
- CO / CA Manpower
- Relational Exchange
- Requirements Definition
- Education & Training
- Personnel Workload

Note: The survey is designed to be completed by individuals who currently administer service contracts or have done so in the recent past. Approximately ten (10) responses are requested from each contracting unit.

The survey was approved by the Air Force Survey Office (control number 10-063). Our office fully supports this research and requests your cooperation to complete the surveys by 15 Jun 2010.

The point of contract for the survey is Captain William Muir, who can be reached at (831) 236-1179 or via e-mail to william.muir@us.af.mil.

ROGER S. CORRELL
Deputy Assistant Secretary (Contracting)
Assistant Secretary (Acquisition)

WENDY M. MASIELLO, Brig Gen, USAF
Air Force Program Executive Officer
for Combat and Mission Support

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APPENDIX D. DESCRIPTIVE STATISTICS FOR TESTS OF BIAS

Variable	Group	N	Mean	St. dev.	S. E.	95% CI for mean		Min.	Max.
						Lower bound	Upper bound		
Age	1	80.00	40.81	11.92	1.33	38.16	43.46	22.00	65.00
	2	80.00	42.01	13.04	1.46	39.11	44.91	20.00	65.00
	3	80.00	43.36	11.34	1.27	40.83	45.88	24.00	65.00
	Total	240.00	42.06	12.11	0.78	40.52	43.60	20.00	65.00
Gender	1	80.00	0.55	0.50	0.06	0.44	0.66	0.00	1.00
	2	80.00	0.53	0.50	0.06	0.41	0.64	0.00	1.00
	3	80.00	0.48	0.50	0.06	0.36	0.59	0.00	1.00
	Total	240.00	0.52	0.50	0.03	0.45	0.58	0.00	1.00
Experience	1	80.00	11.80	9.59	1.07	9.67	13.93	0.83	38.00
	2	80.00	10.74	9.90	1.11	8.53	12.94	0.00	35.00
	3	80.00	12.88	10.32	1.15	10.58	15.18	0.42	41.00
	Total	240.00	11.81	9.94	0.64	10.54	13.07	0.00	41.00
Education	1	80.00	2.00	0.90	0.10	1.80	2.20	0.00	3.00
	2	80.00	1.95	1.07	0.12	1.71	2.19	0.00	4.00
	3	80.00	1.98	0.97	0.11	1.76	2.19	0.00	4.00
	Total	240.00	1.98	0.98	0.06	1.85	2.10	0.00	4.00
Sufficient requirement definition	1	80.00	26.01	6.03	0.67	24.67	27.35	12.00	35.00
	2	80.00	25.79	6.00	0.67	24.45	27.12	11.00	35.00
	3	80.00	25.41	6.70	0.75	23.92	26.90	8.00	35.00
	Total	240.00	25.74	6.23	0.40	24.95	26.53	8.00	35.00
Regulatory and statutory compliance	1	80.00	27.58	5.69	0.64	26.31	28.84	7.00	35.00
	2	80.00	28.31	4.81	0.54	27.24	29.38	14.00	35.00
	3	80.00	28.19	4.88	0.55	27.10	29.27	8.00	35.00
	Total	240.00	28.03	5.13	0.33	27.37	28.68	7.00	35.00
Service quality	1	80.00	80.28	13.64	1.53	77.24	83.31	48.00	98.00
	2	80.00	77.60	15.08	1.69	74.24	80.96	39.00	98.00
	3	80.00	79.86	14.97	1.67	76.53	83.19	42.00	98.00
	Total	240.00	79.25	14.57	0.94	77.39	81.10	39.00	98.00

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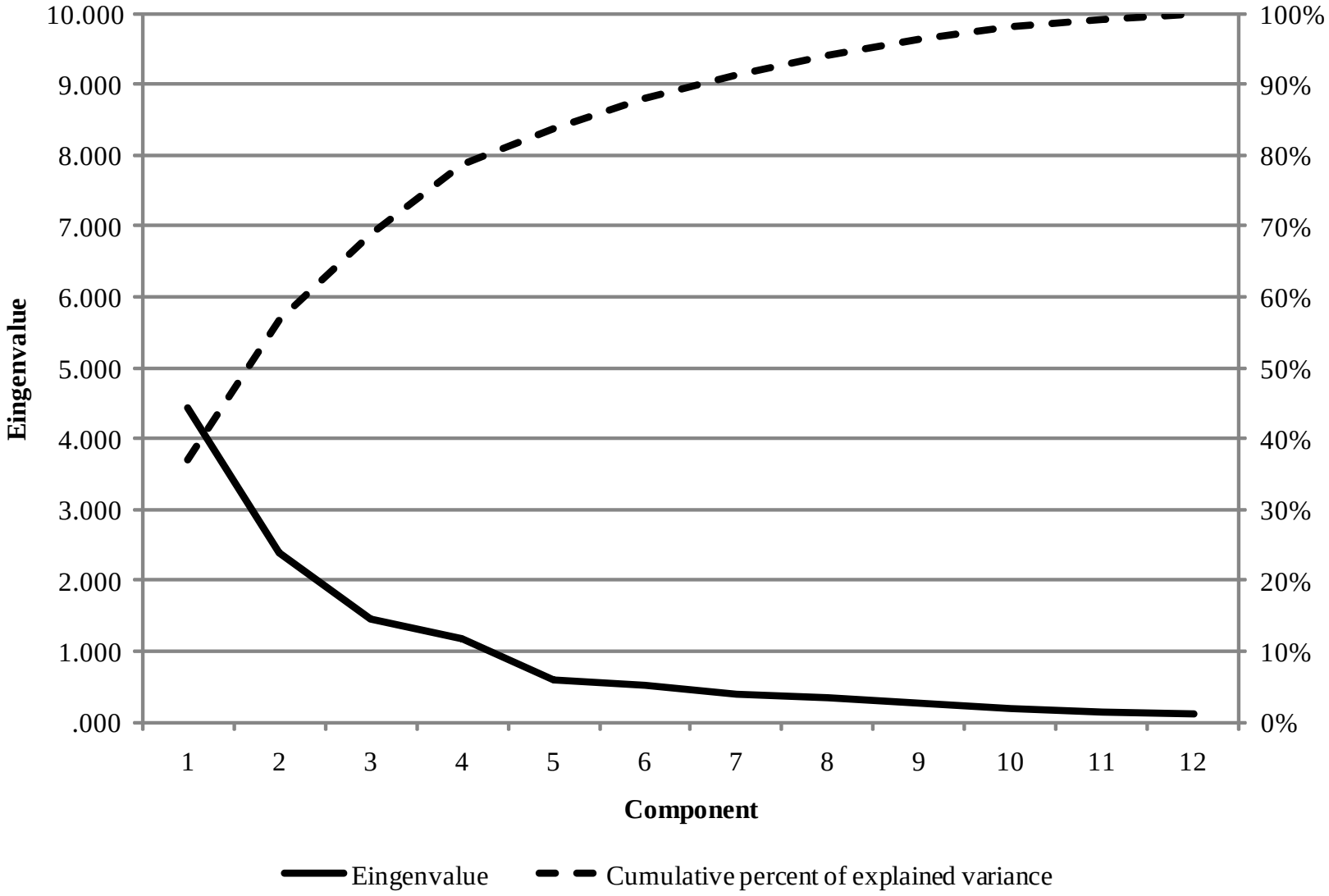
APPENDIX E. SCREE PLOT OF EXOGENOUS FACTORS



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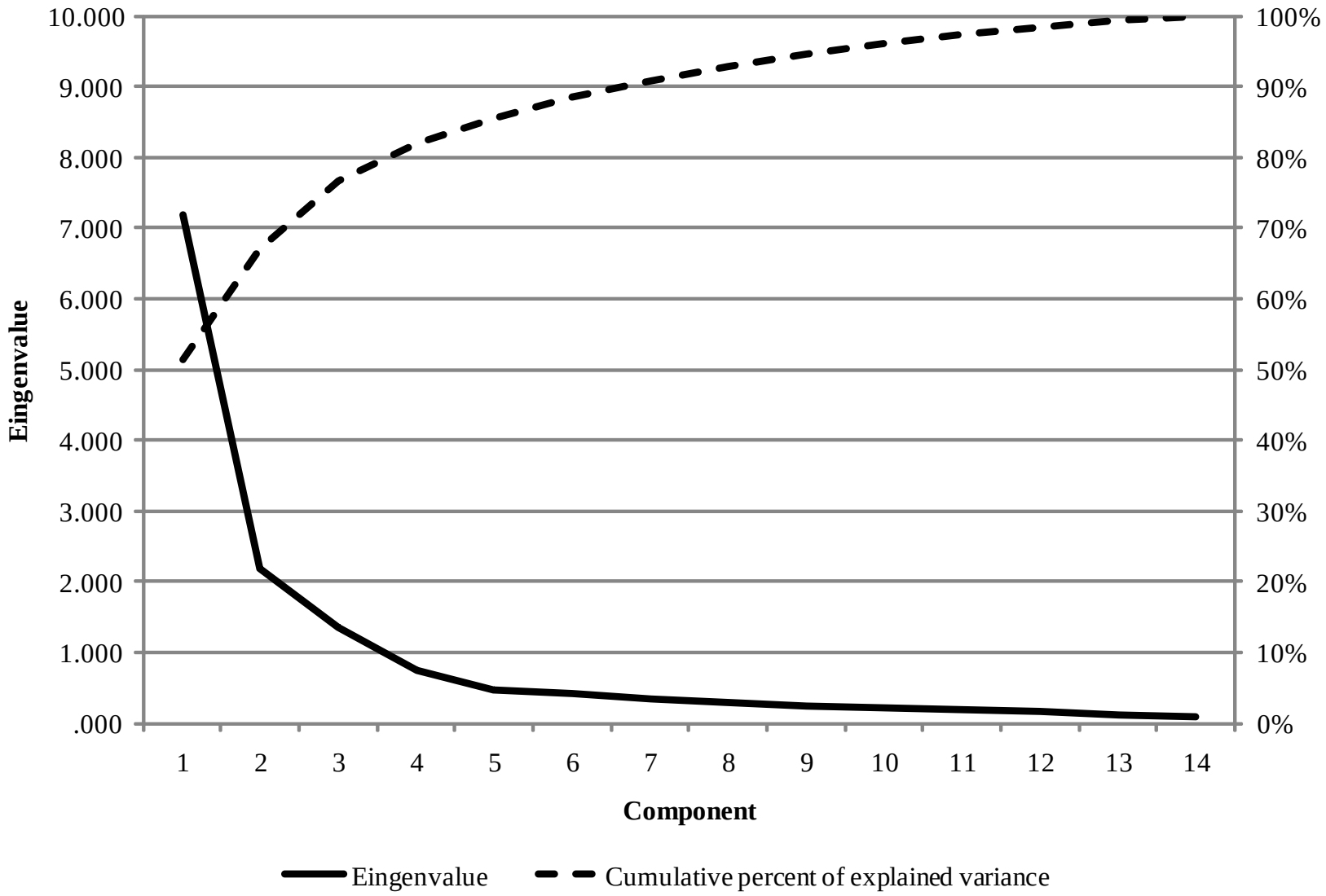
APPENDIX F. SCREE PLOT OF ENDOGENOUS FACTORS



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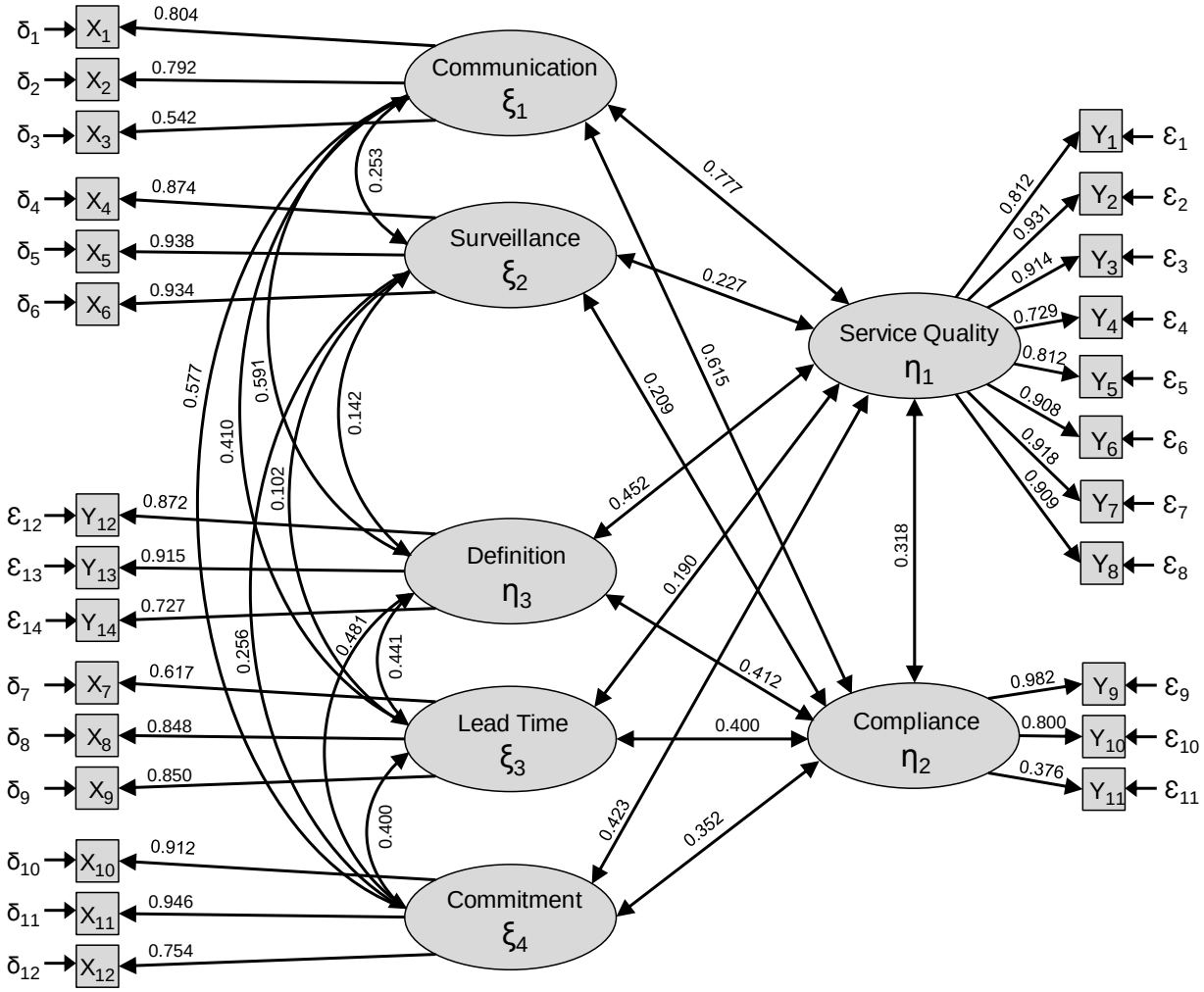
APPENDIX G. COMBINED MEASUREMENT MODEL



	χ^2	*P* value	χ^2/df	CFI	TLI	RMSEA	SRMR
Measurement model	383.71	< 0.01	1.38	0.98	0.98	0.04	0.04
Fitness criterion		> 0.05	< 3.00	> 0.95	> 0.95	< 0.08	< 0.08

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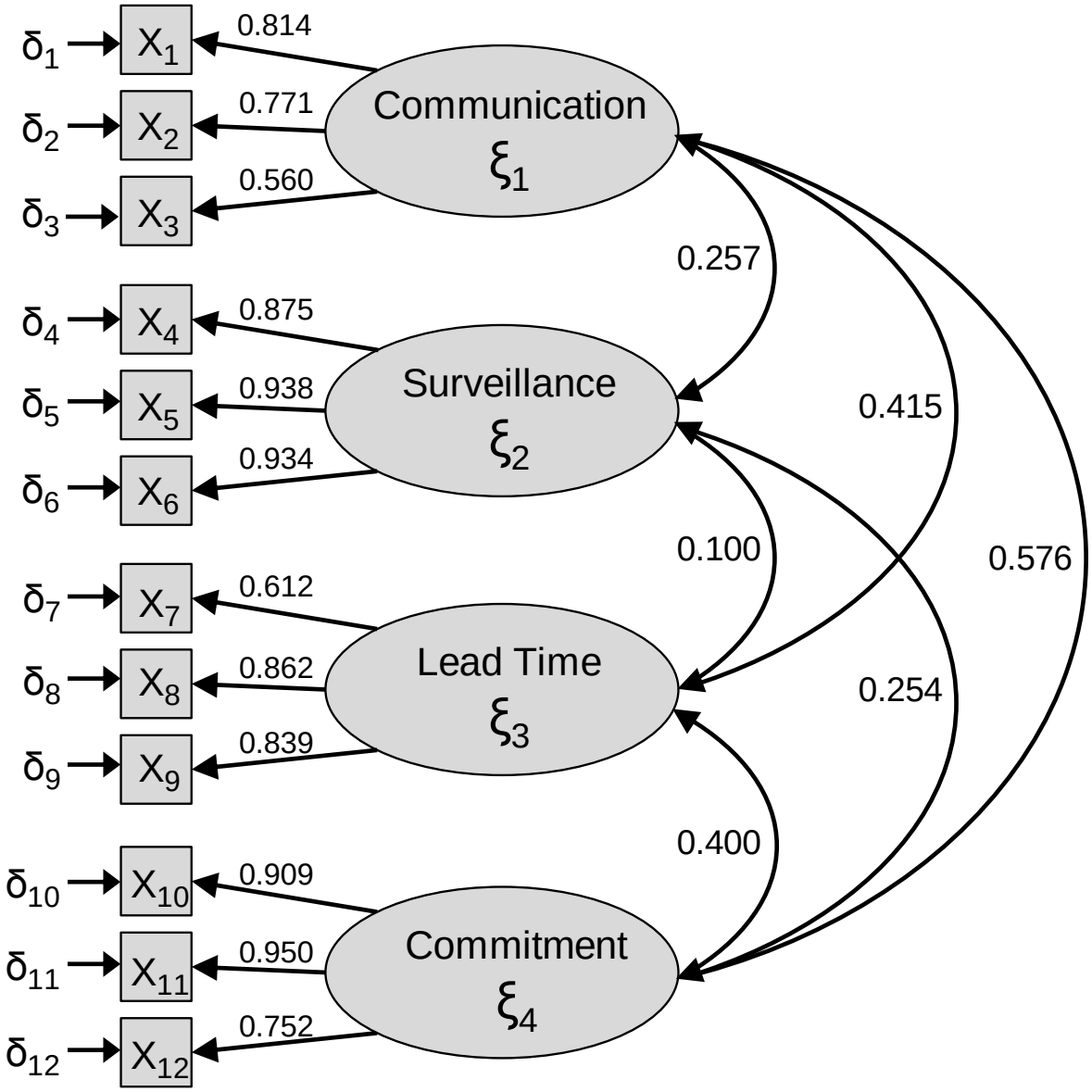
APPENDIX H. EXOGENOUS CFA MODEL AND ESTIMATES



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APPENDIX I. RESIDUAL VARIANCE TABLES

Exogenous Measurement Model

Construct	Item	Residual variance	Standard error	Critical ratio	*P* value
Communication	REa	0.34	0.06	5.29	< 0.01
	REb	0.41	0.06	6.40	< 0.01
	REd	0.69	0.06	11.65	< 0.01
Amount of	AT1a	0.24	0.03	7.56	< 0.01
survellance	AT1c	0.12	0.02	5.10	< 0.01
	AT1d	0.13	0.02	5.35	< 0.01
Procurement lead-	RBV1c	0.63	0.06	10.95	< 0.01
time sufficiency	RBV1d	0.26	0.06	4.57	< 0.01
	RBV1e	0.30	0.06	5.28	< 0.01
Internal customer	ICCa	0.17	0.03	5.72	< 0.01
commitment	ICCb	0.10	0.03	3.52	< 0.01
	ICCd	0.44	0.05	9.44	< 0.01

Endogenous Measurement Model

Construct	Item	Residual variance	Standard error	Critical ratio	*P* value
Service quality	SQa	0.34	0.04	9.07	< 0.01
	SQc	0.13	0.02	7.06	< 0.01
	SQd	0.17	0.02	7.55	< 0.01
	SQf	0.47	0.05	10.31	< 0.01
	SQi	0.34	0.04	9.09	< 0.01
	SQj	0.17	0.02	7.66	< 0.01
	SQk	0.16	0.02	7.40	< 0.01
	SQm	0.18	0.02	7.62	< 0.01
Regulatory and	RSCa	0.10	0.07	1.32	0.19
statutory compliance	RSCc	0.32	0.06	5.02	< 0.01
	RSCe	0.85	0.05	18.13	< 0.01
Requirement	RD1a	0.24	0.04	5.96	< 0.01
definition sufficiency	RD1b	0.16	0.04	4.16	< 0.01
	RD1e	0.48	0.05	9.47	< 0.01

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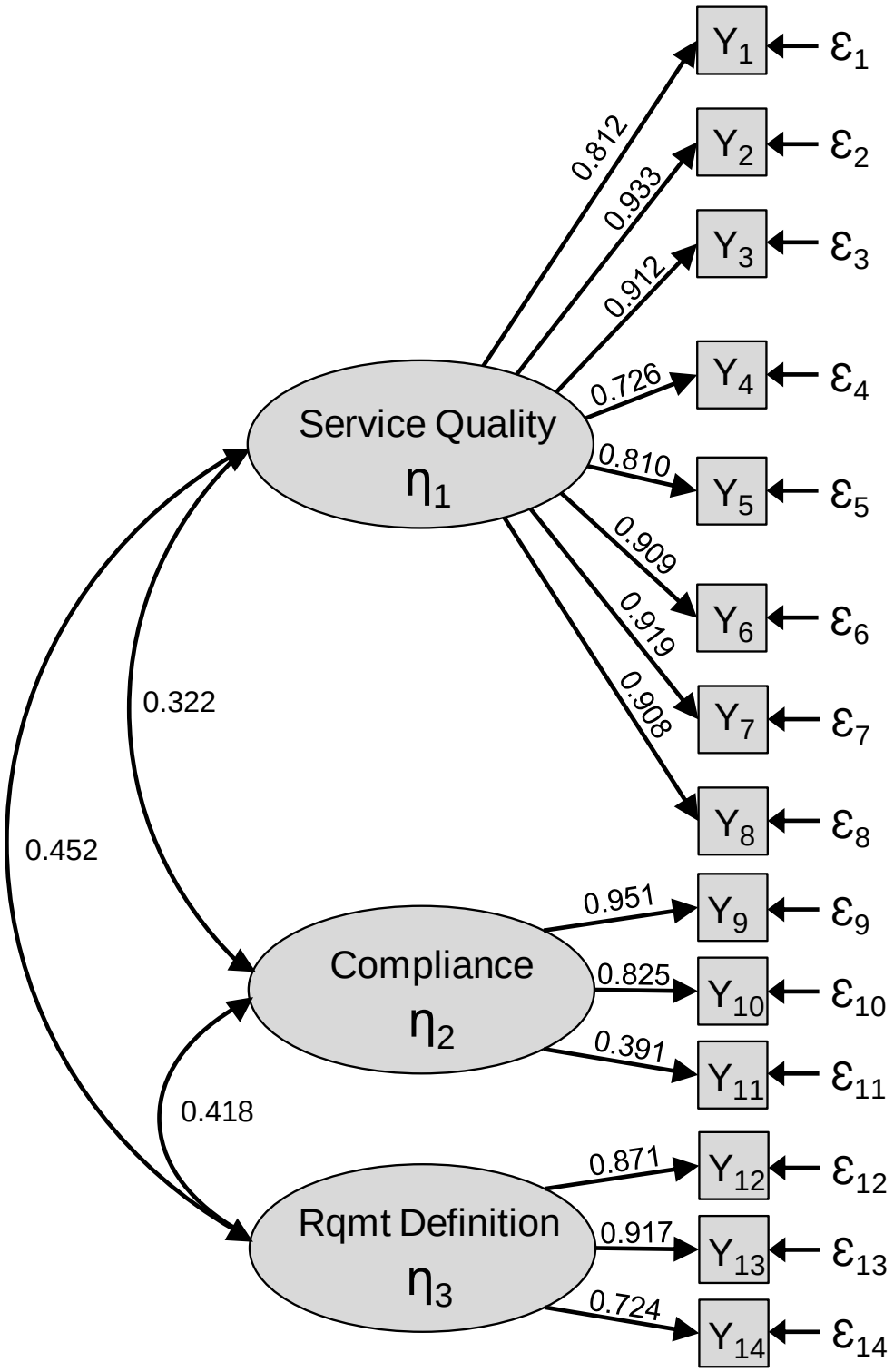
APPENDIX J. ENDOGENOUS CFA MODEL AND ESTIMATES



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APPENDIX K. CORRELATION MATRIX

Variable	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) REa	5.73	1.18	1.00														
(2) REb	5.65	1.29	.623**	1.00													
(3) REd	5.88	1.17	.452**	.451**	1.00												
(4) AT1a	5.29	1.49	.181**	.126	.123	1.00											
(5) AT1c	5.34	1.53	.228**	.172**	.170**	.818**	1.00										
(6) AT1d	5.44	1.48	.199**	.131*	.203**	.819**	.875**	1.00									
(7) RBV	4.45	1.93	.290**	.206**	.150*	.015	.024	.056	1.00								
(8) RBV	4.13	1.84	.306**	.258**	.224**	.036	.084	.042	.517**	1.00							
(9) RBV	4.45	1.69	.291**	.208**	.186**	.083	.126	.107	.520**	.725**	1.00						
(10) ICCa	5.25	1.47	.418**	.406**	.248**	.238**	.277**	.191**	.222**	.309**	.255**	1.00					
(11) ICCb	5.40	1.37	.448**	.442**	.250**	.189**	.245**	.173**	.231**	.329**	.315**	.865**	1.00				
(12) ICCd	5.67	1.33	.384**	.399**	.207**	.208**	.228**	.177**	.290**	.337**	.306**	.678**	.711**	1.00			
(13) SQa	5.38	1.34	.548**	.531**	.311**	.099	.153*	.093	.104	.249**	.184**	.434**	.401**	.324**	1.00		
(14) SQc	5.77	1.17	.573**	.539**	.357**	.172**	.226**	.206**	.063	.192**	.107	.372**	.335**	.252**	.734**	1.00	
(15) SQd	5.70	1.18	.575**	.592**	.377**	.151*	.219**	.179**	.043	.149*	.107	.332**	.292**	.247**	.743**	.841**	1.00
(16) SQf	5.62	1.17	.506**	.537**	.276**	.107	.206**	.146*	.137*	.215**	.131*	.349**	.344**	.310**	.577**	.691**	.647**
(17) SQi	5.49	1.30	.545**	.559**	.354**	.111	.189**	.157*	.094	.185**	.190**	.371**	.349**	.281**	.705**	.749**	.753**
(18) SQj	5.78	1.23	.549**	.580**	.320**	.151*	.240**	.212**	.044	.166*	.102	.369**	.356**	.287**	.734**	.848**	.819**
(19) SQk	5.76	1.18	.576**	.544**	.317**	.144*	.216**	.195**	.040	.199**	.119	.395**	.373**	.294**	.744**	.891**	.824**
(20) SQm	5.71	1.25	.563**	.586**	.299**	.164*	.196**	.169**	.074	.164*	.103	.374**	.336**	.268**	.751**	.831**	.868**
(21) RSCa	6.19	1.16	.467**	.492**	.357**	.127*	.206**	.212**	.139*	.190**	.234**	.276**	.340**	.304**	.254**	.297**	.271**
(22) RSCc	6.23	1.18	.328**	.407**	.260**	.071	.119	.148*	.127*	.183**	.176**	.234**	.322**	.256**	.199**	.214**	.221**
(23) RSCe	4.80	1.75	.171**	.169**	.184**	.030	.068	.047	.120	.151*	.110	.036	.090	.110	.068	.031	.101
(24) RD1a	5.31	1.49	.438**	.377**	.335**	.045	.155*	.143*	.252**	.349**	.343**	.344**	.366**	.350**	.391**	.346**	.349**
(25) RD1b	5.25	1.45	.460**	.383**	.323**	.049	.146*	.118	.254**	.320**	.327**	.414**	.390**	.430**	.386**	.341**	.356**
(26) RD1e	4.91	1.59	.396**	.276**	.261**	.069	.089	.067	.208**	.259**	.320**	.362**	.383**	.395**	.400**	.308**	.289**
(27) AT2	5.60	1.63	.171**	.191**	.143*	.183**	.257**	.233**	.091	.072	.176**	.167**	.195**	.144*	.100	.119	.115
(28) RD2	2.57	1.74	.033	.086	-.012	.077	.057	.032	-.083	.019	-.009	.094	.087	.040	.015	.064	.066
(29) RBV	1.22	1.17	-.017	-.091	.031	-.054	-.039	-.044	.077	.002	-.017	-.003	-.077	-.028	.008	.076	.023
(30) CBV	11.66	9.88	-.036	.018	.128*	-.022	-.009	.028	-.161*	-.137*	-.178**	-.014	.007	-.022	.085	.099	.108
(31) CBV	1.68	1.06	.014	.013	.125	.014	.063	.086	-.146*	-.172**	-.177**	-.101	-.079	-.108	.032	.011	.081
(32) CBV	1.98	0.98	-.052	.034	-.013	.041	.058	.059	-.050	-.122	-.075	.015	.009	.040	-.054	-.044	-.045

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

Variable	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
(16) SQf	1.00																
(17) SQi	.642**	1.00															
(18) SQj	.665**	.754**	1.00														
(19) SQk	.638**	.727**	.834**	1.00													
(20) SQm	.666**	.694**	.830**	.823**	1.00												
(21) RSCa	.236**	.291**	.308**	.287**	.253**	1.00											
(22) RSCc	.206**	.230**	.234**	.216**	.247**	.785**	1.00										
(23) RSCe	.034	.031	.057	.036	.054	.364**	.357**	1.00									
(24) RD1a	.306**	.360**	.332**	.378**	.382**	.356**	.271**	.141*	1.00								
(25) RD1b	.304**	.345**	.369**	.371**	.396**	.356**	.281**	.168**	.801**	1.00							
(26) RD1e	.228**	.308**	.312**	.332**	.299**	.339**	.261**	.209**	.620**	.665**	1.00						
(27) AT2	.082	.128*	.125	.160*	.080	.162*	.130*	.141*	.112	.181**	.105	1.00					
(28) RD2	.026	.133*	.086	.068	.032	.020	.056	-.060	-.082	-.078	-.019	-.155*	1.00				
(29) RBV	.060	.023	.083	.034	.044	-.114	-.163*	-.124	-.024	.007	-.068	-.061	-.073	1.00			
(30) CBV	.068	.031	.149*	.063	.082	.013	.061	.014	.005	-.034	-.013	.024	-.085	.011	1.00		
(31) CBV	.022	.048	.061	.032	.028	-.038	.006	-.008	-.005	-.062	-.027	.028	-.027	.122	.601**	1.00	
(32) CBV	.011	-.035	-.059	-.077	-.012	.015	.030	.020	.016	.030	-.058	-.008	-.035	.037	-.045	.135*	1.00

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

APPENDIX L. MPLUS INPUT FOR HYPOTHESIZED MODEL

```
TITLE:          HYPOTHESIZED MODEL
DATA:           FILE IS "DATASET.DAT";
VARIABLE:       NAMES ARE REa REb REd AT1a AT1c AT1d RBV1c RBV1d RBV1e
                ICCa ICCb ICCd SQa SQc SQd SQf SQi SQj SQk SQm RSCa RSCc
                RSCe RD1a RD1b RD1e AT2 RD2 RBV2 CBV1 CBV2 CBV3;
MODEL:          RE BY REa REb REd;
                RBV1 BY RBV1c RBV1d RBV1e;
                ICC BY ICCa ICCb ICCd;
                AT1 BY AT1a AT1c AT1d;
                SQ BY SQa SQc SQd SQf SQi SQj SQk SQm;
                RSC BY RSCa RSCc RSCe;
                RD1 BY RD1a RD1b RD1e;
                SQ ON RE AT1 AT2 RD2 RD1 RBV1 RBV2 RSC;
                RSC ON RE RD1 RBV1 RBV2 CBV1 CBV2 CBV3 ICC;
                RD1 ON RD2 RBV1 CBV1 CBV2 CBV3 ICC;
MODEL INDIRECT:
                SQ IND RE;
                SQ IND RD1;
                SQ IND RD2;
                SQ IND RBV1;
                SQ IND RBV2;
                RSC IND RBV1;
                RSC IND CBV1;
                RSC IND CBV2;
                RSC IND CBV3;
                RSC IND ICC;
ANALYSIS:       TYPE IS GENERAL;
                ESTIMATOR IS ML;
                ITERATIONS = 1000;
                CONVERGENCE = 0.00005;
OUTPUT:         STANDARDIZED;
```

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APPENDIX M. MPLUS OUTPUT FOR HYPOTHESIZED MODEL

```
Mplus VERSION 6
MUTHEN & MUTHEN
10/10/2010   5:05 PM

HYPOTHESIZED MODEL

SUMMARY OF ANALYSIS

Number of groups                                                 1
Number of observations                                         240

Number of dependent variables                                   26
Number of independent variables                                  6
Number of continuous latent variables                            7

Observed dependent variables

  Continuous
   REA         REB         RED         AT1A        AT1C        AT1D
   RBV1C       RBV1D       RBV1E       ICCA        ICCB        ICCD
   SQA         SQC         SQD         SQF         SQI         SQJ
   SQK         SQM         RSCA        RSCC        RSCE        RD1A
   RD1B        RD1E

Observed independent variables
   AT2         RD2         RBV2        CBV1        CBV2        CBV3

Continuous latent variables
   RE          RBV1        ICC         AT1         SQ          RSC
   RD1


Estimator                                                       ML
Information matrix                                        OBSERVED
Maximum number of iterations                                  1000
Convergence criterion                                    0.500D-04
Maximum number of steepest descent iterations                   20

Input data file(s)
  DATASET.DAT

Input data format  FREE

THE         MODEL         ESTIMATION         TERMINATED         NORMALLY
```

TESTS OF MODEL FIT

Chi-Square Test of Model Fit

Value	532.257
Degrees of Freedom	403
P-Value	0.0000

Chi-Square Test of Model Fit for the Baseline Model

Value	5395.376
Degrees of Freedom	481
P-Value	0.0000

CFI/TLI

CFI	0.974
TLI	0.969

Loglikelihood

H0 Value	-11221.121
H1 Value	-10954.992

Information Criteria

Number of Free Parameters	130
Akaike (AIC)	22702.242
Bayesian (BIC)	23154.725
Sample-Size Adjusted BIC (n* = (n + 2) / 24)	22742.657

RMSEA (Root Mean Square Error Of Approximation)

Estimate	0.037	
90 Percent C.I.	0.028	0.045
Probability RMSEA <= .05	0.998	

SRMR (Standardized Root Mean Square Residual)

Value	0.047

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
RE BY				
REA	1.000	0.000	999.000	999.000
REB	1.104	0.087	12.625	0.000
RED	0.673	0.081	8.275	0.000
RBV1 BY				
RBV1C	1.000	0.000	999.000	999.000
RBV1D	1.293	0.135	9.616	0.000
RBV1E	1.193	0.124	9.621	0.000
ICC BY				
ICCA	1.000	0.000	999.000	999.000
ICCB	0.955	0.042	22.998	0.000
ICCD	0.747	0.050	15.058	0.000
AT1 BY				
AT1A	1.000	0.000	999.000	999.000
AT1C	1.102	0.051	21.588	0.000
AT1D	1.056	0.049	21.551	0.000
SQ BY				
SQA	1.000	0.000	999.000	999.000
SQC	0.998	0.054	18.550	0.000
SQD	0.985	0.055	18.031	0.000
SQF	0.782	0.061	12.889	0.000
SQI	0.963	0.064	15.046	0.000
SQJ	1.025	0.057	17.871	0.000
SQK	0.991	0.055	18.147	0.000
SQM	1.035	0.058	17.888	0.000
RSC BY				
RSCA	1.000	0.000	999.000	999.000
RSCC	0.854	0.066	12.919	0.000
RSCE	0.600	0.106	5.688	0.000
RD1 BY				
RD1A	1.000	0.000	999.000	999.000
RD1B	1.027	0.059	17.410	0.000
RD1E	0.892	0.069	12.968	0.000
SQ ON				
RE	1.066	0.129	8.256	0.000
AT1	0.040	0.045	0.885	0.376
RD1	0.150	0.055	2.728	0.006
RBV1	-0.183	0.063	-2.928	0.003
RSC	-0.245	0.074	-3.326	0.001
RSC ON				
RE	0.681	0.114	5.959	0.000
RD1	0.128	0.066	1.944	0.052
RBV1	-0.025	0.073	-0.341	0.733
ICC	-0.032	0.065	-0.494	0.621

RD1	ON				
RBV1		0.343	0.086	3.983	0.000
ICC		0.363	0.067	5.395	0.000
SQ	ON				
AT2		-0.029	0.035	-0.827	0.408
RD2		0.017	0.032	0.527	0.598
RBV2		0.071	0.048	1.497	0.134
RSC	ON				
RBV2		-0.089	0.055	-1.613	0.107
CBV1		0.004	0.008	0.538	0.591
CBV2		-0.070	0.076	-0.922	0.356
CBV3		0.058	0.064	0.902	0.367
RD1	ON				
RD2		-0.082	0.044	-1.874	0.061
CBV1		0.001	0.010	0.149	0.882
CBV2		0.054	0.091	0.588	0.556
CBV3		0.042	0.079	0.531	0.596
RBV1	WITH				
RE		0.477	0.105	4.525	0.000
ICC	WITH				
RE		0.725	0.110	6.608	0.000
RBV1		0.645	0.136	4.730	0.000
AT1	WITH				
RE		0.319	0.094	3.403	0.001
RBV1		0.162	0.113	1.427	0.154
ICC		0.451	0.125	3.598	0.000
AT2	WITH				
RE		0.357	0.107	3.344	0.001
RBV1		0.290	0.134	2.158	0.031
ICC		0.433	0.141	3.066	0.002
AT1		0.535	0.136	3.932	0.000
RD2	WITH				
RE		0.105	0.113	0.932	0.351
RBV1		-0.020	0.140	-0.146	0.884
ICC		0.215	0.150	1.431	0.152
AT1		0.125	0.144	0.870	0.384
RBV2	WITH				
RE		-0.060	0.077	-0.778	0.437
RBV1		0.007	0.094	0.071	0.943
ICC		-0.079	0.101	-0.778	0.437
AT1		-0.072	0.097	-0.746	0.456
CBV1	WITH				
RE		0.363	0.626	0.580	0.562
RBV1		-2.342	0.824	-2.842	0.004
ICC		-0.053	0.854	-0.062	0.951
AT1		0.037	0.819	0.045	0.964

CBV2 WITH				
RE	0.022	0.067	0.324	0.746
RBV1	-0.262	0.088	-2.966	0.003
ICC	-0.140	0.092	-1.528	0.127
AT1	0.092	0.088	1.049	0.294
CBV3 WITH				
RE	-0.034	0.062	-0.548	0.584
RBV1	-0.126	0.080	-1.590	0.112
ICC	0.021	0.085	0.253	0.800
AT1	0.075	0.081	0.927	0.354
Intercepts				
REA	5.729	0.074	77.242	0.000
REB	5.654	0.081	69.559	0.000
RED	5.883	0.074	79.160	0.000
AT1A	5.292	0.093	56.793	0.000
AT1C	5.342	0.095	56.259	0.000
AT1D	5.442	0.092	59.376	0.000
RBV1C	4.454	0.122	36.496	0.000
RBV1D	4.129	0.115	35.957	0.000
RBV1E	4.446	0.105	42.267	0.000
ICCA	5.250	0.092	57.090	0.000
ICCB	5.400	0.085	63.504	0.000
ICCD	5.671	0.084	67.610	0.000
SQA	5.396	0.257	21.033	0.000
SQC	5.791	0.252	22.937	0.000
SQD	5.724	0.250	22.939	0.000
SQF	5.633	0.203	27.702	0.000
SQI	5.512	0.247	22.303	0.000
SQJ	5.800	0.260	22.320	0.000
SQK	5.783	0.251	23.024	0.000
SQM	5.734	0.263	21.835	0.000
RSCA	6.255	0.183	34.116	0.000
RSCC	6.284	0.162	38.831	0.000
RSCE	4.838	0.151	32.044	0.000
RD1A	5.333	0.249	21.392	0.000
RD1B	5.271	0.254	20.727	0.000
RD1E	4.926	0.229	21.484	0.000
Variances				
RE	0.877	0.125	7.018	0.000
RBV1	1.432	0.287	4.992	0.000
ICC	1.805	0.200	9.041	0.000
AT1	1.695	0.200	8.478	0.000
Residual Variances				
REA	0.503	0.063	7.962	0.000
REB	0.589	0.076	7.789	0.000
RED	0.956	0.093	10.271	0.000
AT1A	0.528	0.060	8.793	0.000
AT1C	0.275	0.051	5.436	0.000
AT1D	0.281	0.048	5.911	0.000
RBV1C	2.266	0.232	9.746	0.000
RBV1D	0.974	0.164	5.958	0.000
RBV1E	0.792	0.137	5.766	0.000
ICCA	0.357	0.056	6.344	0.000

ICCB	0.209	0.047	4.485	0.000
ICCD	0.756	0.076	9.908	0.000
SQA	0.610	0.059	10.275	0.000
SQC	0.183	0.021	8.605	0.000
SQD	0.229	0.025	9.138	0.000
SQF	0.642	0.061	10.563	0.000
SQI	0.570	0.056	10.271	0.000
SQJ	0.263	0.028	9.318	0.000
SQK	0.219	0.024	9.023	0.000
SQM	0.270	0.029	9.240	0.000
RSCA	0.088	0.076	1.145	0.252
RSCC	0.472	0.070	6.723	0.000
RSCE	2.592	0.242	10.709	0.000
RD1A	0.533	0.080	6.668	0.000
RD1B	0.338	0.074	4.585	0.000
RD1E	1.187	0.123	9.617	0.000
SQ	0.398	0.074	5.354	0.000
RSC	0.746	0.104	7.154	0.000
RD1	1.110	0.144	7.715	0.000

STANDARDIZED MODEL RESULTS

STDYX Standardization

		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
RE	BY				
REA		0.797	0.031	25.975	0.000
REB		0.803	0.030	26.436	0.000
RED		0.542	0.051	10.689	0.000
RBV1	BY				
RBV1C		0.622	0.046	13.601	0.000
RBV1D		0.843	0.031	27.643	0.000
RBV1E		0.849	0.030	28.030	0.000
ICC	BY				
ICCA		0.914	0.016	57.963	0.000
ICCB		0.942	0.014	66.622	0.000
ICCD		0.756	0.030	24.973	0.000
AT1	BY				
AT1A		0.873	0.018	48.857	0.000
AT1C		0.939	0.013	74.629	0.000
AT1D		0.933	0.013	72.045	0.000
SQ	BY				
SQA		0.809	0.023	34.756	0.000
SQC		0.929	0.010	90.246	0.000
SQD		0.911	0.012	74.245	0.000
SQF		0.724	0.032	22.933	0.000
SQI		0.808	0.023	34.526	0.000
SQJ		0.906	0.013	71.239	0.000
SQK		0.915	0.012	77.684	0.000
SQM		0.906	0.013	70.654	0.000
RSC	BY				
RSCA		0.966	0.030	31.801	0.000
RSCC		0.808	0.033	24.168	0.000
RSCE		0.381	0.059	6.491	0.000
RD1	BY				
RD1A		0.871	0.023	38.322	0.000
RD1B		0.916	0.020	45.241	0.000
RD1E		0.727	0.034	21.094	0.000

SQ	ON				
	RE	0.930	0.079	11.773	0.000
	AT1	0.048	0.055	0.887	0.375
	RD1	0.181	0.066	2.716	0.007
	RBV1	-0.204	0.068	-2.993	0.003
	RSC	-0.252	0.074	-3.406	0.001
RSC	ON				
	RE	0.578	0.083	6.963	0.000
	RD1	0.149	0.077	1.937	0.053
	RBV1	-0.027	0.079	-0.341	0.733
	ICC	-0.039	0.079	-0.494	0.621
RD1	ON				
	RBV1	0.317	0.071	4.454	0.000
	ICC	0.377	0.065	5.780	0.000
SQ	ON				
	AT2	-0.044	0.053	-0.827	0.408
	RD2	0.027	0.051	0.527	0.598
	RBV2	0.077	0.052	1.498	0.134
RSC	ON				
	RBV2	-0.094	0.059	-1.599	0.110
	CBV1	0.038	0.071	0.537	0.591
	CBV2	-0.067	0.073	-0.925	0.355
	CBV3	0.051	0.057	0.901	0.367
RD1	ON				
	RD2	-0.110	0.058	-1.884	0.060
	CBV1	0.011	0.075	0.149	0.882
	CBV2	0.044	0.074	0.589	0.556
	CBV3	0.032	0.060	0.531	0.596
RBV1	WITH				
	RE	0.425	0.068	6.281	0.000
ICC	WITH				
	RE	0.576	0.051	11.247	0.000
	RBV1	0.401	0.062	6.444	0.000
AT1	WITH				
	RE	0.262	0.069	3.779	0.000
	RBV1	0.104	0.071	1.457	0.145
	ICC	0.258	0.065	3.996	0.000
AT2	WITH				
	RE	0.234	0.068	3.461	0.001
	RBV1	0.149	0.067	2.218	0.027
	ICC	0.198	0.063	3.130	0.002
	AT1	0.253	0.062	4.083	0.000
RD2	WITH				
	RE	0.065	0.069	0.934	0.350
	RBV1	-0.010	0.068	-0.146	0.884
	ICC	0.092	0.064	1.439	0.150
	AT1	0.056	0.064	0.872	0.383

RBV2	WITH				
	RE	-0.055	0.070	-0.778	0.436
	RBV1	0.005	0.067	0.071	0.943
	ICC	-0.050	0.065	-0.778	0.436
	AT1	-0.048	0.064	-0.747	0.455
CBV1	WITH				
	RE	0.039	0.068	0.580	0.562
	RBV1	-0.198	0.066	-2.994	0.003
	ICC	-0.004	0.064	-0.062	0.951
	AT1	0.003	0.064	0.045	0.964
CBV2	WITH				
	RE	0.022	0.068	0.324	0.746
	RBV1	-0.207	0.066	-3.130	0.002
	ICC	-0.099	0.064	-1.537	0.124
	AT1	0.067	0.064	1.052	0.293
CBV3	WITH				
	RE	-0.037	0.068	-0.549	0.583
	RBV1	-0.108	0.067	-1.612	0.107
	ICC	0.016	0.064	0.253	0.800
	AT1	0.059	0.064	0.929	0.353
Intercepts					
	REA	4.876	0.231	21.096	0.000
	REB	4.389	0.210	20.916	0.000
	RED	5.058	0.239	21.119	0.000
	AT1A	3.549	0.173	20.476	0.000
	AT1C	3.497	0.171	20.462	0.000
	AT1D	3.693	0.179	20.601	0.000
	RBV1C	2.316	0.123	18.792	0.000
	RBV1D	2.249	0.120	18.735	0.000
	RBV1E	2.643	0.136	19.480	0.000
	ICCA	3.570	0.174	20.488	0.000
	ICCB	3.963	0.191	20.751	0.000
	ICCD	4.272	0.205	20.859	0.000
	SQA	4.062	0.266	15.284	0.000
	SQC	5.019	0.315	15.953	0.000
	SQD	4.931	0.309	15.956	0.000
	SQF	4.853	0.280	17.332	0.000
	SQI	4.303	0.273	15.750	0.000
	SQJ	4.776	0.303	15.746	0.000
	SQK	4.971	0.311	15.986	0.000
	SQM	4.671	0.300	15.572	0.000
	RSCA	5.472	0.294	18.628	0.000
	RSCC	5.384	0.278	19.351	0.000
	RSCE	2.779	0.152	18.299	0.000
	RD1A	3.590	0.234	15.349	0.000
	RD1B	3.634	0.241	15.098	0.000
	RD1E	3.105	0.202	15.385	0.000
Variances					
	RE	1.000	0.000	999.000	999.000
	RBV1	1.000	0.000	999.000	999.000

ICC	1.000	0.000	999.000	999.000
AT1	1.000	0.000	999.000	999.000
Residual Variances				
REA	0.365	0.049	7.450	0.000
REB	0.355	0.049	7.277	0.000
RED	0.707	0.055	12.877	0.000
AT1A	0.237	0.031	7.608	0.000
AT1C	0.118	0.024	4.990	0.000
AT1D	0.130	0.024	5.364	0.000
RBV1C	0.613	0.057	10.757	0.000
RBV1D	0.289	0.051	5.620	0.000
RBV1E	0.280	0.051	5.446	0.000
ICCA	0.165	0.029	5.735	0.000
ICCB	0.112	0.027	4.221	0.000
ICCD	0.429	0.046	9.385	0.000
SQA	0.346	0.038	9.193	0.000
SQC	0.137	0.019	7.179	0.000
SQD	0.170	0.022	7.607	0.000
SQF	0.477	0.046	10.438	0.000
SQI	0.348	0.038	9.196	0.000
SQJ	0.179	0.023	7.742	0.000
SQK	0.162	0.022	7.512	0.000
SQM	0.179	0.023	7.708	0.000
RSCA	0.067	0.059	1.142	0.253
RSCC	0.347	0.054	6.417	0.000
RSCE	0.855	0.045	19.140	0.000
RD1A	0.242	0.040	6.109	0.000
RD1B	0.161	0.037	4.335	0.000
RD1E	0.472	0.050	9.413	0.000
SQ	0.345	0.058	5.898	0.000
RSC	0.612	0.061	9.969	0.000
RD1	0.663	0.057	11.592	0.000

STDY Standardization

		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
RE	BY				
REA		0.797	0.031	25.975	0.000
REB		0.803	0.030	26.436	0.000
RED		0.542	0.051	10.689	0.000
RBV1	BY				
RBV1C		0.622	0.046	13.601	0.000
RBV1D		0.843	0.031	27.643	0.000
RBV1E		0.849	0.030	28.030	0.000
ICC	BY				
ICCA		0.914	0.016	57.963	0.000
ICCB		0.942	0.014	66.622	0.000
ICCD		0.756	0.030	24.973	0.000
AT1	BY				
AT1A		0.873	0.018	48.857	0.000
AT1C		0.939	0.013	74.629	0.000
AT1D		0.933	0.013	72.045	0.000
SQ	BY				
SQA		0.809	0.023	34.756	0.000
SQC		0.929	0.010	90.246	0.000
SQD		0.911	0.012	74.245	0.000
SQF		0.724	0.032	22.933	0.000
SQI		0.808	0.023	34.526	0.000
SQJ		0.906	0.013	71.239	0.000
SQK		0.915	0.012	77.684	0.000
SQM		0.906	0.013	70.654	0.000
RSC	BY				
RSCA		0.966	0.030	31.801	0.000
RSCC		0.808	0.033	24.168	0.000
RSCE		0.381	0.059	6.491	0.000
RD1	BY				
RD1A		0.871	0.023	38.322	0.000
RD1B		0.916	0.020	45.241	0.000
RD1E		0.727	0.034	21.094	0.000
SQ	ON				
RE		0.930	0.079	11.773	0.000
AT1		0.048	0.055	0.887	0.375
RD1		0.181	0.066	2.716	0.007
RBV1		-0.204	0.068	-2.993	0.003
RSC		-0.252	0.074	-3.406	0.001
RSC	ON				
RE		0.578	0.083	6.963	0.000
RD1		0.149	0.077	1.937	0.053
RBV1		-0.027	0.079	-0.341	0.733
ICC		-0.039	0.079	-0.494	0.621

RD1	ON				
	RBV1	0.317	0.071	4.454	0.000
	ICC	0.377	0.065	5.780	0.000
SQ	ON				
	AT2	-0.027	0.033	-0.828	0.408
	RD2	0.016	0.029	0.527	0.598
	RBV2	0.066	0.044	1.502	0.133
RSC	ON				
	RBV2	-0.081	0.050	-1.603	0.109
	CBV1	0.004	0.007	0.537	0.591
	CBV2	-0.064	0.069	-0.926	0.354
	CBV3	0.053	0.058	0.902	0.367
RD1	ON				
	RD2	-0.063	0.033	-1.891	0.059
	CBV1	0.001	0.008	0.149	0.882
	CBV2	0.042	0.070	0.589	0.556
	CBV3	0.032	0.061	0.531	0.595
RBV1	WITH				
	RE	0.425	0.068	6.281	0.000
ICC	WITH				
	RE	0.576	0.051	11.247	0.000
	RBV1	0.401	0.062	6.444	0.000
AT1	WITH				
	RE	0.262	0.069	3.779	0.000
	RBV1	0.104	0.071	1.457	0.145
	ICC	0.258	0.065	3.996	0.000
AT2	WITH				
	RE	0.234	0.068	3.461	0.001
	RBV1	0.149	0.067	2.218	0.027
	ICC	0.198	0.063	3.130	0.002
	AT1	0.253	0.062	4.083	0.000
RD2	WITH				
	RE	0.065	0.069	0.934	0.350
	RBV1	-0.010	0.068	-0.146	0.884
	ICC	0.092	0.064	1.439	0.150
	AT1	0.056	0.064	0.872	0.383
RBV2	WITH				
	RE	-0.055	0.070	-0.778	0.436
	RBV1	0.005	0.067	0.071	0.943
	ICC	-0.050	0.065	-0.778	0.436
	AT1	-0.048	0.064	-0.747	0.455
CBV1	WITH				
	RE	0.039	0.068	0.580	0.562
	RBV1	-0.198	0.066	-2.994	0.003
	ICC	-0.004	0.064	-0.062	0.951
	AT1	0.003	0.064	0.045	0.964

CBV2 WITH				
RE	0.022	0.068	0.324	0.746
RBV1	-0.207	0.066	-3.130	0.002
ICC	-0.099	0.064	-1.537	0.124
AT1	0.067	0.064	1.052	0.293
CBV3 WITH				
RE	-0.037	0.068	-0.549	0.583
RBV1	-0.108	0.067	-1.612	0.107
ICC	0.016	0.064	0.253	0.800
AT1	0.059	0.064	0.929	0.353
Intercepts				
REA	4.876	0.231	21.096	0.000
REB	4.389	0.210	20.916	0.000
RED	5.058	0.239	21.119	0.000
AT1A	3.549	0.173	20.476	0.000
AT1C	3.497	0.171	20.462	0.000
AT1D	3.693	0.179	20.601	0.000
RBV1C	2.316	0.123	18.792	0.000
RBV1D	2.249	0.120	18.735	0.000
RBV1E	2.643	0.136	19.480	0.000
ICCA	3.570	0.174	20.488	0.000
ICCB	3.963	0.191	20.751	0.000
ICCD	4.272	0.205	20.859	0.000
SQA	4.062	0.266	15.284	0.000
SQC	5.019	0.315	15.953	0.000
SQD	4.931	0.309	15.956	0.000
SQF	4.853	0.280	17.332	0.000
SQI	4.303	0.273	15.750	0.000
SQJ	4.776	0.303	15.746	0.000
SQK	4.971	0.311	15.986	0.000
SQM	4.671	0.300	15.572	0.000
RSCA	5.472	0.294	18.628	0.000
RSCC	5.384	0.278	19.351	0.000
RSCE	2.779	0.152	18.299	0.000
RD1A	3.590	0.234	15.349	0.000
RD1B	3.634	0.241	15.098	0.000
RD1E	3.105	0.202	15.385	0.000
Variances				
RE	1.000	0.000	999.000	999.000
RBV1	1.000	0.000	999.000	999.000
ICC	1.000	0.000	999.000	999.000
AT1	1.000	0.000	999.000	999.000
Residual Variances				
REA	0.365	0.049	7.450	0.000
REB	0.355	0.049	7.277	0.000
RED	0.707	0.055	12.877	0.000
AT1A	0.237	0.031	7.608	0.000
AT1C	0.118	0.024	4.990	0.000
AT1D	0.130	0.024	5.364	0.000
RBV1C	0.613	0.057	10.757	0.000
RBV1D	0.289	0.051	5.620	0.000
RBV1E	0.280	0.051	5.446	0.000

ICCA	0.165	0.029	5.735	0.000
ICCB	0.112	0.027	4.221	0.000
ICCD	0.429	0.046	9.385	0.000
SQA	0.346	0.038	9.193	0.000
SQC	0.137	0.019	7.179	0.000
SQD	0.170	0.022	7.607	0.000
SQF	0.477	0.046	10.438	0.000
SQI	0.348	0.038	9.196	0.000
SQJ	0.179	0.023	7.742	0.000
SQK	0.162	0.022	7.512	0.000
SQM	0.179	0.023	7.708	0.000
RSCA	0.067	0.059	1.142	0.253
RSCC	0.347	0.054	6.417	0.000
RSCE	0.855	0.045	19.140	0.000
RD1A	0.242	0.040	6.109	0.000
RD1B	0.161	0.037	4.335	0.000
RD1E	0.472	0.050	9.413	0.000
SQ	0.345	0.058	5.898	0.000
RSC	0.612	0.061	9.969	0.000
RD1	0.663	0.057	11.592	0.000

STD Standardization

		Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
RE	BY				
REA		0.937	0.067	14.036	0.000
REB		1.035	0.073	14.163	0.000
RED		0.630	0.074	8.520	0.000
RBV1	BY				
RBV1C		1.197	0.120	9.984	0.000
RBV1D		1.548	0.105	14.772	0.000
RBV1E		1.428	0.096	14.894	0.000
ICC	BY				
ICCA		1.344	0.074	18.082	0.000
ICCB		1.284	0.068	19.014	0.000
ICCD		1.003	0.074	13.526	0.000
AT1	BY				
AT1A		1.302	0.077	16.955	0.000
AT1C		1.435	0.075	19.103	0.000
AT1D		1.375	0.073	18.891	0.000
SQ	BY				
SQA		1.074	0.070	15.320	0.000
SQC		1.072	0.056	19.146	0.000
SQD		1.058	0.057	18.519	0.000
SQF		0.840	0.064	13.071	0.000
SQI		1.035	0.068	15.286	0.000
SQJ		1.101	0.060	18.363	0.000
SQK		1.065	0.057	18.672	0.000
SQM		1.112	0.061	18.352	0.000
RSC	BY				
RSCA		1.104	0.063	17.522	0.000
RSCC		0.943	0.068	13.969	0.000
RSCE		0.663	0.113	5.854	0.000
RD1	BY				
RD1A		1.293	0.079	16.285	0.000
RD1B		1.329	0.076	17.565	0.000
RD1E		1.153	0.091	12.604	0.000
SQ	ON				
RE		0.930	0.079	11.773	0.000
AT1		0.048	0.055	0.887	0.375
RD1		0.181	0.066	2.716	0.007
RBV1		-0.204	0.068	-2.993	0.003
RSC		-0.252	0.074	-3.406	0.001
RSC	ON				
RE		0.578	0.083	6.963	0.000
RD1		0.149	0.077	1.937	0.053
RBV1		-0.027	0.079	-0.341	0.733
ICC		-0.039	0.079	-0.494	0.621

RD1	ON				
	RBV1	0.317	0.071	4.454	0.000
	ICC	0.377	0.065	5.780	0.000
SQ	ON				
	AT2	-0.027	0.033	-0.828	0.408
	RD2	0.016	0.029	0.527	0.598
	RBV2	0.066	0.044	1.502	0.133
RSC	ON				
	RBV2	-0.081	0.050	-1.603	0.109
	CBV1	0.004	0.007	0.537	0.591
	CBV2	-0.064	0.069	-0.926	0.354
	CBV3	0.053	0.058	0.902	0.367
RD1	ON				
	RD2	-0.063	0.033	-1.891	0.059
	CBV1	0.001	0.008	0.149	0.882
	CBV2	0.042	0.070	0.589	0.556
	CBV3	0.032	0.061	0.531	0.595
RBV1	WITH				
	RE	0.425	0.068	6.281	0.000
ICC	WITH				
	RE	0.576	0.051	11.247	0.000
	RBV1	0.401	0.062	6.444	0.000
AT1	WITH				
	RE	0.262	0.069	3.779	0.000
	RBV1	0.104	0.071	1.457	0.145
	ICC	0.258	0.065	3.996	0.000
AT2	WITH				
	RE	0.381	0.109	3.505	0.000
	RBV1	0.243	0.109	2.229	0.026
	ICC	0.322	0.102	3.163	0.002
	AT1	0.411	0.099	4.156	0.000
RD2	WITH				
	RE	0.112	0.120	0.935	0.350
	RBV1	-0.017	0.117	-0.146	0.884
	ICC	0.160	0.111	1.442	0.149
	AT1	0.096	0.110	0.872	0.383
RBV2	WITH				
	RE	-0.064	0.082	-0.779	0.436
	RBV1	0.006	0.078	0.071	0.943
	ICC	-0.059	0.075	-0.779	0.436
	AT1	-0.055	0.074	-0.747	0.455
CBV1	WITH				
	RE	0.388	0.668	0.580	0.562
	RBV1	-1.957	0.647	-3.022	0.003
	ICC	-0.039	0.636	-0.062	0.951
	AT1	0.028	0.629	0.045	0.964

CBV2 WITH				
RE	0.023	0.072	0.324	0.746
RBV1	-0.219	0.069	-3.163	0.002
ICC	-0.104	0.068	-1.540	0.123
AT1	0.071	0.067	1.053	0.292
CBV3 WITH				
RE	-0.036	0.066	-0.549	0.583
RBV1	-0.106	0.065	-1.616	0.106
ICC	0.016	0.063	0.253	0.800
AT1	0.058	0.062	0.930	0.353
Intercepts				
REA	5.729	0.074	77.242	0.000
REB	5.654	0.081	69.559	0.000
RED	5.883	0.074	79.160	0.000
AT1A	5.292	0.093	56.793	0.000
AT1C	5.342	0.095	56.259	0.000
AT1D	5.442	0.092	59.376	0.000
RBV1C	4.454	0.122	36.496	0.000
RBV1D	4.129	0.115	35.957	0.000
RBV1E	4.446	0.105	42.267	0.000
ICCA	5.250	0.092	57.090	0.000
ICCB	5.400	0.085	63.504	0.000
ICCD	5.671	0.084	67.610	0.000
SQA	5.396	0.257	21.033	0.000
SQC	5.791	0.252	22.937	0.000
SQD	5.724	0.250	22.939	0.000
SQF	5.633	0.203	27.702	0.000
SQI	5.512	0.247	22.303	0.000
SQJ	5.800	0.260	22.320	0.000
SQK	5.783	0.251	23.024	0.000
SQM	5.734	0.263	21.835	0.000
RSCA	6.255	0.183	34.116	0.000
RSCC	6.284	0.162	38.831	0.000
RSCE	4.838	0.151	32.044	0.000
RD1A	5.333	0.249	21.392	0.000
RD1B	5.271	0.254	20.727	0.000
RD1E	4.926	0.229	21.484	0.000
Variances				
RE	1.000	0.000	999.000	999.000
RBV1	1.000	0.000	999.000	999.000
ICC	1.000	0.000	999.000	999.000
AT1	1.000	0.000	999.000	999.000
Residual Variances				
REA	0.503	0.063	7.962	0.000
REB	0.589	0.076	7.789	0.000
RED	0.956	0.093	10.271	0.000
AT1A	0.528	0.060	8.793	0.000
AT1C	0.275	0.051	5.436	0.000
AT1D	0.281	0.048	5.911	0.000
RBV1C	2.266	0.232	9.746	0.000
RBV1D	0.974	0.164	5.958	0.000
RBV1E	0.792	0.137	5.766	0.000

ICCA	0.357	0.056	6.344	0.000
ICCB	0.209	0.047	4.485	0.000
ICCD	0.756	0.076	9.908	0.000
SQA	0.610	0.059	10.275	0.000
SQC	0.183	0.021	8.605	0.000
SQD	0.229	0.025	9.138	0.000
SQF	0.642	0.061	10.563	0.000
SQI	0.570	0.056	10.271	0.000
SQJ	0.263	0.028	9.318	0.000
SQK	0.219	0.024	9.023	0.000
SQM	0.270	0.029	9.240	0.000
RSCA	0.088	0.076	1.145	0.252
RSCC	0.472	0.070	6.723	0.000
RSCE	2.592	0.242	10.709	0.000
RD1A	0.533	0.080	6.668	0.000
RD1B	0.338	0.074	4.585	0.000
RD1E	1.187	0.123	9.617	0.000
SQ	0.345	0.058	5.898	0.000
RSC	0.612	0.061	9.969	0.000
RD1	0.663	0.057	11.592	0.000

R-SQUARE

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
REA	0.635	0.049	12.987	0.000
REB	0.645	0.049	13.218	0.000
RED	0.293	0.055	5.344	0.000
AT1A	0.763	0.031	24.429	0.000
AT1C	0.882	0.024	37.314	0.000
AT1D	0.870	0.024	36.022	0.000
RBV1C	0.387	0.057	6.800	0.000
RBV1D	0.711	0.051	13.821	0.000
RBV1E	0.720	0.051	14.015	0.000
ICCA	0.835	0.029	28.981	0.000
ICCB	0.888	0.027	33.311	0.000
ICCD	0.571	0.046	12.486	0.000
SQA	0.654	0.038	17.378	0.000
SQC	0.863	0.019	45.123	0.000
SQD	0.830	0.022	37.123	0.000
SQF	0.523	0.046	11.466	0.000
SQI	0.652	0.038	17.263	0.000
SQJ	0.821	0.023	35.619	0.000
SQK	0.838	0.022	38.842	0.000
SQM	0.821	0.023	35.327	0.000
RSCA	0.933	0.059	15.900	0.000
RSCC	0.653	0.054	12.084	0.000
RSCE	0.145	0.045	3.245	0.001
RD1A	0.758	0.040	19.161	0.000
RD1B	0.839	0.037	22.621	0.000
RD1E	0.528	0.050	10.547	0.000

Latent Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value

SQ	0.655	0.058	11.218	0.000
RSC	0.388	0.061	6.322	0.000
RD1	0.337	0.057	5.883	0.000

QUALITY OF NUMERICAL RESULTS

Condition Number for the Information Matrix 0.136E-04
(ratio of smallest to largest eigenvalue)

TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Effects from RE to SQ				
Total	0.899	0.103	8.735	0.000
Total indirect	-0.167	0.064	-2.592	0.010
Specific indirect				
SQ				
RSC				
RE	-0.167	0.064	-2.592	0.010
Direct				
SQ				
RE	1.066	0.129	8.256	0.000
Effects from RD1 to SQ				
Total	0.119	0.054	2.194	0.028
Total indirect	-0.031	0.018	-1.732	0.083
Specific indirect				
SQ				
RSC				
RD1	-0.031	0.018	-1.732	0.083
Direct				
SQ				
RD1	0.150	0.055	2.728	0.006
Effects from RD2 to SQ				
Total	0.007	0.032	0.220	0.826
Total indirect	-0.010	0.007	-1.433	0.152
Specific indirect				

SQ				
RD1				
RD2	-0.012	0.008	-1.555	0.120
SQ				
RSC				
RD1				
RD2	0.003	0.002	1.277	0.202
Direct				
SQ				
RD2	0.017	0.032	0.527	0.598
Effects from RBV1 to SQ				
Total	-0.136	0.058	-2.355	0.019
Total indirect	0.047	0.028	1.676	0.094
Specific indirect				
SQ				
RSC				
RBV1	0.006	0.018	0.335	0.738
SQ				
RD1				
RBV1	0.051	0.023	2.223	0.026
SQ				
RSC				
RD1				
RBV1	-0.011	0.007	-1.592	0.111
Direct				
SQ				
RBV1	-0.183	0.063	-2.928	0.003
Effects from RBV2 to SQ				
Total	0.093	0.046	2.022	0.043
Total indirect	0.022	0.015	1.445	0.148
Specific indirect				
SQ				
RSC				
RBV2	0.022	0.015	1.445	0.148
Direct				
SQ				
RBV2	0.071	0.048	1.497	0.134
Effects from RBV1 to RSC				

Total	0.019	0.070	0.268	0.789
Total indirect	0.044	0.025	1.753	0.080
Specific indirect				
RSC				
RD1				
RBV1	0.044	0.025	1.753	0.080
Direct				
RSC				
RBV1	-0.025	0.073	-0.341	0.733

Effects from CBV1 to RSC

Total	0.004	0.008	0.555	0.579
Total indirect	0.000	0.001	0.148	0.882
Specific indirect				
RSC				
RD1				
CBV1	0.000	0.001	0.148	0.882
Direct				
RSC				
CBV1	0.004	0.008	0.538	0.591

Effects from CBV2 to RSC

Total	-0.063	0.077	-0.824	0.410
Total indirect	0.007	0.012	0.564	0.573
Specific indirect				
RSC				
RD1				
CBV2	0.007	0.012	0.564	0.573
Direct				
RSC				
CBV2	-0.070	0.076	-0.922	0.356

Effects from CBV3 to RSC

Total	0.064	0.065	0.977	0.328
Total indirect	0.005	0.010	0.513	0.608
Specific indirect				
RSC				
RD1				
CBV3	0.005	0.010	0.513	0.608

Direct				
RSC				
CBV3	0.058	0.064	0.902	0.367

Effects from ICC to RSC

Total	0.014	0.065	0.217	0.828
Total indirect	0.046	0.025	1.836	0.066
Specific indirect				
RSC				
RD1				
ICC	0.046	0.025	1.836	0.066
Direct				
RSC				
ICC	-0.032	0.065	-0.494	0.621

STANDARDIZED TOTAL, TOTAL INDIRECT, SPECIFIC INDIRECT, AND DIRECT EFFECTS

STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Effects from RE to SQ				
Total	0.784	0.060	12.978	0.000
Total indirect	-0.145	0.054	-2.674	0.007
Specific indirect				
SQ				
RSC				
RE	-0.145	0.054	-2.674	0.007
Direct				
SQ				
RE	0.930	0.079	11.773	0.000
Effects from RD1 to SQ				
Total	0.143	0.066	2.181	0.029
Total indirect	-0.038	0.022	-1.741	0.082
Specific indirect				
SQ				
RSC				

RD1	-0.038	0.022	-1.741	0.082
Direct				
SQ				
RD1	0.181	0.066	2.716	0.007

Effects from RD2 to SQ

Total	0.011	0.051	0.220	0.826
Total indirect	-0.016	0.011	-1.428	0.153
Specific indirect				
SQ				
RD1				
RD2	-0.020	0.013	-1.550	0.121
SQ				
RSC				
RD1				
RD2	0.004	0.003	1.278	0.201
Direct				
SQ				
RD2	0.027	0.051	0.527	0.598

Effects from RBV1 to SQ

Total	-0.152	0.064	-2.394	0.017
Total indirect	0.052	0.031	1.682	0.093
Specific indirect				
SQ				
RSC				
RBV1	0.007	0.020	0.335	0.738
SQ				
RD1				
RBV1	0.057	0.025	2.249	0.025
SQ				
RSC				
RD1				
RBV1	-0.012	0.007	-1.611	0.107
Direct				
SQ				
RBV1	-0.204	0.068	-2.993	0.003

Effects from RBV2 to SQ

Total	0.101	0.050	2.027	0.043

Total indirect	0.024	0.016	1.449	0.147
Specific indirect				
SQ				
RSC				
RBV2	0.024	0.016	1.449	0.147
Direct				
SQ				
RBV2	0.077	0.052	1.498	0.134

Effects from RBV1 to RSC

Total	0.020	0.076	0.268	0.789
Total indirect	0.047	0.027	1.766	0.077
Specific indirect				
RSC				
RD1				
RBV1	0.047	0.027	1.766	0.077
Direct				
RSC				
RBV1	-0.027	0.079	-0.341	0.733

Effects from CBV1 to RSC

Total	0.040	0.072	0.555	0.579
Total indirect	0.002	0.011	0.148	0.882
Specific indirect				
RSC				
RD1				
CBV1	0.002	0.011	0.148	0.882
Direct				
RSC				
CBV1	0.038	0.071	0.537	0.591

Effects from CBV2 to RSC

Total	-0.061	0.073	-0.827	0.408
Total indirect	0.007	0.012	0.563	0.573
Specific indirect				
RSC				
RD1				
CBV2	0.007	0.012	0.563	0.573

```
  Direct
    RSC
    CBV2              -0.067      0.073     -0.925      0.355


Effects from CBV3 to RSC

  Total                0.056      0.058      0.976      0.329
  Total indirect       0.005      0.009      0.512      0.608
  Specific indirect

    RSC
    RD1
    CBV3               0.005      0.009      0.512      0.608

  Direct
    RSC
    CBV3               0.051      0.057      0.901      0.367


Effects from ICC to RSC

  Total                0.017      0.079      0.217      0.828
  Total indirect       0.056      0.031      1.830      0.067

  Specific indirect

    RSC
    RD1
    ICC                0.056      0.031      1.830      0.067

  Direct
    RSC
    ICC               -0.039      0.079     -0.494      0.621


STDY Standardization

                                                    Two-Tailed
                    Estimate       S.E.  Est./S.E.    P-Value

Effects from RE to SQ

  Total                0.784      0.060     12.978      0.000
  Total indirect      -0.145      0.054     -2.674      0.007

  Specific indirect

    SQ
    RSC
    RE                 -0.145      0.054     -2.674      0.007


  Direct
    SQ
```

RE	0.930	0.079	11.773	0.000
Effects from RD1 to SQ				
Total	0.143	0.066	2.181	0.029
Total indirect	-0.038	0.022	-1.741	0.082
Specific indirect				
SQ				
RSC				
RD1	-0.038	0.022	-1.741	0.082
Direct				
SQ				
RD1	0.181	0.066	2.716	0.007
Effects from RD2 to SQ				
Total	0.006	0.029	0.220	0.826
Total indirect	-0.009	0.006	-1.404	0.160
Specific indirect				
SQ				
RD1				
RD2	-0.011	0.008	-1.519	0.129
SQ				
RSC				
RD1				
RD2	0.002	0.002	1.261	0.207
Direct				
SQ				
RD2	0.016	0.029	0.526	0.599
Effects from RBV1 to SQ				
Total	-0.152	0.064	-2.394	0.017
Total indirect	0.052	0.031	1.682	0.093
Specific indirect				
SQ				
RSC				
RBV1	0.007	0.020	0.335	0.738
SQ				
RD1				
RBV1	0.057	0.025	2.249	0.025

SQ				
RSC				
RD1				
RBV1	-0.012	0.007	-1.611	0.107
Direct				
SQ				
RBV1	-0.204	0.068	-2.993	0.003
Effects from RBV2 to SQ				
Total	0.087	0.043	2.020	0.043
Total indirect	0.020	0.014	1.446	0.148
Specific indirect				
SQ				
RSC				
RBV2	0.020	0.014	1.446	0.148
Direct				
SQ				
RBV2	0.066	0.044	1.496	0.135
Effects from RBV1 to RSC				
Total	0.020	0.076	0.268	0.789
Total indirect	0.047	0.027	1.766	0.077
Specific indirect				
RSC				
RD1				
RBV1	0.047	0.027	1.766	0.077
Direct				
RSC				
RBV1	-0.027	0.079	-0.341	0.733
Effects from CBV1 to RSC				
Total	0.004	0.019	0.209	0.835
Total indirect	0.000	0.001	0.124	0.901
Specific indirect				
RSC				
RD1				
CBV1	0.000	0.001	0.124	0.901
Direct				
RSC				

CBV1	0.004	0.019	0.208	0.835

Effects from CBV2 to RSC

Total	-0.057	0.069	-0.826	0.409
Total indirect	0.006	0.011	0.563	0.573

Specific indirect

RSC
RD1

CBV2	0.006	0.011	0.563	0.573

Direct

RSC

CBV2	-0.064	0.069	-0.925	0.355

Effects from CBV3 to RSC

Total	0.058	0.059	0.976	0.329
Total indirect	0.005	0.009	0.512	0.608

Specific indirect

RSC
RD1

CBV3	0.005	0.009	0.512	0.608

Direct

RSC

CBV3	0.053	0.058	0.901	0.367

Effects from ICC to RSC

Total	0.017	0.079	0.217	0.828
Total indirect	0.056	0.031	1.830	0.067

Specific indirect

RSC
RD1

ICC	0.056	0.031	1.830	0.067

Direct

RSC

ICC	-0.039	0.079	-0.494	0.621

STD Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Effects from RE to SQ				
Total	0.784	0.060	12.978	0.000
Total indirect	-0.145	0.054	-2.674	0.007
Specific indirect				
SQ				
RSC				
RE	-0.145	0.054	-2.674	0.007
Direct				
SQ				
RE	0.930	0.079	11.773	0.000
Effects from RD1 to SQ				
Total	0.143	0.066	2.181	0.029
Total indirect	-0.038	0.022	-1.741	0.082
Specific indirect				
SQ				
RSC				
RD1	-0.038	0.022	-1.741	0.082
Direct				
SQ				
RD1	0.181	0.066	2.716	0.007
Effects from RD2 to SQ				
Total	0.006	0.029	0.220	0.826
Total indirect	-0.009	0.006	-1.431	0.153
Specific indirect				
SQ				
RD1				
RD2	-0.011	0.007	-1.553	0.120
SQ				
RSC				
RD1				

RD2	0.002	0.002	1.280	0.200
Direct				
SQ				
RD2	0.016	0.029	0.527	0.598
Effects from RBV1 to SQ				
Total	-0.152	0.064	-2.394	0.017
Total indirect	0.052	0.031	1.682	0.093
Specific indirect				
SQ				
RSC				
RBV1	0.007	0.020	0.335	0.738
SQ				
RD1				
RBV1	0.057	0.025	2.249	0.025
SQ				
RSC				
RD1				
RBV1	-0.012	0.007	-1.611	0.107
Direct				
SQ				
RBV1	-0.204	0.068	-2.993	0.003
Effects from RBV2 to SQ				
Total	0.087	0.043	2.036	0.042
Total indirect	0.020	0.014	1.452	0.146
Specific indirect				
SQ				
RSC				
RBV2	0.020	0.014	1.452	0.146
Direct				
SQ				
RBV2	0.066	0.044	1.502	0.133
Effects from RBV1 to RSC				
Total	0.020	0.076	0.268	0.789
Total indirect	0.047	0.027	1.766	0.077
Specific indirect				

```
    RSC
    RD1
    RBV1              0.047      0.027      1.766      0.077

  Direct
    RSC
    RBV1             -0.027      0.079     -0.341      0.733


Effects from CBV1 to RSC

  Total               0.004      0.007      0.555      0.579
  Total indirect      0.000      0.001      0.148      0.882

  Specific indirect

    RSC
    RD1
    CBV1              0.000      0.001      0.148      0.882

  Direct
    RSC
    CBV1              0.004      0.007      0.537      0.591


Effects from CBV2 to RSC

  Total              -0.057      0.069     -0.827      0.408
  Total indirect      0.006      0.011      0.563      0.573

  Specific indirect

    RSC
    RD1
    CBV2              0.006      0.011      0.563      0.573

  Direct
    RSC
    CBV2             -0.064      0.069     -0.926      0.354


Effects from CBV3 to RSC

  Total               0.058      0.059      0.977      0.328
  Total indirect      0.005      0.009      0.513      0.608

  Specific indirect

    RSC
    RD1
    CBV3              0.005      0.009      0.513      0.608

  Direct
    RSC
```

```
    CBV3               0.053      0.058      0.902      0.367


Effects from ICC to RSC

  Total                0.017      0.079      0.217      0.828
  Total indirect       0.056      0.031      1.830      0.067

  Specific indirect

    RSC
    RD1
    ICC                0.056      0.031      1.830      0.067



  Direct
    RSC
    ICC               -0.039      0.079     -0.494      0.621


     Beginning Time:  17:05:40
        Ending Time:  17:05:42
       Elapsed Time:  00:00:02


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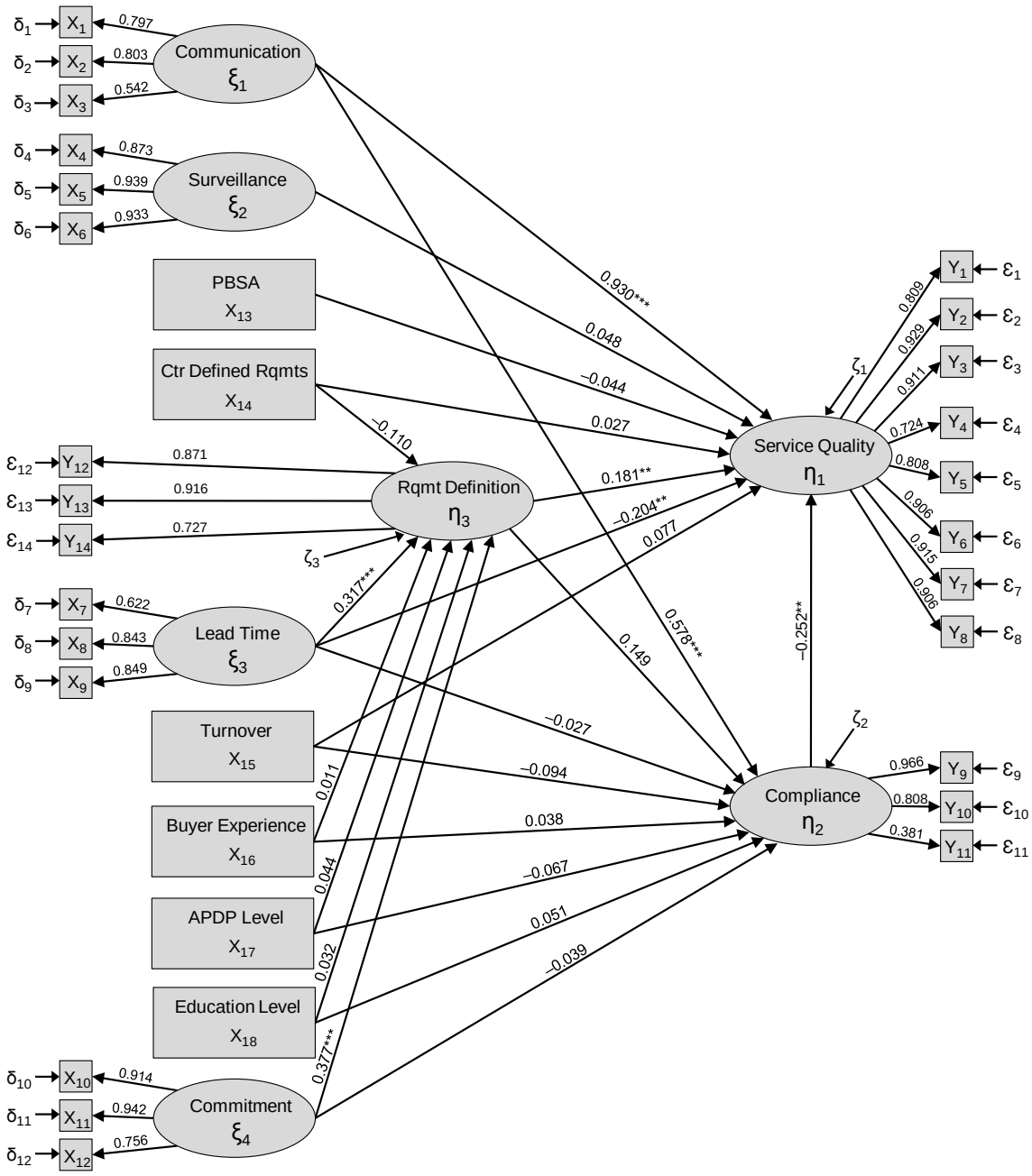
APPENDIX N. HYPOTHESIZED MODEL WITH ESTIMATES



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APPENDIX O. HYPOTHESIZED MODEL MODIFICATION INDICES

Minimum M.I. value for printing the modification index 15.000

			M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
ON/BY Statements						
RE	ON RD1	/				
RD1	BY RE		22.174	0.273	0.377	0.377
RBV1	ON RD1	/				
RD1	BY RBV1		20.913	-1.278	-1.382	-1.382
ICC	ON RD1	/				
RD1	BY ICC		18.222	-0.685	-0.659	-0.659
RD1	ON RE	/				
RE	BY RD1		22.371	0.578	0.418	0.418
RD1	ON SQ	/				
SQ	BY RD1		20.238	0.559	0.464	0.464
RD1	ON RSC	/				
RSC	BY RD1		19.474	0.730	0.623	0.623
ON Statements						
RE	ON RD1A		19.308	0.191	0.204	0.303
RE	ON RD1B		18.729	0.198	0.212	0.307
RBV1	ON RD1B		16.196	-0.610	-0.510	-0.739
ICC	ON RD1A		16.416	-0.387	-0.288	-0.428
RD1	ON REA		20.017	0.331	0.256	0.301
RD1	ON SQM		18.276	0.405	0.313	0.384
RD1	ON RSCA		19.559	0.706	0.546	0.624
SQC	ON SQK		27.761	0.414	0.414	0.417
SQD	ON SQM		18.361	0.317	0.317	0.335
SQK	ON SQC		27.761	0.497	0.497	0.493
SQM	ON SQD		18.360	0.374	0.374	0.353
WITH Statements						
RD1	WITH RE		22.174	0.303	0.307	0.307
RD1	WITH RBV1		20.913	-1.419	-1.125	-1.125
RD1	WITH ICC		18.222	-0.760	-0.537	-0.537
SQK	WITH SQC		27.761	0.091	0.091	0.453
SQM	WITH SQD		18.360	0.086	0.086	0.344

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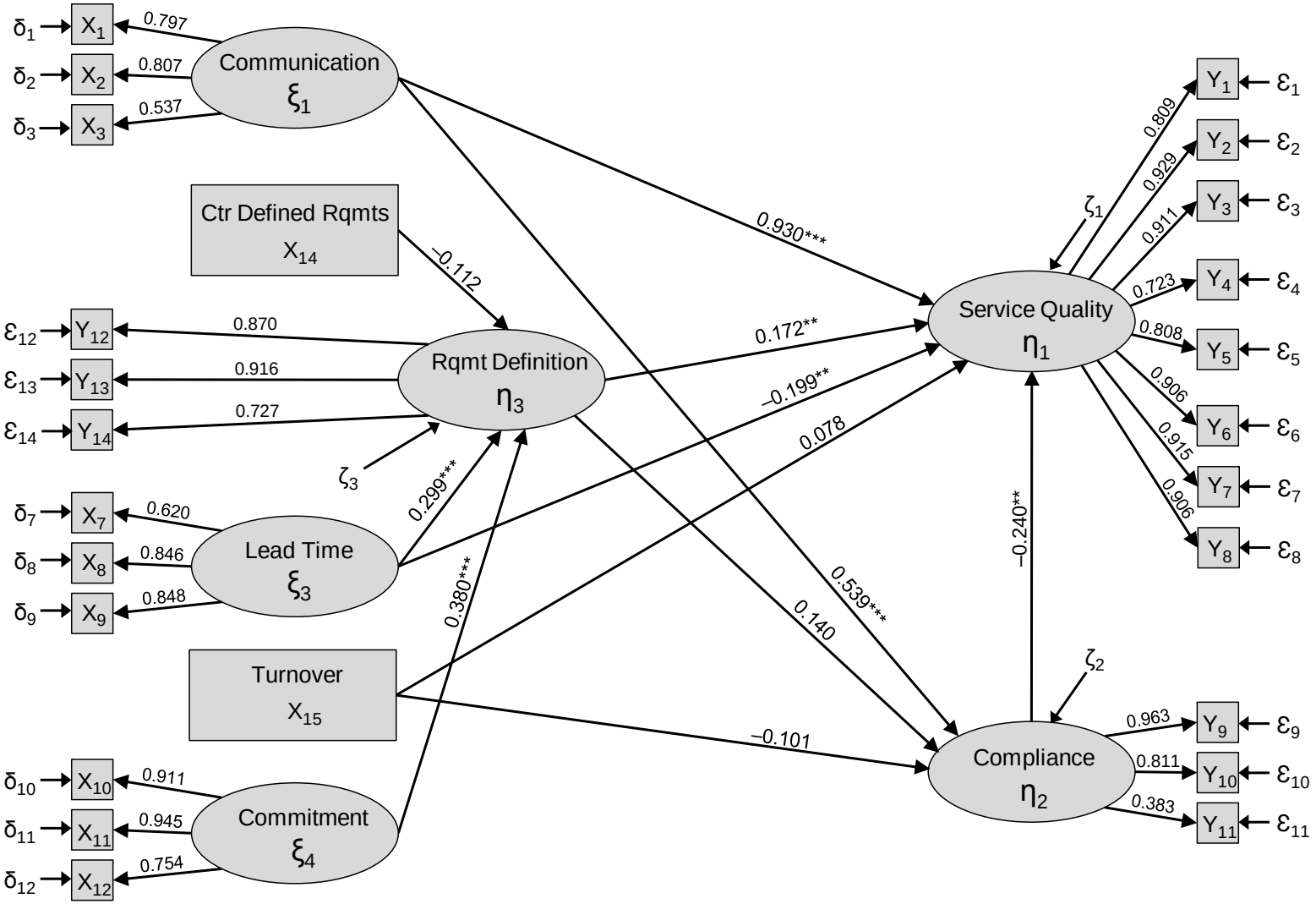
APPENDIX P. TRIMMED MODEL WITH ESTIMATES



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APPENDIX Q. TRIMMED MODEL MODIFICATION INDICES

Minimum M.I. value for printing the modification index 15.000

			M.I.	E.P.C.	Std E.P.C.	StdYX E.P.C.
ON/BY Statements						
RE	ON RD1	/				
RD1	BY RE		23.206	0.282	0.389	0.389
RBV1	ON RD1	/				
RD1	BY RBV1		22.807	-1.548	-1.679	-1.679
ICC	ON RD1	/				
RD1	BY ICC		23.047	-0.834	-0.805	-0.805
RD1	ON RE	/				
RE	BY RD1		23.211	0.576	0.417	0.417
RD1	ON SQ	/				
SQ	BY RD1		20.179	0.533	0.443	0.443
ON Statements						
RE	ON RD1A		20.798	0.202	0.215	0.320
RE	ON RD1B		19.480	0.205	0.219	0.318
ICC	ON RD1A		19.886	-0.448	-0.334	-0.497
RD1	ON REA		20.382	0.332	0.257	0.302
RD1	ON SQD		15.180	0.381	0.295	0.342
RD1	ON SQM		18.535	0.396	0.306	0.375
SQC	ON SQK		27.743	0.414	0.414	0.417
SQD	ON SQM		18.317	0.317	0.317	0.336
SQK	ON SQC		27.742	0.497	0.497	0.493
SQM	ON SQD		18.317	0.373	0.373	0.353
WITH Statements						
RD1	WITH RE		23.205	0.316	0.319	0.319
RD1	WITH RBV1		22.805	-1.732	-1.374	-1.374
RD1	WITH ICC		23.047	-0.934	-0.659	-0.659
SQK	WITH SQC		27.743	0.091	0.091	0.453
SQM	WITH SQD		18.317	0.086	0.086	0.344

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2003 - 2010 SPONSORED RESEARCH TOPICS

Acquisition Management

- Acquiring Combat Capability via Public-Private Partnerships (PPPs)
- BCA: Contractor vs. Organic Growth
- Defense Industry Consolidation
- EU-US Defense Industrial Relationships
- Knowledge Value Added (KVA) + Real Options (RO) Applied to Shipyard Planning Processes
- Managing the Services Supply Chain
- MOSA Contracting Implications
- Portfolio Optimization via KVA + RO
- Private Military Sector
- Software Requirements for OA
- Spiral Development
- Strategy for Defense Acquisition Research
- The Software, Hardware Asset Reuse Enterprise (SHARE) repository

Contract Management

- Commodity Sourcing Strategies
- Contracting Government Procurement Functions
- Contractors in 21st-century Combat Zone
- Joint Contingency Contracting
- Model for Optimizing Contingency Contracting, Planning and Execution
- Navy Contract Writing Guide
- Past Performance in Source Selection
- Strategic Contingency Contracting
- Transforming DoD Contract Closeout
- USAF Energy Savings Performance Contracts
- USAF IT Commodity Council
- USMC Contingency Contracting

Financial Management

- Acquisitions via Leasing: MPS case
- Budget Scoring
- Budgeting for Capabilities-based Planning
- Capital Budgeting for the DoD
- Energy Saving Contracts/DoD Mobile Assets
- Financing DoD Budget via PPPs
- Lessons from Private Sector Capital Budgeting for DoD Acquisition Budgeting Reform
- PPPs and Government Financing
- ROI of Information Warfare Systems
- Special Termination Liability in MDAPs
- Strategic Sourcing
- Transaction Cost Economics (TCE) to Improve Cost Estimates

Human Resources

- Indefinite Reenlistment
- Individual Augmentation
- Learning Management Systems
- Moral Conduct Waivers and First-tem Attrition
- Retention
- The Navy's Selective Reenlistment Bonus (SRB) Management System
- Tuition Assistance

Logistics Management

- Analysis of LAV Depot Maintenance
- Army LOG MOD
- ASDS Product Support Analysis
- Cold-chain Logistics
- Contractors Supporting Military Operations
- Diffusion/Variability on Vendor Performance Evaluation
- Evolutionary Acquisition
- Lean Six Sigma to Reduce Costs and Improve Readiness

- Naval Aviation Maintenance and Process Improvement (2)
- Optimizing CIWS Lifecycle Support (LCS)
- Outsourcing the Pearl Harbor MK-48 Intermediate Maintenance Activity
- Pallet Management System
- PBL (4)
- Privatization-NOSL/NAWCI
- RFID (6)
- Risk Analysis for Performance-based Logistics
- R-TOC AEGIS Microwave Power Tubes
- Sense-and-Respond Logistics Network
- Strategic Sourcing

Program Management

- Building Collaborative Capacity
- Business Process Reengineering (BPR) for LCS Mission Module Acquisition
- Collaborative IT Tools Leveraging Competence
- Contractor vs. Organic Support
- Knowledge, Responsibilities and Decision Rights in MDAPs
- KVA Applied to AEGIS and SSDS
- Managing the Service Supply Chain
- Measuring Uncertainty in Earned Value
- Organizational Modeling and Simulation
- Public-Private Partnership
- Terminating Your Own Program
- Utilizing Collaborative and Three-dimensional Imaging Technology

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