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# AN EXPLORATION OF KNOWLEDGE-BASED FACTORS AFFECTING PROCUREMENT COMPLIANCE

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**ABSTRACT.** Public procurement officials are bound by extensive policies, procedures, and laws. However, procurement professionals perpetually struggle to comply with these vast requirements – particularly in the acquisition of services. The purpose of this research is to explore knowledge-based factors affecting compliance of service contracts. A regression model using data acquired via survey from 219 U.S. Government procurement professionals reveals that the extent of compliance is affected by buyer experience, personnel turnover, the sufficiency with which service requirements are defined, post-award buyer-supplier communication, and the sufficiency of procurement lead time. From these results, implications for practice and theory are drawn. The study concludes with a discussion of limitations and directions for future research.

## INTRODUCTION

Public procurement officials are bound by a litany of policies, procedures, laws, and rules in the execution of their duties to procure goods and services that satisfy agency needs, promote public policy objectives, and maintain the public's trust ensuring efficiency, fairness, and transparency. The amount of government regulation in public procurement is overwhelming – arguably necessary to manage the increasing complexity of acquisition (Acquisition Advisory Panel,

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2007). But procurement laws and regulations are also self-perpetuating as officials and lawmakers react to the latest problem, implement additional rules, and invite more opportunities for non-compliance (Coopers & Lybrand, 1994).

Suppliers' compliance with these rules adds tremendous costs to acquisitions. Stemming from an awareness that some key companies refused to do business with the U.S. government, the U.S. Department of Defense (DoD) commissioned a study to explore the effects of regulation. The study found that laws and rules such as the Truth in Negotiations Act, Cost Accounting Standards, and military specifications added an 18 percent premium to value-added costs (Coopers and Lybrand, 1994). These rules affect not only suppliers; they increase transaction costs to the public agencies that must promulgate, implement, and enforce them.

The U.S. Federal contracting workforce is overworked (Government Accountability Office [GAO], 2009a) and understaffed (GAO, 2001). Competency levels in the federal contracting workforce decreased from 2008 to 2012 (Federal Acquisition Institute [FAI], 2012). Cracks in the seams of work products are showing – particularly in the realm of service contracting. In 2001, the U.S. Government Accountability Office (GAO) labeled the DoD's acquisition of services as 'high risk' (GAO, 2001), stating the department's poor management of service contracts undermined the government's ability to obtain value for the taxpayer's dollar. The DoD struggles with defining contract requirements, providing sufficient contractor oversight, and adequately staffing contracting professionals. The DoD lacks the key elements at the strategic and tactical levels to make service contracts a managed outcome (GAO, 2007a). The GAO (2007b) again questioned whether the DoD applies sound business practices to the acquisition and management of contracted services in: defining requirements, obtaining adequate competition, managing contractors in a contingency environment, assessing contractor performance, and executing interagency contracts and task orders. Recent reports highlighted compliance issues including a lack of required documentation (GAO, 2007c), failures to compete contracts (Department of Defense Inspector General [DoDIG], 2004, 2010; GAO, 2004), contracting for inherently governmental functions (GAO, 2012a), failures to record contractor performance assessment

reports (GAO, 2013), and increased rates of bid protests (GAO, 2012c).

But why is the DoD experiencing so much trouble with the acquisition and management of contracted services? Public contracting processes are promulgated through many people in many agencies. Effectiveness depends on mastery of vast knowledge. This knowledge is explicit and tacit – accumulating from education, training, and experiences. However, the knowledge-related factors affecting the extent of regulatory and statutory compliance have not been explored. While some research is dedicated to exploring compliance by the targets of regulations and laws, such as individuals' compliance with tax laws and contractors' compliance with acquisition laws and regulations (Mwakibinga & Buvik, 2013), very little research addresses the government's challenge of administering them.

With this backdrop, the purpose of this research is to explore factors affecting statutory and regulatory compliance of service contracts. Such research is important because the U.S. federal government spends approximately 15 percent of its budget, or $537 billion (GAO, 2012b), on purchased goods and services. If agency noncompliance is as pervasive as reported, substantial funds could be at risk of waste. Further, many public policy objectives could be compromised.

To address these research questions, we first scanned extant literature addressing services and knowledge management. We combined the relevant antecedents into a model that explains compliance. The remainder of this work is organized as follows. First, the study discusses the conceptual framework and proposed hypotheses. Next, the study presents the research design and methodology. Then, the study provides an analysis of the proposed model and reports the findings. Lastly, the study offers a summary discussion, including conclusions and implications.

## LITERATURE REVIEW & HYPOTHESES

The regulation of public agencies entails "processes by which standards are set, monitored and/or enforced in some way, by bureaucratic actors who are somewhat separate from units or bodies that have direct operational or service delivery responsibilities" (Hood

and Scott, 1996, p. 321). These standards are set applying rules – "a broad range of requirements, including laws, regulations, and agency policies and procedures" (Kassel, 2008, p. 242). Once rules are established, however, regulatory problems emerge in organizational control (Piper, 2005). Problems that have been investigated include: organizational resistance, ritual compliance, capture, performance ambiguity, data problems (Ashworth et al., 2002), a lack of resources (Weil, 1997), and agencies' acceptance of the rules (Ramsay, 2006). These problems have been explained using underlying theories such as principle-agent theory (Barrow, 1996) and legitimacy theory (Kaplan & Norton, 2001).

Ntayi et al. (2012) examined deliberate non-compliance (i.e., selective compliance) by public procurement officials in Uganda citing defiance in procurement structures, contract awards, solicitation and bidding processes, offer evaluations, reporting, contract performance, and record keeping. Often, however, agencies do not intentionally fail to comply (Spriggs, 1997). Rather, procedural and structural barriers restrict the degree of compliance possible. In his study of the regulatory performance of employment regulation, Weil (1997) found that the effectiveness of regulations depends not only on firms' reactions to enforcement activities, but also on how the public agencies enforce or administer the regulations. Our research approaches non-compliance through a different lens. Rather than investigating cases of selective (non)compliance, this research approaches non-compliance as unintentional.

Similar to the findings of Ashworth et al. (2002), we were unable to find a single comprehensive theoretical framework explaining statutory and regulatory compliance shortfalls of those responsible for their implementation. Nonetheless, since much of the discourse focuses on the acquisition workforce, this research views the compliance problem through a lens of personnel capabilities and experiences stemming from knowledge.

## Knowledge Management

Knowledge management is defined as "performing the activities involved in discovering, capturing, sharing, and applying knowledge so as to enhance, in a cost-effective fashion, the impact of knowledge on the unit's goal achievement" (Becerra-Fernandez & Leidner, 2008, p. 6). Effective knowledge management within an organization can

lead to a competitive advantage. On average, companies that effectively manage their knowledge achieve a five percent increase in their return on sales, return on assets, operating income to assets, and operating income to sales (Holsapple & Wu, 2011). Benefits of effective knowledge management include superior knowledge acquisition, superior storage and retrieval, superior sharing and dissemination, and superior decision-making (Holsapple & Wu, 2011).

For employers to capture knowledge from their employees, they must understand the difference between tacit and explicit knowledge. Explicit knowledge is articulated in some sort of trade secret, patent, copyright, process, written instruction, or document (Nissen, 2006). Tacit knowledge, on the other hand, is knowledge specific to an organization and gained through experience (Nissen, 2006). Tacit knowledge is often more powerful than its explicit counterpart (e.g., reading a book about flying an airplane is not the same as having experienced flying), but it is also problematic: it does not flow freely; it is difficult to transfer; it is not easily understood by others; and it is often taken for granted until it is gone (Nissen, 2006). This is particularly the case when tacit knowledge walks out of the door in the minds and experiences of seasoned professionals who retire, quit, transfer or otherwise leave an organization.

Knowledge flow within an organization, whether tacit or explicit, is only as good as the methods that employees within a firm use to start and keep it flowing. Tacit knowledge tends to flow within an organization very slowly, whereas explicit knowledge tends to flow very broadly and quickly. Activity is the key to knowledge flow (Nissen, 2006). Similar to Newton's law of motion, knowledge confined within an individual, or even in an information system, tends to stay at rest unless there is some sort of activity (e.g., training, mentoring, research, trial and error, discussion) to spark the learning process (Nissen, 2006, p. 34). Activity causes continuous learning, whether it is in the business or academic realm. The more knowledge a firm applies through action and performance, the more likely the organization will gain a competitive advantage. Organizations that rely on explicit knowledge for a competitive advantage are susceptible to imitation by competitors, whereas organizations that rely more on tacit knowledge are more sustainable because tacit knowledge is difficult to imitate.

Experience accumulation, knowledge articulation, and knowledge codification are the three learning mechanisms in the development of dynamic knowledge flow capabilities within an organization (Winter & Zollo, 2002). *Experience accumulation* is experiential learning through trial and error of tacit knowledge and explicit routines. *Knowledge articulation* refers to implicit knowledge articulation through constructive confrontations of colleagues in order to understand how to execute and perform a task better. *Knowledge codification* refers to the documented codification of an individual's understanding of performance implications and routines.

Nonaka (2007) developed the spiral of knowledge model to display knowledge creation and knowledge flow. The center of the model begins with knowledge creation from an individual, group, or organization. The individual, group, or organization can pass this new knowledge on to others through socialization or articulation. Once the individual, group, or organization explicitly captures the knowledge, it can combine with other tacit or explicit knowledge to create something new or build on an individual's tacit knowledge. As long as knowledge creation and sharing continue, the spiral continues to turn, and knowledge-based organizational performance amplifies over time. Nonaka (2007) broke down tacit and explicit knowledge into four categories that are usable in any organization: from tacit to tacit (sharing knowledge from one person to another through socialization); from tacit to explicit (articulating tacit knowledge into usable information that someone else can use); from explicit to explicit (combining pieces of explicit knowledge into something new); and from explicit to tacit (personnel take explicit knowledge and internalize it in order to build upon their tacit knowledge).

## Experience

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. 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.

Time spent in a competency correlates strongly with self-reported proficiency levels in that competency (FAI, 2012), suggesting that experience matters. Therefore, it is posited that:

$H_1$: Contracting personnel experience will be positively related to compliance.

## Turnover

Problems have emerged from insufficient manpower and increased turnover due to acquisition workforce reductions including: 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, 2000b, 2003). The excessive turnover of acquisition personnel – estimated as 8,000 to 10,000 personnel annually out of 133,000 (Department of Defense [DoD], 2010) – 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).

The stability of government staff and their knowledge and skills were recently identified as two key success factors in acquisitions (GAO, 2011). In a recent survey of 97 acquisition professionals, the greatest challenge to successful acquisitions was a lack of training and experience (Govloop, 2013). In this study, 37 percent of respondents reported the stability of government staff as critical to acquisition success.

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. Increased employee turnover causes firms to continuously figure out ways to capture knowledge from their employees, suppliers, and purchasers to obtain a competitive advantage. Contracting professionals rely on their tacit knowledge to navigate the rules. When these personnel leave an organization or a buyer-supplier relationship, they take with them tacit knowledge gained over time. Thus, we posit that:

$H_2$: Contracting personnel turnover will be negatively related to compliance.

## Communication

As previously discussed, communication is a pinnacle requirement for knowledge transfer. In procurement, communication between a buyer and prospective suppliers that occurs prior to contract award ensures that contractual requirements are understood. *Requirement definition sufficiency* is the extent to which the buyer defined all of its needs accurately, accounting for possible ambiguities, errors, and omissions. It reflects the extent to which an acquisition team is able to convert tacit knowledge to explicit knowledge in order to more fully and consistently transfer required knowledge to the supplier. Knowledgeable procurement professionals should be able to: (1) recognize when a requirement is (not) sufficiently defined and (2) help requiring organizations define their requirements. A recent study identified the procurement phase of 'planning and defining requirements' as the greatest gap in knowledge (Govloop, 2013).

Purchasers of goods and services should clearly define their requirements (i.e., expectations) to achieve procurement objectives (van der Valk & Rozemeijer, 2009). This is among the most problematic tasks in the sourcing process (van der Valk & Rozemeijer, 2009). When acquiring services, the specification and measurement of performance are often more complex than when acquiring goods (Brynste, 1996; Smeltzer & Ogden, 2002). Because of these complexities in specifying service tasks, service outcomes, and service performance measurement, van der Valk and Rozemeijer

(2009) suggested that the business-to-business sourcing process incorporate pre-award steps to "develop an initial specification with a sufficient level of detail" (p. 7) and "obtain information and input from suppliers to further detail the specification" (p. 7). Recent Government reports highlight several instances of decreased service outcomes due to inadequately defined requirements (GAO 2009a; GAO 2007b; GAO 2002). Without a complete understanding of the buyer's service requirement, a supplier may not perform work that the buyer expects to receive and may not meet the buyer's expectations in terms of function, performance, quality, and compliance. Additionally, requiring organizations that fail to determine and document specific requirements may jeopardize effective decision-making in the acquisition planning process. For example, an inappropriate assignment of contract type (e.g., time and materials versus firm-fixed price), driven by poorly defined work specifications, may violate regulatory requirements to choose the type of contract that apportions fair risk to both parties. Therefore, it is posited that:

$H_{3a}$: Requirements definition sufficiency will be positively related to compliance.

After award of a contract, communication persists in order to interpret complex requirements and coordinate acceptable actions by the supplier. Communication between buyers and suppliers 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 (Monczka et al., 1998; Palmatier et al., 2013; Wittmann, Hunt, & Arnett, 2009). When contracting for services, proper communication between a services buyer, a supplier, and an end user is critically important to handle variations or unforeseen events in service delivery (Bryntse, 1996). Kong and Mayo (1993) emphasized the need for supply chain members to integrate (i.e., high involvement and frequency of contact) the respective functional areas of each firm in order to maximize service levels to the end consumer. Likewise, they also warn that, where buyer-supplier interfaces are constrained (i.e., cross-functional, cross-organizational dialogue is controlled or stymied), gaps in service delivery will occur. Since not all knowledge can be made explicit, post-award communication with suppliers is needed. Finally, in a recent study of acquisition success factors, the following testimony is telling: "Any acquisition with clear, concise requirements

and active communication is always successful" (Govloop, 2013, p. 14). Therefore, we posit that:

$H_{3b}$: Post-award communication will be positively related to compliance.

### Procurement Lead Time

Properly executing the procurement process can consume significant time. Internal customers need time to define needs and develop cost estimates. Buyers need time to conduct market research, develop an appropriate sourcing strategy, and develop requests for proposals. Suppliers must develop their strategy for performing the work in a way that is favorable to the buyer, and then must estimate the costs to perform the work. The parties often negotiate, and contracts and order releases must be documented. Hence, time is a valuable resource in the procurement process. Due to the high level of focus on mission accomplishment in the government sector, the time required to award contracts is often scrutinized and emphasized.

Many processes and documents require specific content and must be performed within prescribed timeframes. (e.g., advertising for 30 days and debriefing within 10 days). The amount of needed procurement lead-time varies between procurements depending on many factors such as the urgency of the need, the market structure (i.e., sole/single source or competitive), the resources available, internal politics, dollar value, and acquisition criticality. The amount of lead time afforded likely determines how well the contract complies with the myriad of sourcing laws and regulations (Roberts, 2010). Stated another way, in cases in which adequate time is not available or allowed the odds of omitting or overlooking a matter of compliance should increase. As such, we posit that:

$H_4$: Sufficiency of procurement lead time will be positively related to compliance.

## METHODOLOGY

The research employed multiple regression analysis using cross-sectional survey data in order to test the hypotheses. The remainder of this section details the instrument development, the sample, data collection, and reliability and validity.

## Questionnaire Design and Construct Measurement

Interviews with subject matter experts and pretests were used to verify the hypothesized antecedents and measurements thereof. For latent constructs, survey items were assessed on seven-point Likert-type scales. The latent constructs were measured using or adapting existing scales of established validity. The scale used to measure communication was adapted from Morgan and Hunt (1994) and assesses the effectiveness of communication between the buyer and supplier after contract award. Existing scales were not available for measurement of contract compliance, the sufficiency of the requirement definition, or the sufficiency of lead time; thus, we relied upon five interviews with five practitioners to develop them. Extent of contract compliance assessed the degree that the contract was compliant with policy, laws, and regulations, based on the buyer's knowledge of the contract. Sufficiency of the requirement definition assessed the extent to which the buyer defined all of its needs accurately, accounting for possible ambiguities, errors, and omissions. Sufficiency of procurement lead time was measured subjectively, as recommended by Hult et al. (2000), and assessed the extent to which the buyer believed he or she had enough time to properly conduct the source selection process. Rather than measuring buyer turnover as a departure from the employer, since the unit of analysis is the contract, turnover represents the ratio (percent) of contracting, quality assurance, and technical representatives that left an active contract to the number of those assigned. Buyer experience was measured as the number of years of experience that the buyer had in the contracting profession.

Face validity was bolstered through pretest reviews of the survey by 10 practitioners, two M.B.A. students, and three academicians – all of whom specialize in the field of procurement. As recommended by Dillman (2000), feedback was solicited regarding whether the survey items: (1) captured the domain of the construct (content validity), (2) were unambiguous, (3) were simple to understand, and (4) were consistently interpretable. Inputs received from these individuals were used to refine the measures. To ensure content validity, interviewees and reviewers were also presented with a copy of the hypotheses. The constructs and the hypotheses were explained. Responses from these individuals supported each of the proposed constructs and research hypotheses.

## Sample

In order to capture a wide variety of services in terms of types, values, and complexity, we sampled a population of U.S. Air Force procurement personnel who manage service contracts. Public and private sector procurement differ in some respects. For example, public organizations compete more of their procurements (Williams & Bakhshi, 1988), tend not to segment spend using a portfolio approach (Hawkins et al., 2011), use procurement to advance socioeconomic policy, and are more transparent to taxpaying stakeholders (Kolchin, 1990). While some differences exist between aspects of procurement in the private and public sectors, the buying process is quite similar (Sheth et al., 1983; Kolchin, 1990). Both fulfill a service to the organization of leveraging supplier capabilities to meet operational needs. Both must determine purchase requirements. Both communicate the needs to prospective suppliers. Both evaluate offers according to evaluation criteria – often considering non-price factors. Finally, both negotiate contracts to establish the terms and conditions of the sale and to properly allocate risk. In sum, the sequence of tasks in the procurement process is the same, as are many of the decisions that must be made throughout the process (Sheth et al., 1983).

## Data Collection

An online survey (Appendix) was used to collect data about individual service contracts – the unit of analysis. In order to maximize the response rate, we utilized Dillman's (2000) "Tailored Design Method" for internet surveys. Because it is difficult to identify personnel who manage service contracts, an invitation was forwarded through electronic mail to eligible individuals via supervisors of U.S. Air Force contracting units. Of the 60 contracting units invited to participate in the study, 42 units agreed and distributed the survey to 743 personnel who administer service contracts. Of the 743 potential participants, 252 individuals responded, yielding a 34% response rate, which is consistent with rates reported for web-based surveys (Larson, 2005). Within these responses, 29 were later discarded due to missing or inconsistent responses. The remaining data were then assessed for normality and for the presence of outliers. Two items were transformed to accommodate for non-normal distributions. First, a natural log transformation was used on values of buyer experience to achieve acceptable skew and kurtosis.

Next, values of buyer turnover were transformed, but a square root transformation was selected due to the presence of responses indicating that no turnover had occurred. Assessments for univariate and multivariate outliers (Mahalanobis, 1936) identified four responses for further evaluation. Each was carefully examined and later eliminated due to straight-line responses or implausible entries on one or more items.

From the 219 usable responses, the average respondent was 42 years old and had 12 years of sourcing experience. The gender of respondents was nearly even, with males accounting for 53% of respondents and females accounting for 47% of respondents. Respondents had a diverse range of educational experience, with the highest level of education for 11% of respondents being a high school diploma or general equivalency diploma, the highest level of education for 12% of respondents being an associate's degree, the highest level of education for 43% of respondents being a bachelor's degree, and the highest level of education for 33% of respondents being a master's degree. Only two respondents, or 1%, held a doctoral or professional degree. Additionally, the services represented in the sample varied widely in scope and type (Table 1). Contract values ranged from $6K to $4B (mean $64M; standard deviation $321K). 34 contracts (16%) were other than fixed price-type (e.g., cost reimbursement, time and materials, labor-hour, or a combination), indicating that several complex services were represented. Complex services included construction, logistics and transportation, weapon system repair, environmental management

TABLE 1
Service Types Represented

| | |
|---|---|
| Maintenance / repair | 21.5% |
| Professional, administrative and management support | 17.8% |
| Utilities and housekeeping services | 17.4% |
| Medical services | 10.5% |
| Education and training | 4.2% |
| Architect-engineering | 3.2% |
| Quality control, testing and inspection | .9% |
| Research and development | .9% |
| Other | 23.6% |

support, research and development, and information technology support.

## Reliability and Validity

Through iterative scale purification (Churchill, 1979) using exploratory factor analysis with varimax rotation, 20 survey items reduced to 13 across four latent factors. The reliability of latent constructs was assessed using composite reliabilities (Fornell & Larcker, 1981). These measures, ranging from .774 to .898 (see Table 2), proved to be sufficiently reliable – exceeding the minimum acceptable threshold of .700 (Nunnally, 1978). Construct validity was assessed through confirmatory factor analysis (CFA) in Mplus Version 6.11 (Muthén & Muthén, 2010). All loadings were significant at the .05 level and their standard errors were not abnormal; no standardized loadings exceeded 1.0, and no negative error variances (Heywood Cases) occurred.

A global assessment (Bagozzi & Yi, 1988) of the various goodness-of-fit indices indicated acceptable fit. While the chi square test was significant for the measurement model ($\chi^2_{(59)} = 127.69$, $p < .01$), indicating a difference between the hypothesized model and the

TABLE 2
Correlation Matrix and Composite Reliabilities

| | *RSC* | *RD* | *CM* | *LT* | *PTO* | *CV* | *BE* |
|---|---|---|---|---|---|---|---|
| RSC | *.799* | | | | | | |
| RD | .433 | *.898* | | | | | |
| CM | .496 | .542 | *.876* | | | | |
| LT | .306 | .397 | .279 | *.774* | | | |
| PTO | –.184 | –.024 | –.043 | .018 | — | | |
| CV | –.115 | –.035 | .058 | –.149 | .175 | — | |
| BE | .042 | .001 | .005 | –.216 | .064 | .328 | — |

Notes: (1) Correlations are below the diagonal. (2) Composite reliabilities of the latent factors are on the diagonal. (3) RSC = contract compliance; RD = sufficiency of the requirement definition; CM = extent of post-award communication; LT = sufficiency of acquisition lead time; PTO = square root of percent personnel turnover; CV = natural log of contract value; BE = natural log of years of buyer experience.

data, the values of .95 for CFI and .94 for TLI suggest good fit. Similarly, the values of .07 for RMSEA and .07 for SRMR are less than the threshold of .08 proposed by each by Hair et al. (2010). The model demonstrated solid fit indices and statistically significant path coefficient loadings on the intended factors, indicative of convergent validity (Anderson and Gerbing, 1988). Table 3 shows the average variance extracted (AVE) of each construct; all exceeded the .50 standard, demonstrating convergent validity (Fornell & Larcker, 1981). We then compared each AVE to the variance shared between constructs. None of the shared variances approached the AVE, providing sufficient evidence that the constructs were indeed unique (Lam, Shankar & Murthy, 2004). We tested for non-response bias using Armstrong and Overton's (1977) approach. Responses were categorized into three groups according to the time received. Tests for differences in three latent constructs and two demographic variables revealed no significant differences, indicating a lack of response bias in the data.

TABLE 3
Convergent and Discriminant Validity

| | *RSC* | *RD* | *CM* | *LT* |
|---|---|---|---|---|
| RSC | *.518* | | | |
| RD | .187 | *.746* | | |
| CM | .246 | .293 | *.703* | |
| LT | .093 | .157 | .078 | *.539* |

Notes: (1) Diagonal entries represent average variance extracted (AVE). (2) Off-diagonal entries represent shared variance.

## Control Variable

Recognizing that procured services differ in terms of dollar value, risk, and criticality, we controlled for such effects using the dollar value of contracts as a proxy. As the value of a contract increases, so does the amount of regulations that are applicable to the procurement and the degree of difficulty placed on the buyer to ensure that contractual actions are fully compliant with policy, laws, and regulations. After an examination of responses, a natural logarithm transformation was applied to contract values to remedy non-normality of the distribution.

## RESULTS

A multiple linear regression was estimated using ordinary least squares in R (2013). Scales were summated (arithmetic mean) for the latent variables. The regression results are displayed in Table 4. An examination of plots did not indicate the presence of heteroscedasticity or non-normally distributed error terms. Variance inflation factors (VIF) ranged from 1.08 to 1.25, indicating a low degree of multicollinearity between the independent variables. The regression ($F$=18.649) and each coefficient were significant at the .05 level; the determinants in the model explained 32.7% of the variance in contract compliance.

TABLE 4
Multiple Regression Results for Contract Compliance

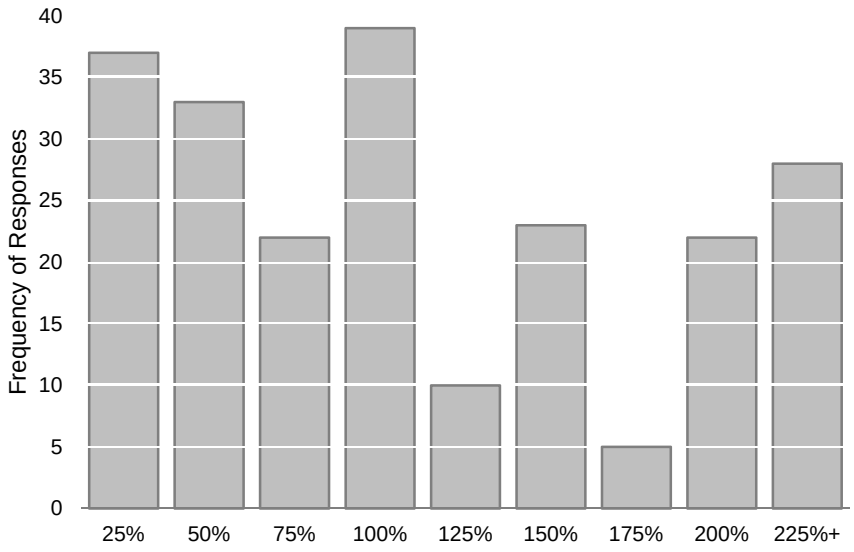
| Variable | Unstandardized Coefficient | Std. Error | Standardized Coefficient | *t* | *p*-value |
|---|---|---|---|---|---|
| Intercept | 2.843 | .567 | — | 5.017 | .000 |
| BE | .125 | .062 | .122 | –2.031 | .044 |
| PTO | –.318 | .117 | –.154 | –2.717 | .007 |
| RD | .148 | .061 | .169 | 2.432 | .016 |
| CM | .401 | .074 | .362 | 5.422 | .000 |
| LT | .114 | .048 | .148 | 2.356 | .019 |
| CV | –.059 | .030 | –.121 | –2.004 | .046 |

Notes: (1) Multiple R-squared=.346, Adjusted R-squared=.327.

Buyer experience significantly increases the extent of compliance. While the effect size is small, this finding supports Hypothesis 1. Similar support was found for Hypothesis 2; increased personnel turnover is associated with decreased compliance. 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). Figure 1 presents a histogram of turnover responses from the sample. The mean respondent was assigned to a contract in which turnover was in excess of 120%. Nearly 22% of respondents were assigned to contracts in which turnover was at least 200%, and 7% of respondents were assigned to

contracts in which turnover was at least 300%. Alternatively, only 32% of respondents were assigned to contracts in which turnover was no more than 50% and less than 17% were assigned to contracts with no more than 25% turnover.

FIGURE 1
Histogram of Percent Turnover of Acquisition Personnel

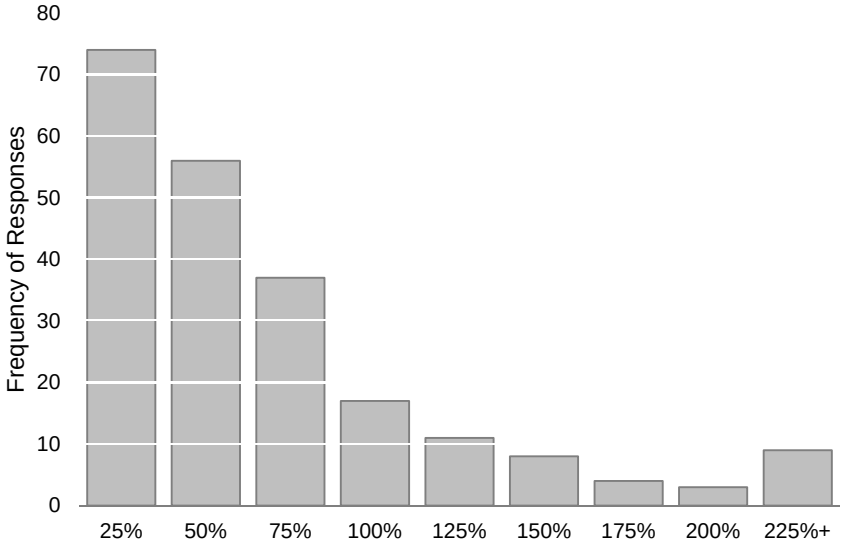



Support for Hypothesis 2 was further developed. Using the median turnover ratio of 1.00, responses were categorized in a binary fashion. Responses above the median – those where more personnel had turned over than were assigned to manage the contract – were assigned a value of one while responses below the median were assigned a value of zero. A simple linear regression of compliance on the binary variable was statistically significant ($F$=6.786, $p$<0.001) with a negative coefficient (beta=–.190), indicating that compliance was significantly less when turnover exceeded 100% of personnel assigned.

Next, to assess the degree of personnel turnover over time, or *churn rate*, the turnover ratio was recalculated as an annualized percentage. As before, the rates are alarming (Figure 2). The mean

annual churn of personnel exceeded 65%. Nearly 19% of respondents were assigned to contracts in which acquisition personnel turned over at least once annually, and only less than 15% were assigned to contracts in which personnel turned over less than 10% annually.

FIGURE 2
Histogram of Annualized Percent Turnover of Acquisition Personnel




The effect of personnel churn on contract compliance was estimated. An initial examination of the data revealed several univariate outliers (i.e., exceptionally high rates) that were associated with newly-awarded contracts – the result of an extrapolation of annualized churn rates from the initial months of a contract in which personnel turnover had occurred. To remedy the potential effects of these cases, only well-established contracts with at least six months of performance were retained for further analysis (n = 195). A square root transformation was then applied to churn rates to establish normality of the distribution – a fundamental assumption of regression. A regression of contract compliance on churn rates was significant ($F$=4.511, $p$=0.035) with a negative coefficient (beta=–

.151), indicating that increased churn rates are associated with decreased levels of contract compliance.

Hypotheses 3a and 3b were also supported, confirming the importance of a buyer's skill in communicating with suppliers – both in terms of defining requirements sufficiently and in working closely with the supplier after contract award. Finally, the sufficiency of pre-award procurement lead time was found to positively affect compliance, confirming Hypothesis 4.

## DISCUSSSION

The purpose of this research is to explore factors affecting statutory and regulatory compliance of service contracts. Such research is important because the U.S. federal government spends approximately $537 billion (GAO, 2012b), on purchased goods and services. If agency noncompliance is as pervasive as reported, substantial funds could be at risk of waste. Further, many public policy objectives could be compromised. Public organizations increasingly outsource large, complex services and buyers struggle to properly manage this spend. This study is the first that we are aware of to quantitatively examine how knowledge-based factors affect regulatory and statutory compliance. To examine this, a multiple regression model of knowledge-based determinants of compliance was tested and found to explain a respectable share of variance in compliance. Many of the findings have significant managerial and theoretical implications to the management of service procurements.

### Managerial Implications

The findings herein highlight the critical role of knowledge in sourcing. As buyer experience decreases, the extent that contracts are compliant with laws and regulations also decreases. Therefore, procurement executives should take extra measures to retain procurement professionals who have gained valuable experience navigating the complex laws, regulations, and procedures of government sourcing. Executives should also commit their most experienced procurement professionals to the most risky, valuable, and mission critical requirements. Rather than waiting for procurement professionals to individually learn by experience, leaders could develop means to instill experience without having to wait for exposure to multiple types of contracts and requirements that could

take many years to acquire. For example, offering sourcing training by way of case studies and situational simulations might allow procurement professionals to learn from others' experiences and mistakes.

The results of testing Hypothesis 2 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 reduce the current levels of turnover. First, managers should avoid assigning temporary employees or employees who are expected 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 exhibit substantial levels of personnel churn.

Another contribution of this research pertains to the means by which workforce turnover is evaluated. In the DoD, for example, turnover is counted when a member leaves the department. However, the unit of analysis is not the employer-employee relationship; rather, it is the contract. In our approach, when personnel cease to work on an enduring contract, turnover occurs. Hence, all of the tacit knowledge peculiar to that buyer-supplier relationship – unless captured – is lost. Thus, public procurement organizations should reassess the methods of computing turnover.

Since the extent that a buyer's requirement (need) is adequately defined is associated with the level of compliance, buyers should commit sufficient resources and effort to thoroughly communicate their performance expectations to suppliers. This finding supports Ellram et al.'s (2007) recommendation to use concrete performance requirements. This finding lends credence to the use of a more structured process for defining requirements and minimum performance levels such as the 'acquisition requirements roadmap tool' developed by the Defense Acquisition University. Looking deeper, this finding also suggests that the buyer retain some degree of proficiency in the outsourced service in order to be able to

adequately define the requirement. As a case in point, in 2008, the U.S. Navy delayed for one year the refurbishment of warheads because the National Nuclear Security Administration lost the requisite technical expertise (GAO, 2009b).

Second, that communication was the strongest antecedent of compliance is in stark contrast to the way procurement personnel are trained, educated, and developed. Rarely 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 communication. Clearly, procurement leaders should assign effective communicators and relationship builders to manage service procurements. When looking to enhance communication, dimensions of communication such as frequency, bi-directionality, and formality (Mohr & Sohi, 1995) should be considered. More frequent communication also increases communication quality. All three dimensions increase satisfaction with communication. Mohr and Nevin (1990) posit that satisfaction affects channel performance. Therefore, structured communications with suppliers could be pursued such as: (1) aligning commensurate buyer and supplier personnel by name at multiple levels of their respective hierarchies, (2) regularly-scheduled, frequent discussions of key personnel, and (3) communication modes that employ two-way interaction such as video conferencing and on-site meetings. For high-risk, complex, high-value services, buyers and suppliers could consider co-located management teams.

Allocating adequate procurement lead time appears to be important to achieving compliance in services acquisitions. Sourcing managers should allocate sufficient time to sourcing teams such that they can improve the definition of needs. Ellram et al. (2007) recommended that resources be allocated commensurate with the importance of the spend. Sufficient lead time can be enhanced by securing senior leaders' buy-in to the procurement project's pre-award milestones (i.e., project plan). Cross-functional commodity councils can also help in this regard since milestones could be developed jointly by procurement personnel and internal customers. Additionally, in planning for forthcoming outsourced service needs, internal customers should coordinate with procurement to understand how much time is adequate such that the procurement is initiated within the window of adequate lead time. In this vein, a

center-led sourcing organization could publish standard lead times as preliminary planning factors. These times could be established by type of service, dollar value, risk, and criticality of the service.

## Theoretical Implications

Theoretical development of knowledge management in the context of public procurement remains nascent. Agency theory seems to offer promise since tacit knowledge ultimately resides with an agent (e.g. a procurement professional or a supplier). Problems of agency arise when agents' self-interests differ from his or her employer's goals (Bergen et al., 1992). The bureau-shaping model explains why agency goals might depart from those of public policy. It posits that public managers develop a sense of ownership of their agencies, and shape them to satisfy personal utilities (Barberis, 1998). Bureau-shaping predicts desired outcomes such as reducing personal risk and increasing access to centers of power in ways that do not unduly increase the scope of the problems under their responsibility. Problems emerge when agents must serve conflicting goals of multiple principals – also known as the "hydra factor" (Shapiro, 2005). Since an enormous amount of vast laws and regulations promulgate vast public objectives – many of which are not of direct interest to bureaucrats such as small business goals (Arrowsmith, 2010), conflicts of agency are not hard to imagine. Nonetheless, agency theory and the bureau shaping model do not explain how agencies reconcile divergent goals.

This research suggests that, in explaining the extent of compliance, focus should be placed on the knowledge accumulated by the individual agent. Perhaps the agent, through knowledge, is uniquely able to navigate the immediate objectives of his or her employer and those of multiple laws and statutes representing vast public interests so as to accomplish the mission and achieve compliance. This study demonstrates the importance of knowledge management and then links manifestations of knowledge to compliance. Buyer experience (accumulated knowledge), buyer turnover (fleeting knowledge), sufficiency of requirements definition and communication (transfer of knowledge to suppliers), and sufficiency of procurement lead time (opportunity to apply knowledge) affect compliance. Explaining why knowledge is not better managed in a public procurement context may require a blending of these

multiple theories that attempt to explain a variety of buyer-supplier phenomenon and public organization behavior.

## Study Limitations & Future Research Directions

Limitations of this study, and those common to survey methodologies, should be considered. First, the response rate of 34% is contingent on accurate reporting from each unit's focal point of contact. Second, because this sample came solely from the U.S. Air Force, the extent of generalizability of the study findings to the for-profit sector is uncertain. While basic procurement processes are similar across sectors (Sheth et al., 1983), there may be meaningful distinctions. Third, the use of a convenience sample rather than a random sample may introduce response bias.

Future research could shed more light on the knowledge-based effects on procurement outcomes. For example, future research could delve deeper into particular types of experience such as different types of contracts, different types of services (e.g., research and development versus installation support), and different source selection methodologies (e.g., full tradeoff versus sealed bidding). More research is also needed to understand why turnover is excessively high on service contracts. Future research could also examine whether a limitation on the availability of experienced resources constrains an organization's ability to comply with laws and regulations. In other words, at what point do added laws and regulations drive an increase in personnel to properly implement them? Regardless of the angle taken, future research surrounding knowledge management should offer valuable insights to matters of compliance – a critically important aspect of public procurement.

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## APPENDIX A
## Measurement Scale

**Contract Compliance** (I=5; F=4; New Scale)

RSC1 This contract is compliant with all applicable policy letters, the Federal Acquisition Regulation and its Supplements, and procurement law

**APPENDIX A** (Continued)

RSC2 There is nothing wrong with this contract
RSC3 This contract does not violate applicable requirements of policy letters, the Federal Acquisition Regulation (FAR), FAR Supplements, or procurement law
RSC4 If this contract were to be inspected by an independent organization, it would be deemed compliant‡
RSC5 There are aspects of this contract that, if changed, would make it more compliant with policy, laws, or regulations†

**Sufficiency of the Requirement Definition** (I=5; F=3; New Scale)

RD1 The requirement was very well defined in the contract
RD2 The contract (including the statement of work, performance work statement, specification, drawings, etc.) defined the requirement very well
RD3 There were no flaws or omissions in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.) ‡
RD4 The requirement, as defined in the contract, expressed to the contractor exactly what we needed
RD5 There were no ambiguities in the definition of the requirement (including the statement of work, performance work statement, specification, drawings, etc.) ‡

**Extent of Post-Award Communication** (I=5; F=3; Morgan and Hunt, 1994)

CM1 In our relationship, the government and contractor effectively communicate expectations for each other's performance‡
CM2 In our relationship, the government and contractor keep each other informed of new developments
CM3 In our relationship, the government and contractor provide each other with information that helps both parties
CM4 I am able to communicate my needs effectively to this contractor‡
CM5 This contractor listens carefully to my requests

**Sufficiency of Lead Time** (I=5; F=3; New Scale)

LT1 I did not have enough time to award a quality contract†
LT2 The milestones for awarding this contract were too aggressive†

**APPENDIX A** (Continued)

| | |
|---|---|
| LT3 | My leadership or my customer wanted this contract awarded too fast‡† |
| LT4 | I was not rushed to award this contract‡ |
| LT5 | I had sufficient time to get this contract awarded |

Notes: All responses were obtained using 7-point Likert-type scales; I = Initial number of scale items; F = Final number of scale items after measure purification; ‡Item Purged; †Reverse code.