An Analysis of Decision Support Systems Used for Contract Quality Management: A Multiple-case Study

by

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I. Problem Statement and Goal

Introduction

The author is a Division Chief responsible for contract management and systems development. The author’s team of analysts and programmers developed and implemented two automated decision support systems to assist in the various quality management decisions involved in the operation of two major $30 million contracts at Fort Benning, Georgia, one of the Army’s largest training and deployment installations.

The systems are used on contracts that support the efforts to support the training, mobilization, and deployment of Army military units. The contracts cover all logistics and facilities support functions including the following: housing, food service, supply, transportation, and maintenance.

With the increasing efforts of the federal government to compete government operations with private industry, contracting efforts in the federal government are becoming common place. Efforts to contract out all logistics and facilities support functions within the training and doctrine command and army-wide reached a peak during the period 1997 to 2003. As discussed in Peckenpaugh (2003), the Office of Management and Budget (OMB), the federal office that oversees contracting and outsourcing programs, has stated that public-private outsourcing competitions will become a common occurrence within the government. As the Peckenpaugh (2003) article explained, in May 2003 the OMB released a major revision of the government’s competition regulation referred to as OMB Circular A-76. The article also revealed that this new guidance sets tighter deadlines for job competitions and expanded rules that encourage contracting out of previously performed government functions. The OMB’s
office of Federal Procurement Policy stated that the new guidance is expected to assist in pushing forward the administration’s competitive outsourcing program and is expected to place 425,000 federal jobs up for competition with private sector companies (Peckenpaugh).

Problem Statement

Quality management on major service contracts within the government is a challenging task that involves the evaluation of hundreds of quality measures, many of which are subjective in nature. Contracts of this type typically create information overload that can conceal critical data relationships, trends, and present a dizzying array of information that can complicate management value and resource allocation decisions. The application of decision support systems to the area of contract quality management could greatly enhance the capability of management to make critical decisions that impact on the success or failure of major government contract operations. The author plans to conduct a multiple-case study that will analyze the structure and functionality of two separate decision support systems used for quality management of two major Army contracts at Fort Benning, Georgia. The two decision support systems support a logistics and facilities cost-reimbursement incentive contract, and a food services fixed-price incentive contract. The study will document the successful implementation and use of these systems and a cross-case comparison of the systems will be used to develop a conceptual framework that can serve as a guide for future development of decision support systems of this type for various operational domains and contract types. The decision support systems to be studied have many of the components described by Turban and Aronson (2001, pp. 113 - 114). Some of these components include text based
decision support system’s assists, mathematical based suggested decisions, group
support, and what-if analysis. The group components of these decision support systems
involve the use of the systems by many individuals that perform separate and distinct
tasks that have a common end (Turban & Aronson, 2001, p. 118). The decisions made
using these systems tend to be individual in nature and are not made in a collective
environment so the systems cannot be categorized as group support systems as defined by
Turban and Aronson (2001, p. 119). Research to date indicates that these systems are the
only automated decision support systems of their type being used at Army installations
for quality management of major service contracts. The systems have received praise
from visiting Army Contracting Agency personnel and the interest of several Army
installations as possible prototypes for use on their major contracts. The author is
concerned, however, that the systems have never been fully studied in relation to current
literature and research in the field of decision support systems. In addition, the systems
have not been formally studied or compared with each other in terms of the quality
management decision making involved in contracts of different types, capabilities of each
system in supporting decisions encountered on different types of contracts, and the
strengths and weaknesses of each system when compared to each other.

Goal

The goal of this study is to develop a conceptual framework, with associated
models, that can be used in the design of contract quality management decision support
systems for a significant portion of contract types used within the Department of Army
and Department of Defense.
II. Prior Research

There is a wealth of research that exists concerning quality. Studies in the areas of quality control, quality assurance, and quality management are extensive and cover a wide variety of specific applications. Many of these studies also present findings that relate to quality concerns in contractual relationships. Examples of the variety of interest and breadth of coverage that exist in this field of study can be found from a sample listing of articles reviewed for this report. Baiman, Fisher, and Rajan (2000) presents findings that describe the overall problem of the relationship between product quality, cost of quality, and information in general contracting situations. Renuad and Yacout (1995) present a decision support system that is used for quality assurance in the fish and seafood processing industry in Canada. Li and Benton (2003) empirically examine the effect of key factors in hospital characteristics that impact on quality of service. Tam and Hui (1996) present findings on total quality management for public transportation in Hong King. Li and Rajagopalan (1998) and many others present research in learning impacts on quality. Finally, Kumar (2003) discusses the results of his research related to detecting textile defects utilizing a linear neural network approach. Other articles dealt directly with the service industry and with contractual quality issues. One example is research related to web based decision support systems concerned with the management of service contracts (Sundarraj, 2003, in press) in which the author discusses his specific findings related to spare parts support contracts. These articles describe significant findings related to the relationship between variables that impact on quality decisions and delve into customer feedback and satisfaction measures. Soteriou and Chase (2000, Summer) develop a robust optimization model that links service process variables with
service quality metric and assists managers in making resource allocation decisions. Their work points out one of the facets of improving quality that is at the essence of the problem faced in any quality management endeavor. As they point out in their article, quality related decisions in the service industry must consider all of the relevant factors involved to include facilities, technology, personnel, and operating costs. This tradeoff represents the major challenge of improving service quality (Soteriou & Chase, 2000).

The existing research serves as an excellent guide into the relationships that must be considered in quality assurance and management decision support systems. The research offers a rich variety of models that can be studied. However, none of the research reviewed to date addresses the real life challenges of providing an integrated decision support system that can be used to manage the quality of major contracts that encompass variety, complexity, and volume of variables that must be considered within the Department of Defense and its military installations. In addition, the research reviewed does not address the successful development and implementation of a complete decision support system that serves a wide variety of levels of quality decision making on service contracts. Finally, Youngdahl and Kellogg (1997) and other researchers address the importance of establishing active relationships between customers and service providers in terms of improving quality efforts. However, existing research does not reveal a working decision support system model that addresses the needs of both the client, in this case the government, and the contractor in addressing the quality assurance and management improvement challenge. One of the Fort Benning systems to be studied was established for a contract that is founded upon a new concept in government service contracting referred to as “partnering”. Under this concept of contracting, the
government and the contractor establish a formal partnering relationship that eliminates many of the adversarial relationships that exist in most contractual situations. The government and contractor reach a mutual consensus and develop a document referred to as a “partnering agreement”. The partnering agreement lists mutual goals and common aims for the contract and establishes an open relationship in terms of the sharing of information between the two parties. As a result of this partnering relationship, the decision support system used for this contract is available to both government and contractor alike. The system provides valuable information to both parties that help them to collectively and individually pursue objectives for quality improvement. This presents special challenges and consideration not addressed in the existing body of research.

III. Relevance and Significance

With the nation’s focus on the “war on terror” and an increasing reliance on contracting out of military support efforts, it is imperative that the quality of that support be optimized and that resources paying for the effort be effectively applied. The application of decision support technologies will help government organizations ensure that the quality of contract support of military units is optimized and that resources are effectively applied to war support efforts.

Identifying a solution to the difficulties involved in managing the quality of output of major government contracts should have broad consequences for contract management organizations and contractors throughout the Department of Army, Department of Defense, and government in general. The stepped up pace of government
contracting within the last five years has resulted in numerous management decision challenges for both government and contractor management staffs to insure that contracted government operations remain viable and effective. New technologies and decision support approaches need to be applied to meet the challenges of this fast growing contracting trend.

This study is expected to make the following research contributions to the field of contract quality management that are currently not addressed in existing literature:

- Development of a conceptual framework of a complete decision support system for contract quality management that can be applied to the design and benchmarking of proposed designs for decision support systems of other operational domains and contract types.

- Provide valuable insights into the incorporation of government and contractor “partnering” efforts into a decision support system design.

- Provide a comprehensive presentation of the structure of two existing contract quality decision support systems that have been successfully implemented and used for two of the most prevalent contract types (fixed-price incentive and cost-reimbursement incentive) in an army service operation domain.

- Provide insights into the practical uses of decision support systems in the field of contract quality management and that will hopefully serve as a platform for further research and development in this area.
IV. Barriers and Issues

A barrier to the study is the lack of specific research information related to the development of contract quality management decision support systems. A review of literature showed that there is a significant amount of research in the area of decision support systems and an interest in the area of contract quality. However, the review indicated little research work that directly addresses the development of full scaled contract quality management decision applications. This is especially true for larger sized service contracts. In addition, research to date indicates that Fort Benning has the only existing automated decisions support systems used in support of contract quality management at Army installations. It appears that there is little in the way of applications development in the area of quality management that can be of direct benefit to this study.

The volume of quality assurance information produced by quality assurance activities on major contracts is voluminous, and the existence of hundreds of quality measures, many of which are subjective in nature, complicates the development of models that can reduce the data in meaningful ways for management use.

Leedy and Ormrod (2001) state that one of the major weaknesses of the case study approach is a lack of surety that the results of the study can be generalized to other applications in the area of study. There are numerous contracting types used to contract out government operations. Two contract types that reflect a significant portion of service type contracts in existence at Army installations are the cost-reimbursement and fixed-price type contracts. Each of the contract types has numerous sub categories that may have specific quality management requirements that must be considered in any decision support design effort. The decision support systems used at Fort Benning were
developed specifically for a fixed-price incentive contract and a cost-reimbursement incentive contract which covers many aspects of most Army contracting situations. However, there are differences between each of the contracting types that are expected to impact on the types of decisions typically required and models used to assist with those decisions. Therefore, the findings of this study may not be universally applicable to all major government contracting situations. However, due to the breadth of contract coverage provided by these two cases, it is expected that the study will result in a conceptual framework that can serve as a basis for the design of systems used in support of a significant portion of government contracting situations.

This study will require the analysis of a broad range of fields of study to include quality management, human computer interface design, decision support systems, decision making theory, and software engineering. It will require the integration of the latest research in these fields and the application of those theories to the contract management environment.

The study involves the review of a limited amount of procurement sensitive contract information that must be excluded from the final report and case study database. This is not expected to present a significant problem. The author is trained and experienced in contracting and procurement sensitivity issues. The author also has access to experienced procurement officials that can assist in insuring that sensitive data is not included in the final report. The absence of such information will have no impact on the development of the conceptual framework or its associated models. Procurement sensitive numbers used in decision tables and mathematical models will be either modified or blotted out to hide their exact values. The modification or hiding of sensitive
numbers is not expected to take away from the presentation of the structure of the two case decision support systems. The conduct of the study involves no security issues and does not require the gathering of classified information.

V. Approach

Introduction

The research will be accomplished using the multiple-case study method. A multiple-case study approach will be used for the eventual development of a dissertation. According to Leedy and Ormrod (2001) a single-case study is useful for an in-depth study of a specific program to bring out its uniqueness or special qualities. Leedy and Ormand point out that a single-case study can serve as a guide for similar situations. According to Leedy and Ormrod, a multiple-case study approach is especially useful for making comparisons between similar, yet different situations where comparisons are important and where generalizations and theories are to be developed.

Descriptive case studies will be performed on each of the two decision support systems being studied. A comparison of the two case studies will be performed in which similar and contrasting elements of the two systems will be used to develop a conceptual framework, with associated models, to guide future decision support system development efforts within the department of defense community (Yin, 2003). Similar elements will be used to identify those components that are common to all contract quality management decision support system designs, and contrasting elements will be analyzed in terms of their application to requirements for specific contract types.
Design Objectives

A set of idealized design objectives, for the conceptual framework, were derived from an analysis of contract quality management functions described in subparts 16 and 46 of the Federal Acquisition Regulation (2003, December 11) and the NASA Award Fee Contracting Guide (2001, June 27). These objectives will be used to guide the research, interpret results, and provide replication logic for the study (Yin, 2003). The objectives are as follows:

- The framework should assist in making quality performance determinations.
- The framework should provide quality rating reporting for management review.
- The framework should provide a means of identifying and tracking chronic quality problems.
- The framework should provide a quality scoring method that results in incentive recommendations, where applicable to the contract type.
- The framework should assist management in assessing and making incentive decisions.
- The framework should assist the government and contractor in evaluating incentive factors and making changes to promote contract quality improvements.

Research Questions

The overall questions to be answered in this study that will serve as a guide for research efforts are as follows:

- How do the systems studied provide assists in making quality performance determinations?
- How is quality rating reporting supported by each system?
• How do the systems studied support the identification and tracking of chronic problems?
• How are incentive recommendations provided for by each system studied?
• How does each system assist management in assessing and deciding on incentives to be awarded?
• How does each system assist government and contractor management in evaluating incentives and making changes to promote contract quality improvements?

Research Plan and Schedule

A list of steps proposed for this study with tentative time frames for completing each step is as follows:

7. Refine and further develop research questions based on literature review - August 15, 2004.

The main purpose of a literature review in the case study approach is not for the purpose of developing answers, but is for the purpose of developing focused and purposeful questions (Yin, 2003). The overall questions of a case study serve as a constant reminder to the investigator of the type of data to be collected and insure consistency in approach (Tellis,
1997). The research questions will also serve as a guide for developing the
detailed questions to be used in interviews and surveys.

8. Determine data gathering protocol and finalize plans for data collection -
covers both the survey instruments, procedures, and rules to be used in the
data collection process. Yin (2003) stresses that the development of a data
collection protocol is critical in terms of multiple-case studies to insure
replication. Yin points out that the protocol is an essential element in insuring
reliability in a case study.

9. Submit the Formal Dissertation Proposal and receive approval - November 15,
   2004.

10. Gather data through the various sources available for the case studies involved
    - February 15, 2005. Sources of obvious benefit to this study are expected to
    be interviews with key personnel and the review of programming documents.
    However, all sources of information will be considered as defined by Yin
    (2003). As recommended by Yin, multiple sources of information will be
    used to provide convergence and accuracy to the findings of this study.
    Specific sources mentioned by Yin that will be considered are: documents,
    archival records, interviews, direct observation, participant-observation, and
    physical artifacts.

11. Analyze the data and develop conclusions - May 15, 2005. The analysis will
    involve the following: organizing the facts in logical order, categorization of
    the data, identifying meanings and patterns in the data, performing a cross-
case comparison of similarities and differences, developing conclusions, and
developing generalizations where applicable (Leedy & Ormrod, 2001). A
structured analysis approach will be utilized in documenting and analyzing the
two case study systems (Whitten & Bentley, 1998). It is expected, due to the
nature of qualitative research approaches, that the analysis will lead to further
redefinition and expansion of the study and may also result in a repetition of
data gathering and analyses (Leedy & Ormrod).

12. Develop and finalize a conceptual framework with related conceptual models
- July 15, 2005. This framework and its associated models can serve as an
overall guide in the development of contract quality management decision
support systems in a variety of operational domains and contract types, other
than those included in this study (Moody & Shanks, 2003). The framework
will be derived from the analysis phase of this study. The presentation format
of the framework and associated models will utilize a structured design
approach and is expected to include a conceptual depiction of data structures,
decision tables, mathematical models, and procedural approaches (Whitten &
Bentley, 1998). The framework and model specifications are expected to
identify decision support system components that are common to all contract
types and contract specific components that can possibly be applied to other
contracting types and environments.

report will provide findings of the structured analysis conducted on each of
the studied system, a cross-case analysis of the two systems, and a proposed
conceptual framework for a contract quality management decision support system. The proposed conceptual framework is expected to serve as a design guide for different operational domains and for different contract types within those domains. To insure focus in reporting study results, both the case study design objectives and research questions will serve as a guide to developing the composition of the report (Tellis, 1997). The report will also propose areas for future research.

VI. Resources

The author is the Division Chief responsible for contract management and for systems development related to the two case studies being performed. The author has access to all of the key persons involved in the use of these systems to include quality assurance personnel, contracting personnel, government management, and contractor management. The author also has access to the analysts and programmers involved in the development of the systems. However, the author intends to obtain written permission to conduct the study and publish the results from the contracting officer in charge of the contracts involved and from the directorate head that is responsible for the systems. No other special requirements or resources are envisioned for completion of this study.
Reference List


