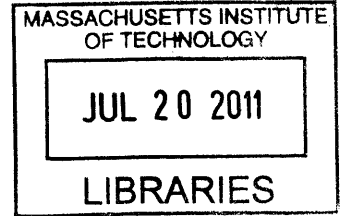


**Predictors of Successful Outcomes of
U. S. Coast Guard Construction Contracts**

By

Dennis C. Evans



B.S. Civil Engineering, U.S. Coast Guard Academy, 1993
M.S. Civil Engineering, University of Illinois at Champaign-Urbana, 1997

Submitted to the System Design and Management Program
in Partial Fulfillment of the Requirements for the Degree of

ARCHIVES

Master of Science in Engineering and Management

at the
Massachusetts Institute of Technology

May 2011

(June 2011)

© 2011 Dennis C. Evans. All Rights Reserved

The author hereby grants to MIT permission to reproduce and to distribute publicly paper and electronic copies of this thesis document in whole or in part in any medium now known or hereafter created.

Signature of Author

A handwritten signature in black ink, appearing to read "Dennis C. Evans", written over a horizontal line.

System Design and Management Program
May 6, 2011

Certified by

A handwritten signature in black ink, appearing to read "Ricardo Valerdi", written over a horizontal line.

Dr. Ricardo Valerdi
Thesis Supervisor
Research Associate, Lean Advancement Initiative

A handwritten signature in black ink, appearing to read "Patrick Hale", written over a horizontal line.

Accepted by

A handwritten signature in black ink, appearing to read "Patrick Hale", written over a horizontal line.

Patrick Hale
Director
System Design and Management Program

Disclaimer -- The views expressed in this thesis are those of the author and do not reflect the official policy or position of the U.S. government or the Department of Homeland Security.

---THIS PAGE INTENTIONALLY BLANK---

Predictors of Successful Outcomes of U. S. Coast Guard Construction Contracts

By

Dennis C. Evans

Submitted to the System Design and Management Program on May 06, 2011
in Partial Fulfillment of the Requirements for the Degree of Master of Science in Engineering
and Management

ABSTRACT

The U. S. federal government contracts over five hundred billion dollars in goods and services each year. Traditionally, these contracts are awarded on the basis of a combination of a contractor's proposed cost, quality, technical capability and demonstrated past performance. While all valid and important comparators, the overall quality and customer satisfaction achieved at the completion of contracts awarded on these bases remains highly variable from contract-to-contract.

This thesis examines potential reasons for the variability of these results and further proposes additional factors for contract evaluation and award that should improve the chances for successful contract outcomes. Twenty four randomly selected and recently completed U. S. Coast Guard construction contracts were used as the basis for study. The documented performance information for each contract was compared against contract demographic information in a search for correlations that are predictive of the likelihood of a high level of contract satisfaction. Contract performance ratings, contract timeliness and contract on-budget performance were compared to overall contractor annual revenue, total contractor employees, the relative contract size and a contractor's revenue per employee.

The main finding is that total contractor revenue, relative contract size (higher is better) and contractor revenue per employee (higher is better) are reliable predictors of performance and should be considered as relevant source selection factors for negotiated contracts. Capable small contractors should be selected not simply as a matter of conformance to a social program, but because the expected results are higher.

In addition, the following recommendations apply in order to maximize the probability of positive performance outcomes on U. S. Coast Guard construction contracts:

- 1) Improve the collection and utilization of past performance data.
- 2) Minimize sealed-low bid contracting.
- 3) Maximize contracts by negotiation.
- 4) Maximize the usage of small businesses, above the "micro-small" level.

Thesis Supervisor: Dr. Ricardo Valerdi
Title: Research Associate, Lean Advancement Initiative

ACKNOWLEDGEMENTS

I owe special thanks to my wife, Nicole and our two children, Rachel and Christopher for their understanding and patience over the course of the past year. For all the times Rachel or Christopher asked, “Daddy, can we go to the park, ride bikes, play soccer” or whatever the activity of the day happened to be and I had to reply, “Sorry, Daddy has to work on school now”, I apologize. Such are the perils of working from home. For as many times as I could say “yes”, I will forever remember each “no” far more. Hopefully, I have also instilled a sense of dedication and commitment to learning.

I offer my sincere gratitude to Dr. Ricardo Valerdi, my mentor and advisor throughout the thesis process. Your many great ideas, insights regarding agency theory and suggestions for analyzing the data in ways I had not initially considered all proved invaluable, and greatly increased my own insights and understandings of the material.

Within the United States Coast Guard, I owe a large debt to Ms. Cathy Broussard, the Chief of the Coast Guard’s Shore Infrastructure Logistics Center (SILC) construction contracting activities. A thesis is nothing without data, and contracting data is often close-held and hard for those on the outside to access. I am forever grateful for Cathy’s efforts to both make the data available to me and for her assistance with collections from a myriad of far-flung Coast Guard organizations. Those organizations include FD&CC Atlantic, FD&CC Pacific, CEU Juneau, CEU Oakland, CEU Cleveland and CEU Providence. In addition to Cathy, personnel at each who provided invaluable data collection support include Ms. Pam Argilan, Mr. Francis Brito, Lieutenant Commander Andy Brown, Mr. James Dinda, Captain Pat McMillin, Mr. Jerry Fortin, Ms. Janice Preston and Ms. Maggie Wilson.

I offer my thanks to all students in the SDM Cohorts of 2010 and 2011 that provided outstanding camaraderie and enhanced my own learning and way of thinking. More than ever, I now understand the true importance of worldwide diversity in thought and experiences. A significant portion of my learning throughout the System Design and Management program, as well as many of the insights reflected in this thesis, ultimately came from you.

Finally, I owe great thanks to Pat Hale who provided the guidance and leadership for my understanding of the System Design and Management Program, its value to my Coast Guard career and my future aspirations beyond the Coast Guard.

TABLE OF CONTENTS

Abstract.....	3
Acknowledgements.....	4
Table of Contents.....	5
List of Figures.....	11
List of Tables.....	12
List of Abbreviations.....	13
CHAPTER 1 – INTRODUCTION.....	15
1.1 Thesis Motivations.....	15
1.2 Empirical Observations Regarding Contract Failure Modes.....	15
1.2.1. <i>The contractor is too small to be capable</i>	15
1.2.2. <i>The contractor is too big to care.</i>	16
1.2.3. <i>The size of the project is a bad fit for the size of the contractor</i>	17
1.3 Government Data Collection.....	18
1.4 Thesis Overview.....	19
1.4.1. <i>Chapter 2 Overview</i>	19
1.4.2. <i>Chapter 3 Overview</i>	19
1.4.3. <i>Chapter 4 Overview</i>	19
1.4.4. <i>Chapter 5 Overview</i>	20
1.4.5. <i>Chapter 6 Overview</i>	20
1.4.6. <i>Chapter 7 Overview</i>	20
1.4.7. <i>Chapter 8 Overview</i>	20
1.4.8. <i>Chapter 9 Overview</i>	21
CHAPTER 2 - FEDERAL ACQUISITION REGULATIONS.....	22
2.1 Federal Acquisition Regulations Introduction.....	22
2.2 FAR Part 1 – Federal Acquisition Regulations.....	22
2.2.1. <i>FAR Guiding Principles</i>	22
2.2.2. <i>FAR Deviations</i>	23
2.3 FAR Part 3 – Improper Business Practices and Personal Conflicts of Interest.....	23
2.4 FAR Part 6 – Competition Requirements.....	24

2.4.1 . <i>Limitations</i>	24
2.4.2. <i>Policy</i>	24
2.4.3. <i>Small Business Set Asides</i>	24
2.4.4. <i>Permissible Other-than-Full and Open Competition</i>	25
2.5 FAR Part 9 – Contractor Qualifications.....	26
2.6 FAR Part 13 - Simplified Acquisitions Procedures (SAP)	27
2.6.1. <i>SAP General</i>	27
2.6.2. <i>SAP and Small Business Set-Asides</i>	27
2.6.3. <i>SAP Summary</i>	28
2.7 FAR Part 15 – Contracts by Negotiation	29
2.7.1. <i>General</i>	29
2.7.2. <i>Evaluation Factors</i>	29
2.8 FAR Part 17 – Special Contracting Methods.....	30
2.8.1. <i>General</i>	30
2.8.2. <i>Leader Company Contracting</i>	31
2.8.3. <i>Economy Act</i>	31
2.9 FAR Part 19 – Small Business Programs.....	31
2.9.1 <i>Qualification as Small Business</i>	31
2.9.2. <i>Small Business Set Asides</i>	33
2.9.3. <i>Historically Underutilized Business Zones</i>	33
2.10 FAR Contextual Conclusions.....	34
CHAPTER 3 - CONTRACT THEORY	35
3.1 Contract Theory Introduction.....	35
3.2 U. S. Coast Guard Contract Needs	35
3.3 Why Hire a Contractor?	36
3.3.1. <i>Risk Transference</i>	36
3.3.2. <i>Expected Gains of Principal and Agent</i>	36
3.3.3. <i>Specialization</i>	36
3.4 Principal / Agent Problem (Moral Hazard).....	36
3.4.1. <i>Overcoming Moral Hazard</i>	37
3.4.1.1. <i>Decision of the Principal Approach</i>	37

3.4.1.2. <i>Maximum Welfare of the Principal Approach</i>	38
3.4.1.3. <i>Contract Incentives</i>	38
3.4.1.4. <i>Contract Penalties</i>	38
3.5 Complete vs. Incomplete Contracts	39
3.5.1. <i>Complete Contracts</i>	39
3.5.1.2. <i>Limitations of Complete Contracts</i>	39
3.5.2. <i>Incomplete Contracts</i>	40
3.6 Self-Enforcing Contracts.....	41
3.6.1 <i>Reasons for Self-Enforcement</i>	41
3.6.2. <i>Self-Enforcement in Federal Government Contracts</i>	41
3.6.3 <i>Why Self-Enforcement Works</i>	42
3.6.4. <i>Self-Enforcement Complements Contract Terms and Specifications</i>	42
3.6.5. <i>Why Self-Enforcement Alone Isn't Enough</i>	43
3.7 Contracting Costs	43
CHAPTER 4 - PROJECTS SELECTED FOR STUDY	45
4.1 Introduction of U. S. Coast Guard Project Contracts Selected for Thesis	45
4.2 Project Contract Selection Methodology	45
4.3 Profile of Projects Selected for Study	48
CHAPTER 5 - RESEARCH METHODOLOGY AND TOOLS	56
5.1 Data Collection Sources and Methodology.....	56
5.2 Contractor Evaluation Areas	56
5.3 Contract Evaluation Completion Responsibilities	57
5.4 Contractor Review and Concurrence with Evaluation.....	57
5.4.1 <i>Ramifications of Poor Contract Performance Evaluations</i>	57
5.4.2. <i>Undesirability of Appeals Leads to Inaccurate Ratings</i>	57
5.5 Addressing Rating Bias.....	58
5.5.1 <i>Computing Overall Performance Rating in Lieu of Assigned</i>	59
5.5.1.1 <i>Weighting Performance Dimension Subcategories</i>	59
5.5.1.2 <i>Weighting Performance Dimension Categories</i>	62
5.5.1.3. <i>Sensitivity Analysis and Validation of Computed Rating</i>	65

CHAPTER 6 - RESEARCH RESULTS	68
6.1 Contract Performance Metric Introduction	68
6.2 Contract Demographic Metric Introduction.....	68
6.3 Twelve Points of Thesis Comparison.....	68
6.4 Overall Contract Performance Rating	69
6.4.1 <i>Contract Performance Rating vs Contractor Size (as measured by revenue)</i>	69
6.4.2. <i>Contract Performance Rating vs Contractor Size (as measured by total employees)</i>	71
6.4.3. <i>Contract Performance Rating vs Relative Contract Size (ratio of contract value to overall contractor revenue)</i>	72
6.4.4. <i>Contract Performance rating vs Contractor employee efficiency (total revenue per employee)</i>	74
6.5 On-Time Performance.....	74
6.5.1. <i>On time performance vs. Contractor Size (as measured by revenue)</i>	75
6.5.2. <i>On time performance vs. Contractor Size (as measured by total employees)</i>	78
6.5.3. <i>On time performance vs. Relative Contract Size (ratio of contract value to overall contractor revenue)</i>	79
6.5.4. <i>On time performance vs. Contractor employee efficiency (total revenue per employee)</i>	80
6.6 On-budget performance.....	81
6.6.1. <i>On-budget performance vs. Contractor Size (as measured by revenue)</i>	82
6.6.2. <i>On-budget performance vs. Contractor Size (as measured by total employees)</i>	83
6.6.3. <i>On-budget performance vs. Relative Contract Size (ratio of contract value to overall contractor revenue)</i>	84
6.6.4. <i>On-budget performance vs. Contractor employee efficiency (total revenue per employee)</i>	85
CHAPTER 7 - DISCUSSION	86
7.1 Research Findings Summary.....	86
7.2 Well Correlated Factors	86
7.3 Factors with Poor or Insignificant Correlations	87
7.4 Further Discussion.....	88
7.4.1. <i>Performance ratings vs Revenue, Small Contractors</i>	88
7.4.2. <i>Performance ratings vs Revenue per employee</i>	89
7.4.3. <i>Performance ratings vs Relative Size</i>	90
7.4.4. <i>Timeliness vs Total Revenue</i>	91

7.4.5. <i>Timeliness vs Revenue per employee</i>	92
7.4.6. <i>On-budget performance vs Revenue, Small Contractors</i>	93
7.4.7. <i>Performance ratings vs Revenue, Large Contractors</i>	94
7.4.8. <i>Total employees</i>	94
7.4.9. <i>On budget performance</i>	94
7.5 Research Analysis Summary	95
7.6 Research Analysis Conclusions	95
CHAPTER 8 - IMPLICATIONS FOR GOVERNMENT ACQUISITION	96
8.1 Practical Application Introduction	96
8.2. The Case for Incomplete Contracts	96
8.3 The Importance of Self-Enforcement	97
8.4 The Need for Better Performance Information	97
8.5 Tailoring Contract Methodology to Leverage Self-Enforcement	99
8.5.1. <i>Problems with Sealed-Low Bid</i>	99
8.5.1.1. <i>U. S. Coast Guard Awareness of Sealed Low Bid Limitations</i>	100
8.5.2. <i>Selecting Partners for Negotiated Contracts</i>	101
8.5.2.1. <i>Value of Direct Past Performance Information</i>	101
8.5.2.2. <i>When Personal Past Performance Experience Does not Exist</i>	101
8.6 Application of Thesis Research to Source Selection	102
8.6.1. <i>Source Selection within the FAR Context</i>	103
8.7 Implications for the Acquisition Community	105
CHAPTER 9 - SUMMARY AND CONCLUSIONS	107
9.1 Summary of Overall Recommendation and Conclusions	107
9.2 Chapter Summaries	107
9.2.1. <i>Chapter 1 Summary</i>	107
9.2.2. <i>Chapter 2 Summary</i>	108
9.2.3. <i>Chapter 3 Summary</i>	109
9.2.4. <i>Chapter 4 Summary</i>	110
9.2.5. <i>Chapter 5 Summary</i>	110
9.2.6. <i>Chapter 6 Summary</i>	113
9.2.7. <i>Chapter 7 Summary</i>	111

9.2.8. *Chapter 8 Summary*..... 115
9.3 Next Steps 116
Bibliography.....117
Appendix A: Construction Contract Evaluation Forms.....119

LIST OF FIGURES

Figure 2-1: Qualifying HUBZones by Region.....	33
Figure 4-1: Thesis Project Contract Locations.....	45
Figure 4-2: Summary of Project Award Values.....	47
Figure 5-1: Changed Unsatisfactory Mark Example.....	58
Figure 5-2: Weightings for Overall Computed Rating.....	63
Figure 5-3: Overall Rating (Assigned on Evaluation).....	66
Figure 5-4: Overall Rating (Computed).....	66
Figure 6-1: Contract Performance Rating vs. Total Contractor Revenue.....	69
Figure 6-2: Contractor Performance Rating vs. Total Contractor Revenue (<5M).....	70
Figure 6-3: Contractor Performance Rating vs. Company Size (Employees).....	71
Figure 6-4: Contractor Performance Rating vs. Company Size (3-15 Employees only).....	72
Figure 6-5: Contractor Performance Rating vs. Relative Contract Size.....	73
Figure 6-6: Contractor Performance Rating vs. Overall Annual Revenue per FTE.....	74
Figure 6-7: Timeliness vs. Total Contractor Revenue.....	76
Figure 6-8: Timeliness vs. Total Contractor Revenue (<\$5M).....	77
Figure 6-9: Timeliness vs. Company Size (Employees).....	78
Figure 6-10: Timeliness vs. Relative Contract Size.....	79
Figure 6-11: Timeliness vs. Overall Annual Revenue per FTE.....	80
Figure 6-12: Modification Ratio vs. Total Contractor Revenue (<\$5M).....	82
Figure 6-13: Modification Ratio vs. Total Contractor Employees (<15 Employees).....	83
Figure 6-14: Modification Ratio vs. Relative Contract Size.....	84
Figure 6-15: Modification Ratio vs. Overall Annual Revenue per FTE.....	85
Figure 7-1: Contractor Performance Rating vs. Relative Contract Size.....	90

LIST OF TABLES

Table 2-1: Small Business Thresholds by Industry.....	32
Table 5-1: Computed Performance Rating Sensitivity Analysis.....	65
Table 7-1: Demographic and Performance Factor Correlations.....	86
Table 7-2: Timely Completion Ratio, Revenue per FTE \geq \$500K.....	93
Table 7-3: Timely Completion Ratio, Revenue per FTE $<$ \$500K.....	93
Table 8-1: Required Contract Assessment Completion.....	98
Table 9-1: Demographic and Performance Factor Correlations.....	114

LIST OF ABBREVIATIONS

CCAS	Construction Contractor Appraisal Support System
CCR	Central Contractor Registration
CEU	Civil Engineering Unit
COTR	Contracting Officer's Technical Representative
DHS	Department of Homeland Security
DoD	Department of Defense
FAR	Federal Acquisition Regulation
FD&CC	Facilities Design and Construction Center
GAO	Government Accountability Office
GSA	General Services Administration
IDIQ	Indefinite Delivery, Indefinite Quantity
KO	Contracting Officer
MSAM	Major Systems Acquisition Manual
PPIRS	Past Performance Information Retrieval System
SAP	Simplified Acquisition Procedures
SBA	Small Business Administration
USCG	United States Coast Guard

---THIS PAGE INTENTIONALLY BLANK---

Chapter 1: Introduction

1.1 Thesis Motivations

Anyone who has served as an owner or client representative for a contract has undoubtedly felt some level of frustration. “Why is my organization not receiving the value for which we are paying or the level of service that we deserve, why isn’t this contract going well, what exactly is going wrong?” I have personally asked and considered these same questions many times.

I am an officer in the United States Coast Guard, frequently called upon to serve as a Contracting Officer’s Technical Representative (COTR). While the contracting officer is responsible for many contracts and must ensure all are carried out in accordance with the Federal Acquisition Regulations (FAR) and other applicable laws, the contracting officer typically has limited knowledge about the actual goods and services being acquired. The contracting officer is an expert in the buying process itself, but not in the details of what is being purchased. This is the job of the COTR. The COTR must understand the intricacies of the work involved to ensure the government receives the contracted goods and services. The COTR must understand what is reasonable and what is not. The COTR works closely with the contractor on a daily basis to oversee and monitor work delivery. When a contract is going well (or poorly), the COTR is typically both the first to know and best positioned to consider the reasons for success or failure.

1.2 Empirical Observations Regarding Contract Failure Modes

In my 18 year Coast Guard career, I have served as a COTR on scores of contracts, spanning everything from small facility maintenance jobs costing several thousand dollars to a major systems acquisition contract encompassing tens of millions. Many have gone well. Some have not. As true of anyone experienced in contract management, I have many empirically based opinions regarding why contracts are successful or not. These are a few:

1.2.1. The contractor is too small to be capable.

Government contracts have been historically awarded to the lowest-priced qualified bidder. “Qualified” is a subjective term. While all can agree that a two person mom-and-pop garage is incapable of building a Joint Strike Fighter aircraft, it is seldom that clear. Unless there are very clear reasons as to why a contractor is unqualified and has no chance of success, the

government generally adopts a “try it and see” type approach when engaged in low bid contracting and the contractor states they are indeed technically capable of doing the work. The onus is on the government to prove the contractor is not capable (very difficult to prove in advance), not the contractor to prove that they are. While I admire this system and the “can do” American spirit it typifies, it can often place the government in a situation where the chances of a successful contract outcome are low. In this situation, it does sometimes work out. Sometimes, a very small contractor where technical capability was in doubt delivers excellent results. Many times however, it does not. When I first started in government construction contraction approximately 15 years ago, almost all government contract work was awarded to a qualified low bidder, as described. In examining the contracts in this thesis, it is apparent that this approach has since changed, as less than 10% of the randomly selected projects were awarded on a sealed low bid basis. In modern contracting, most contracts use a best value approach in determining whom to make the award. In best value contracting, price is only one of the selection criteria, and almost always rated as a less important selection criteria than technical ability and approach.

1.2.2. The contractor is too big to care.

While being too small to perform is typically fairly easy to quantitatively determine, a contractor being too big to care is much more difficult to discern in advance. Many times, large contractor offices are organized where one set of personnel prepares all of the presentations and solicitations involved in pursuing contract award. I refer to this as the “A team”. As one might expect of a team responsible for winning contracts, these personnel are typically the best the organization has. Once the contract is won, the “A team” is re-assigned to pursue another contract. The quality of the replacements is inevitably less. Furthermore, the financial importance of one job – particularly a U. S. Coast Guard job, where budgets are much less than those found in the Department of Defense – is relatively low. The personnel working on the project are not owners or partners in the company (as they often are in a small organization) and are not as personally invested in the outcome. If the contractor gets paid (and they will, assuming at least an average outcome), the organizational expectations for the staff working on it have been met. With large contractors, it has been my personal experience that results are often exceedingly average. Phone calls from government personnel may or may not get returned, problems and issues can take a while to address. Even then, the solutions developed often represent the

minimum acceptable. There seems to be very little incentive for large contractor personnel working on salary to deliver customer-delighting results. Unfortunately, current government contracting processes have no great ways of dealing with this. Government contracting personnel evaluate the award proposals (delivered by the “A” team of course) offered and the technical capability of the company (high, if a large experienced organization). While this process almost always assures at least a marginally acceptable solution in the end, it often falls short of positioning the government for an outstanding outcome, leaving behind unfulfilled expectations and disappointment when the glossy promises of the “A team” proposals ultimately do not materialize.

1.2.3. The size of the project is a bad fit for the size of the contractor.

As will be discussed later in the thesis, size is a relative concept. To a contractor with \$1M/yr in revenues, a \$100K project is significant. If you take this same \$100K project and award it to a \$500M/yr contractor, it’s too small to mean anything whatsoever. I firmly believe that companies act in accordance with what’s important to their bottom line (and rightly so). If a contract represents 10% of the business, it is important that it go well, that the customers be highly satisfied and are willing to do business again. Situations such as this breed a higher level of service. If on the other hand a contract’s impact on the bottom line is only reflected several places beyond the decimal in the annual report, it is likely to get the same attention. Whether it goes well or not means little to the financial well-being of the contractor’s business. The level of service and attention is typically commensurate with that reality.

The United States Coast Guard is a unique organization in that it is considered one of our nation’s five military services, even though it is part of the Department of Homeland Security, not the Department of Defense. As a military service, large Coast Guard projects often attract the attention of major defense contractors. Unfortunately, Coast Guard budgets do not approach that of the Department of Defense. For some perspective, the widely criticized Deepwater project, the largest acquisition (by many orders of magnitude) the Coast Guard has ever attempted is still over 23 times smaller (\$24B vs \$323B) than DoD’s Joint Strike Fighter project. However, the prime contractor is the same. While a \$24B contract is significant by most any measure, the fact remains that it is 23 times smaller than their largest one. **A central hypothesis of this thesis is that Coast Guard contracts that tend to go well are those where the contract represents one**

of the most important pieces of work for a particular contractor. Similarly, Coast Guard contracts that go poorly tend to be those that are significantly down the list in terms of their overall contribution to a contractor's bottom line. I have empirically observed this to be true both at the major systems acquisitions level with multi-million dollar contracts and at the base maintenance level, with contracts only valued in the thousands. What constitutes a big contract for one, may be unimportant to another, depending on overall contribution to the bottom line. While this seems to be a fairly intuitive and obvious bit of common sense, there is absolutely no consideration for this reality in current government contracting processes. At a minimum, I plan to present quantitative data that demonstrates outcomes are indeed tied to the size of the contract as compared to the size of the contractors. I refer to this relationship as the "relative size".

1.3 Government Data Collection

The government has always done a good job of collecting data, even if whether or not the government effectively uses much of the data it collects is a topic for another day and another thesis. In the case of contract evaluation, this means the Contracting Officer (KO) and the technical representative (COTR) dutifully complete a standardized form to evaluate the contractor's performance in the course of executing the contract. These forms then get entered into database known as the Contract Cost Accounting System, or CCAS for short. CCAS captures basic contract information including the date and amount of the original award, any modifications where additional time or money were added to the contract over its life, the acceptance date of the contract work and the government's ratings of the contractor's performance. In general, the government's future use of this data is generally limited to empirical assessments of one particular contractor. If a contractor is being considered for a job, past performance as recorded in CCAS will be reviewed. If performance is particularly good or particularly bad, this can be factored into an award decision where past performance is one of the award criteria (not just price), as is increasingly becoming the case in many government contract awards. There is no effort of which I am aware to attempt to compare and distill performance across a broad range of contractors. This brings me to the work in this thesis.

Even after completing much of the research in this thesis, I continue to be amazed by how little academic work has been completed on this subject. CCAS represents a deep repository of data. However, it is used very sparingly, as described above. After extensively searching for

prior literature and research that seeks to correlate performance on government contracts to any of the empirical opinions I have observed, I repeatedly came up empty. In fact, the most relevant reference located was an April 2009 report from the Government Accountability Office (GAO) entitled “Federal Contractors - Better Performance Information Needed to Support Agency Contract Award Decisions”. This report details the systematically poor job the government typically does in both documenting and using information about contractor performance for future award decisions. Regarding work that seeks to correlate government contract performance with the demographic profile of the contract or contractor, frighteningly little work has been done.

In this thesis, I aspire to begin that work, at least for a relative small number of U. S. Coast Guard contracts in the field of facilities construction.

1.4 Thesis Overview

1.4.1. Chapter 2 Overview

In Chapter 2, I set the context for United States Coast Guard acquisitions. I outline the major rules, regulations and laws by which the service must abide by and discuss some of their meaning and content. In essence, I outline the “realm of the possible” regarding the direction acquisitions can proceed given the current context and framework. I do not aspire to re-write or make the case for changing acquisitions policy or law. Any recommendations I make will be possible within the current federal acquisitions system as outlined in Chapter 2.

1.4.2. Chapter 3 Overview

Chapter 3 provides the theory of contracts within the context of prior academic research. While research attempting to correlate performance on government contracts by demographical profiles is scant, other research is informative. Specifically, Chapter 3 discusses agency theory, difficulties arising from hiring an agent to act on behalf of an organization, difficulties from information disparities, conflicts of interest and general applicability of agency theory to the research findings, particular the importance of the principles of self-enforcement on incomplete contracts.

1.4.3. Chapter 4 Overview

In Chapter 4, I introduce the 24 projects selected to test the hypothesis. Each of these projects has been completed by the Coast Guard’s civil engineering organization to maintain or

improve the service's infrastructure. Projects were intentionally selected from multiple organizations throughout the Coast Guard, to represent a broad range of geographical diversity (east and west coast, Great Lakes and Alaska), size (\$50K to \$3M) and ensure no undue bias specific to a given contracting office. To ensure currency, all 24 of these projects have been competed in the last two and a half years.

1.4.4. Chapter 5 Overview

In Chapter 5, I discuss research methodologies. The standard contract performance evaluation is introduced, along with a discussion of how it was parsed and analyzed. Assumptions are explained. When value judgments are made to process, weight or analyze the data, those value judgments are justified and explained.

1.4.5. Chapter 6 Overview

Chapter 6 presents the results of the research. Results are presented in the form of a four by three analysis, comparing each of four demographic factors that can be used to characterize a proposed contract action in advance (contractor size as measured by revenue, contractor size as measured by personnel, relative contract size and contractor revenue by employee) against three measures of contract success (contractor performance ratings, contract on-time performance, contract on-budget performance). Correlations are sought such that given the demographic information, these factors could be used to help assess the likelihood of contract success or failure in advance, which could then be factored into an award decision.

1.4.6. Chapter 7 Overview

Chapter 7 offers research analysis, organizing, synthesizing and culling the results presented in Chapter 6. Additional discussion and theories for reasons behind the results are offered. The strongest correlations are identified, in addition to identifying those factors that are not relevant or do not correlate well.

1.4.7. Chapter 8 Overview

In Chapter 8, the results of the research are connected back to the acquisition context of the United States Coast Guard. Chapter 2 outlined the service's acquisitions rules. Chapters 5, 6 and 7 presented the case for relevant correlations of demographics and performance outcomes. In this chapter, we revisit the "realm of the possible", discussing how the research findings can be

practically applied into source selection in a manner that fully complies with all federal acquisition policies and regulations.

1.4.8. Chapter 9 Overview

In Chapter 9, key points are summarized and recommendations are made regarding how to use this research to improve successful outcomes of acquisition contracts. While a thesis is ultimately an academic exercise, it is my goal that all recommendations are fully consistent with existing law and policy and are able to be practically applied within existing system constraints.

Chapter 2: The Federal Acquisition Regulations (FAR)

2.1 Federal Acquisition Regulations Introduction

All acquisitions within the federal government must be in compliance with the Federal Acquisition Regulations (FAR). The FAR is a comprehensive document spanning two volumes, fifty three parts and nearly two thousand pages. In order for any recommendations for targeted acquisition practices to be valid for implementation consideration, they must stay within both the letter and the spirit of the FAR. Regardless of how fundamentally sound a recommended practice may appear, it is infeasible if not in keeping with the FAR. This chapter provides an overview of a selected number of the more relevant sections of the FAR with regard to targeted acquisitions in order to explore the “realm of the possible”. Unless otherwise stated, the reference for all material within this chapter is the March 2005 edition of the FAR, jointly issued by GSA, DoD and NASA (FAR, 2005).

2.2 FAR Part 1 – Federal Acquisition Regulations

2.2.1. FAR Guiding Principles

Part 1 of the FAR outlines the general purpose, applicability and authority of the FAR. The guiding principles for the entire federal acquisition system are condensed down to just four. They are:

- (1) Satisfy the customer in terms of cost, quality, and timeliness of the delivered product or service by, for example:
 - (i) Maximizing the use of commercial products and services;
 - (ii) Using contractors who have a track record of successful past performance or who demonstrate a current superior ability to perform; and
 - (iii) Promoting competition;
- (2) Minimize administrative operating costs;
- (3) Conduct business with integrity, fairness, and openness; and

(4) Fulfill public policy objectives.

2.2.2. FAR Deviations

Except as otherwise required by law or with very few limited and specific exceptions, agency specific regulations must not conflict with the FAR. Limited FAR deviations are authorized and fall into one of three categories. First, there are individual deviations that affect only one contract action. Individual deviations must be approved by the head of the agency (i. e., no provision for designees). Next, class deviations are needed when there is an ongoing, permanent need for deviation. These must be proposed by the agency head to the FAR Secretariat (the governing body of the FAR). Finally, deviations necessary to comply with an Executive Order or Treaty are authorized, with notification to the FAR Secretariat. The important concept is that FAR deviations are no small matter, and can generally be considered outside the “realm of the possible” with respect to common every day acquisitions.

2.3 FAR Part 3 – Improper Business Practices and Personal Conflicts of Interest

Part 3 of the FAR focuses on improper business practices, what not to do, and provides general protections for whistleblowers who expose improper practices. Part 3 includes discussions regarding both personal conduct (acceptance of gratuities, business relationships, etc) and prohibited business practices. This summary will focus on prohibited business practices. Practices that are prohibited include anything designed to eliminate competition or restrain trade. Examples given include collusive bidding, follow-the-leader pricing (price changes simultaneously made in collusion with competitors), rotated low bids (competitors collude to take turns submitting a low bid), collusive price estimating systems and sharing of business. With few exceptions, federal contracts may also not be awarded to a government employee or business concern owned or substantially controlled by government employees. In general, Part 3 of the

FAR stresses that federal acquisition must be fair and impartial, both in actuality and in appearance.

2.4 FAR Part 6 – Competition Requirements

Part 6 of the FAR “prescribes policies and procedures to promote full and open competition in the acquisition process.” As importantly, it outlines situations where acquisition via methods other than full and open competition may be appropriate. This is particularly important if targeted acquisition is desirable, as would be necessary to implement thesis findings. Important provisions of part 6 include:

2.4.1 . Limitations

6.002 Limitations. No agency shall contract for supplies or services from another agency for the purpose of avoiding the requirements of this part.

2.4.2. Policy

6.101 Policy.

- (a) 10 U.S.C. 2304 and 41 U.S.C. 253 require, with certain limited exceptions (see Subparts 6.2 and 6.3), that contracting officers shall promote and provide for full and open competition.

2.4.3. Small Business Set Asides

6.203 Set-asides for small business concerns.

- (a) To fulfill the statutory requirements relating to small business concerns, contracting officers may set aside solicitations to allow only such business concerns to compete. This includes contract actions conducted under the Small Business Innovation Research Program established under Pub. L. 97-219.
- (b) No separate justification or determination and findings is required under this part to set aside a contract action for small business concerns.
- (c) Subpart 19.5 prescribes policies and procedures that shall be followed with respect to set-asides.

6.204 Section 8(a) competition.

- (a) To fulfill statutory requirements relating to section 8(a) of the Small Business Act, as amended by Pub. L. 100-656, contracting officers may limit competition to eligible 8(a) contractors (see Subpart 19.8).
- (b) No separate justification or determination and findings is required under this part to limit competition to eligible 8(a) contractors.

6.205 Set-asides for HUBZone small business concerns.

- (a) To fulfill the statutory requirements relating to the HUBZone Act of 1997 (15 U.S.C. 631 note), contracting officers in participating agencies (see 19.1302) may set aside solicitations to allow only qualified HUBZone small business concerns to compete (see 19.1305).
- (b) No separate justification or determination and findings is required under this part to set aside a contract action for qualified HUBZone small business concerns.

6.206 Set-asides for service-disabled veteran-owned small business concerns.

- (a) To fulfill the statutory requirements relating to the Veterans Benefits Act of 2003 (15 U.S.C. 657f), contracting officers may set-aside solicitations to allow only service-disabled veteran-owned small business concerns to compete (see 19.1405).
- (b) No separate justification or determination and findings are required under this part to set aside a contract action for service-disabled veteran-owned small business concerns.

2.4.4. Permissible Other-than-Full and Open Competition

Subpart 6.3 covers circumstances where other than full and open competition may be permitted. These circumstances include:

1. Only one responsible source and no other supplies or services will satisfy agency requirements.
2. Unusual and compelling urgency
3. Industrial mobilization, engineering, developmental or research capability.
4. International agreement
5. Authorized or required by statute
6. National security

Whenever any of these justifications are used, it must be approved in writing, either by the contracting officer (if less than \$500,000), the agency's designated competition advocate (if less than \$10,000,000), a general officer (if less than \$50,000,000) or the senior procurement official of the agency if over that amount.

2.5 FAR Part 9 – Contractor Qualifications

Part 9 outlines the policies, standards, general responsibilities and acceptable conduct for a contractor to be considered qualified. In order to qualify for a government contract, any prospective contractor must meet the following minimum standards:

9.104-1 General standards.

To be determined responsible, a prospective contractor must—

- (a) Have adequate financial resources to perform the contract, or the ability to obtain them
- (b) Be able to comply with the required or proposed delivery or performance schedule, taking into consideration all existing commercial and governmental business commitments;
- (c) Have a satisfactory performance record. A prospective contractor shall not be determined responsible or non-responsible solely on the basis of a lack of relevant performance history, except as provided in 9.104-2;
- (d) Have a satisfactory record of integrity and business ethics.
- (e) Have the necessary organization, experience, accounting and operational controls, and technical skills, or the ability to obtain them.
- (f) Have the necessary production, construction, and technical equipment and facilities, or the ability to obtain them and;
- (g) Be otherwise qualified and eligible to receive an award under applicable laws and regulations.

The government is also able to pre-qualify contractors in some instances (to the exclusion of anyone not prequalified) by using Qualified Product Lists (QPLs), Qualified Materials List (QMLs) or Qualified Bidder Lists (QBLs). Any time a qualification process is used, it must be

advertised in advance and otherwise adhere to FAR standards. Specific details concerning the use of qualification lists can be found in FAR 9.203.

Part 9 of the FAR also enumerates reasons why contractors can be debarred or suspended. Examples include fraud, violation of anti-trust statutes, commission of felonies, or other offenses that indicate a lack of business integrity.

2.6 FAR Part 13 - Simplified Acquisitions Procedures (SAP)

2.6.1. SAP General

The FAR makes distinctions between the process and procedures that must be followed for large contracts and that which applies to much smaller, everyday purchases and acquisitions. This includes procedures for categorical set-asides for small business concerns, disabled veteran owned concerns, etc. The purpose of simplified acquisitions procedures include reduction of administrative costs, improvement of opportunities for small, disadvantaged and women-owned business concerns, promotion of efficiency and economy in contracting and avoiding unnecessary burden for both the government and contractors. Simplified acquisitions procedures are not merely an available convenience.

2.6.2. SAP and Small Business Set-Asides

In fact, the FAR requires that “agencies shall use simplified acquisition procedures to the maximum extent practicable for all purchases of supplies or services not exceeding the simplified acquisition threshold.”

By rule:

13.003 Policy.

Each acquisition of supplies or services that has an anticipated dollar value exceeding \$2,500 (\$15,000 for acquisitions as described in 13.201(g)(1)) and not exceeding \$100,000 (\$250,000 for acquisitions described in paragraph (1) of the Simplified Acquisition Threshold definition at 2.101) is reserved exclusively for small business

concerns and shall be set aside (see 19.000 and Subpart 19.5). See 19.502-2 for exceptions.

The contracting officer may set aside for HUBZone small business concerns (see 19.1305) or service-disabled veteran-owned small business concerns (see 19.1405) an acquisition of supplies or services that has an anticipated dollar value exceeding the micro-purchase threshold and not exceeding the simplified acquisition threshold. The contracting officer's decision not to set aside an acquisition for HUBZone small business or service-disabled veteran-owned small business concerns participation below the simplified acquisition is not subject to review under Subpart 19.4.

The contracting officer shall not use simplified acquisition procedures to acquire supplies and services if the anticipated award will exceed—

- (i) The simplified acquisition threshold; or
- (ii) \$5 million (\$10 million for acquisitions as described in 13.500(e)), including options, for acquisitions of commercial items using Subpart 13.5.

2.6.3. *SAP Summary*

Supplies and service contracts between \$2,500 and \$100,000 are required to be set aside for small business concerns in most circumstances. Additionally, contracts up to \$5,000,000 can be set aside for small business concerns in most circumstances, although are not required to be. The option to set aside contracts up to \$5,000,000 is a particularly important tool already often used by the U. S. Coast Guard, and is vital to any efforts for targeted acquisitions amongst the small business community. The Central Contractor Registration database at www.ccr.gov is a primary source for locating eligible small business concerns from the following categories:

- (1) Small business.
- (2) Small disadvantaged business.
- (3) Women-owned small business.
- (4) HUBZone small business.
- (5) Service-disabled veteran-owned small business.
- (6) Veteran-owned small business.

It is important to note that even when using set aside procedures within the simplified acquisition process, competition is still generally required, as before. The only difference is that competition can be limited to contractors meeting one or more of the above categories. The contracting officer must still promote competition “to the maximum extent practical to obtain

supplies and services from the source whose offer is the most advantageous to the Government.”

2.7 FAR Part 15 – Contracts by Negotiation

2.7.1. General

Discussions thus far have centered upon contracts that are competitively sourced amongst multiple contractors, often using a sealed bidding process. Additionally, the FAR also allows for contracts by negotiation. There are two main types of contracts where negotiation would be used. The first is a sole source acquisition, where the contracting officer has already determined a competitive exception applies. Sole source is an exception (not the rule), and is not our focus here. The other is a competitive acquisition, where elements other than price are also being evaluated in order to obtain the best value for the government.

2.7.2. Evaluation Factors

When contracting through negotiation, all evaluation factors must be clearly identified, with their relative importance stated as part of the solicitation process. The following are the requirements concerning what should be used for evaluation factors for source selection:

15.304 Evaluation factors and significant subfactors.

- (a) The award decision is based on evaluation factors and significant subfactors that are tailored to the acquisition.
- (b) Evaluation factors and significant subfactors must—
 - (1) Represent the key areas of importance and emphasis to be considered in the source selection decision; and
 - (2) Support meaningful comparison and discrimination between and among competing proposals.
- (c) The evaluation factors and significant subfactors that apply to an acquisition and their relative importance, are within the broad discretion of agency acquisition officials, subject to the following requirements:

- (1) Price or cost to the Government shall be evaluated in every source selection.
- (2) The quality of the product or service shall be addressed in every source selection through consideration of one or more non-cost evaluation factors such as past performance, compliance with solicitation requirements, technical excellence, management capability, personnel qualifications, and prior experience; and
- (3) (i) Except as set forth in paragraph (c)(3)(iv) of this section, past performance shall be evaluated in all source selections for negotiated competitive acquisitions expected to exceed \$1,000,000.

(ii) Except as set forth in paragraph (c)(3)(iv) of this section, past performance shall be evaluated in all source selections for negotiated competitive acquisitions issued on or after January 1, 1999, for acquisitions expected to exceed \$100,000. Agencies should develop phase-in schedules that meet or exceed this schedule.

(iii) For solicitations involving bundling that offer a significant opportunity for subcontracting, the contracting officer must include a factor to evaluate past performance indicating the extent to which the offeror attained applicable goals for small business participation under contracts that required subcontracting plans.

(iv) Past performance need not be evaluated if the contracting officer documents the reason past performance is not an appropriate evaluation factor for the acquisition.
- (4) The extent of participation of small disadvantaged business concerns in performance of the contract shall be evaluated in unrestricted acquisitions expected to exceed \$500,000 (\$1,000,000 for construction) subject to certain limitations.
- (5) For solicitations involving bundling that offer a significant opportunity for subcontracting, the contracting officer must include proposed small business subcontracting participation in the subcontracting plan as an evaluation factor.
- (6) If telecommuting is not prohibited, agencies shall not unfavorably evaluate an offer that includes telecommuting unless the contracting officer executes a written determination.

2.8 FAR Part 17 – Special Contracting Methods

2.8.1. General

Part 17 of the FAR discusses special contracting methods. Special methods discussed include multi-year contracting, options, leader company contracting, interagency acquisitions under the Economy Act and Management & Operating Contracts. Of these, the ones that have potential source selection implications include leader company contracting and interagency

acquisitions under the Economy Act. Both are discussed in more detail below.

2.8.2. Leader Company Contracting

Leader company contracting is a special category of sole source contracting that applies when a developer or sole source producer of an emerging technology is designated to furnish assistance under an approved contract to another company so they can become a source of supply. Leader company contracting is considered an “extraordinary acquisition technique”, limited to special circumstances only.

2.8.3. Economy Act

The Economy Act authorizes agencies to enter into mutual agreements to obtain supplies or services through interagency acquisition. The idea is that if one agency has a contract that meets the needs of another agency, both agencies can use the contract without having to enter into a new one themselves. The Economy Act can prove especially useful when a vendor already has a contract for the supplies or services required through another agency.

2.9 FAR Part 19 – Small Business Programs

Part 19 defines small business and delineates special programs for small business contracting. Through these programs, prospective contract actions are “set aside” and limited to competition solely amongst those eligible for small business designation.

2.9.1 Qualification as Small Business

Qualification as a small business is dependent on number of employees and/or average revenue over the last three years, differing dependent on type of industry. Additionally, a small business must meet all of the following characteristics (from <http://www.sba.gov/content/am-i-small-business>):

- Is organized for profit;

- Has a place of business in the US;
- Operates primarily within the U.S. or makes a significant contribution to the U.S. economy through payment of taxes or use of American products, materials or labor;
- Is independently owned and operated; and
- Is not dominant in its field on a national basis.

The size standard is based on employees and/or revenue. While is it highly specific to industry (complete tables can be found at <http://www.sba.gov/content/table-small-business-size-standards>), a maximum of 500 employees and/or average annual revenue between \$7M and \$35M (dependent on industry) are relatively common characterizations of a small business. The below table shows selected examples of small business thresholds by industry:

*Table 2-1
Small Business Thresholds by Industry*

NAICS Codes	NAICS Industry Description	Size Standards in millions of dollars	Size standards in number of employees
236220	Commercial and Institutional Building Construction	\$33.5	
237310	Highway, Street, and Bridge Construction	\$33.5	
237990	Dredging and Surface Cleanup Activities	\$20.0	
238160	Roofing Contractors	\$14.0	
238220	Plumbing, Heating, and Air-Conditioning Contractors	\$14.0	
238320	Painting and Wall Covering Contractors	\$14.0	
313312	Textile and Fabric Finishing Mills		500
321214	Truss Manufacturing		500
323110	Commercial Lithographic Printing		500
325110	Petrochemical Manufacturing		1,000
331111	Iron and Steel Mills		1,000
332116	Metal Stamping		500
445110	Supermarkets and Other Grocery (except Convenience) Stores	\$30.0	
445120	Convenience Stores	\$27.0	
451110	Sporting Goods Stores	\$14.0	
452111	Department Stores (except Discount Department Stores)	\$30.0	
452112	Discount Department Stores	\$27.0	

452910	Warehouse Clubs and Superstores	\$27.0	
452990	All Other General Merchandise Stores	\$30.0	
453210	Office Supplies and Stationery Stores	\$30.0	
481111	Scheduled Passenger Air Transportation		1,500

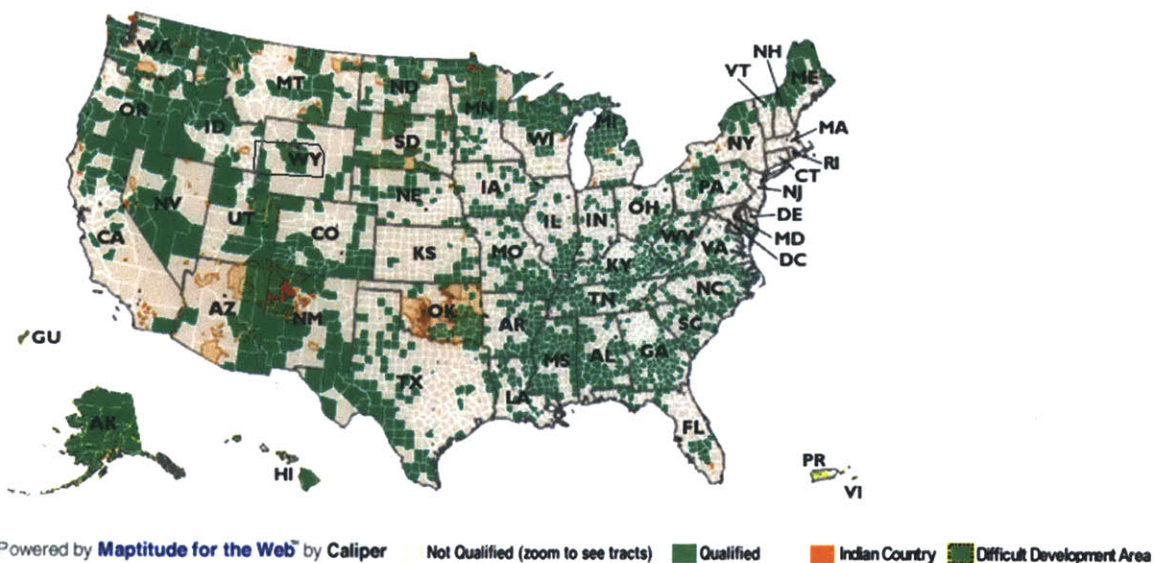
2.9.2. Small Business Set Asides

Once designated through the Small Business Administration as a small business, a business is then eligible for “set-asides”. The FAR formally defines “set aside” as “the practice of reserving an acquisition exclusively for participation by small business concerns.”

Acquisitions between \$2,500 and \$100,000 are automatically reserved for small business set-asides, other than limited exceptions.

2.9.3. Historically Underutilized Business Zones

A subset of small business concerns are Historically Underutilized Business Zone (HUBZone) small businesses. To be considered a HUBZone small business, a business must reside in a designated “underutilized business zone”, typically an area that is economically depressed. Qualifying HUBZone areas are seen on the map below, designated in green and orange.



Source: <http://map.sba.gov>

Figure 2-1
Qualifying HUBZones by Region

The detailed listing of HUBZone qualified regions can be found at <http://map.sba.gov/hubzone/init.asp#address>. If there is only one HUBZone small business concern that can satisfy the requirements, contracting officers can award on a sole source basis without considering other small business concerns for contracts less than \$3M (\$5M for manufacturing). For contracts that are competed on a full and open basis, HUBZone small businesses have a 10% price preference as compared to other non-small business offers (HUBZone contractor bids will be successful if no more than 10% more expensive than non-HUBZone contractors).

2.10 FAR Contextual Conclusions

While the FAR is intended to foster competition, there does exist opportunity to target acquisitions to certain classes of businesses, small or woman owned businesses in particular. By definition, contracts in the range of \$2,500 - \$100K are set aside for these concerns. It is also important to note that the preceding chapter was intended to provide the basics of the FAR with regard to the potential for acquisitions targeting a certain size or class of business. It is in no way intending to provide a complete and comprehensive understanding of the entire federal acquisition system. For that, the entire 2,000 page FAR can be reviewed at <https://www.acquisition.gov/Far/>.

Chapter 3: Contract Theory

“Well then, says I, what’s the use you learning to do right when it’s troublesome to do right and ain’t no trouble to do wrong, and the wages is just the same? I was stuck. I couldn’t answer that. So I reckoned I wouldn’t bother no more about it, but after this always do whichever come handiest at the time”.

- Mark Twain, *The Adventures of Huckleberry Finn* (Twain, 1885, p. 128)

3.1 Contract Theory Introduction

In order to better understand how actual contracts operate, it is insightful to also understand contract theory. First, it is important to consider a key question that much of contract theory takes for granted: “Why even enter into a contract in the first place”?

There’s an old joke in contracting circles related to the definition of a consultant. A consultant is someone you hire to tell you what time it is. Shortly after hiring them, they ask to borrow your watch. You give it to them, and they disappear for several weeks. When the deliverable deadline arrives, they deliver a glossy report, which does indeed tell you the time. As payment, they keep your watch. While it is clear in this simplistic joke that a contractor was probably never needed, it is often not quite so obvious. Unfortunately, sometimes even when it is relatively obvious that a contractor is not required, one is hired anyway, often delivering results not dissimilar from the old joke. When considering entering into a contract, the first question that must be asked and answered is “Do I need the assistance of a contractor?”

3.2 U. S. Coast Guard Contract Needs

The United States Coast Guard has moderate in-house capability for construction work, with some ability to complete small to medium size projects similar to those in this study. For example, Coast Guard Aids to Navigations Teams (ANTs) have the ability to drive piles (they own and operate barge cranes), construct marine towers and do a wide array of in-water construction work. Many of the larger Coast Guard bases have an in-house facilities staff, with tradesmen of most every specialty, including carpenters, electricians, plumbers, etc. This staff is also capable of performing light construction work. Why then, would the Coast Guard ever need a contractor?

3.3 Why Hire a Contractor?

The most obvious reason to hire a contractor is the lack of internal capability, capacity or expertise. If the principal (i. e., owner) lacks any of these, there is no choice but to either acquire it (often expensive, time consuming and impractical) or contract for the same.

3.3.1. Risk Transference

Even when capability does exist internally, one commonly cited reason for hiring a contractor, particularly amongst agency theorists, is the transference of risk (Masten, 2002, p. 274). Even if in-house capability exists, doing work in-house also means that the organization assumes all risks of schedule, performance and budget. In a properly structured contract, an agreed upon amount of risk can be transferred (for a price) from the principal (the Coast Guard in this case) to an agent (the contractor).

3.3.2. Expected Gains of Principal and Agent

When deciding whether or not to enter a contract, both parties must decide if the expected gains (net of the transaction) outweigh the alternative of doing something else or nothing at all.

Expressed mathematically:

$$G^* = G^C, \text{ if } V^C > V^a, \text{ and} \\ = G^a, \text{ if } V^C \leq V^a$$

where G^C represents gain of the principal, G^a is gain of the agent, V^C , is the principal's perceived value in entering into the contract, V^a is the agent's perceived value of entering into the contract and G^* represents the governance form (a contract, in this case) chosen. (Masten, 2002, p. 276). Only when the above equations are true can a contract exist.

3.3.3. Specialization

Even if it costs more, some organizations may choose to outsource for the simple fact that they want to focus on their core mission.

3.4 Principal / Agent Problem (Moral Hazard)

Once the parties have decided that a contractual relationship is in the best interest of each, a problem arises, as suggested by the Mark Twain quote at the start of the chapter. Known as the

principal-agent problem or moral hazard, it refers to the inherent misalignment of priorities for the principal and agent. Per the equation above, both the principal (the U. S. Coast Guard, in this study) and the agent (the construction contractor) entered into the contract with the expectation of achieving a desired outcome for themselves. In the case of the principal, the desired outcome is entirely dependent on the ability of the agency to deliver it. In the case of the agent, achievement of their own desired outcomes (i. e., a profit on the contract) are sometimes in direct competition (and at times, contradiction) with achieving the outcomes desired by the principal. The legal systems of the world are filled with cases stemming from the principal-agent problem and moral hazard. A common approach to mitigate the problem of moral hazard is to incentivize contracts to the maximum extent possible such that principal and agent outcomes align. However, incentives can only accomplish so much, and the fact remains that the agent is an independent entity, free to make their own decisions, which will typically be primarily made with their own best interests in mind.

3.4.1. Overcoming Moral Hazard

The obstacles involved with overcoming the principal – agent problem are quite formidable. To even begin to answer this, there are two basic viewpoints suggested by Dieter Schneider (Bamberg, 1987, p. 485). Both have limitations which will be discussed next.

3.4.1.1. Decision of the Principal Approach

The first is to view the decision the principal would make by himself as the one that maximizes the principal's own welfare and therefore the decision the agent should make. However, this ignores the fact that the agent was specifically hired because of his greater knowledge, expertise and capability. *Because* he knows more than the principal and is therefore capable of making better decisions and reaching more optimal outcomes, the decision the agent makes as compared to what the principal would decide will often not be (and should not be) the same. If it is always the same, a contract was likely never needed in the first place. The approach of viewing the decisions the principal would make on their own as an assessment of the degree to which the agent is acting in their interest is fundamentally flawed, as it belies the entire reason the agent was hired.

3.4.1.2. Maximum Welfare of the Principal Approach

If agent decisions cannot be evaluated by a comparison with what the principal would do on their own, an alternative viewpoint would be to evaluate the agent decisions by what maximizes the welfare of the principal. Unfortunately, this does not work well either. Decisions are almost always made under uncertainty, long before outcomes have been determined or results have become clear. While it is often easy in retrospect to determine what decision would have been optimal, it is generally quite impossible to make the determination before outcomes are known. It is impossible to say with certainty in advance what “maximizes the welfare of the principal”. Individual motives are quite impossible to discern as well. How do you prove in advance that a particular decision was “best”, motivated solely by the desire to maximize the utility of the principal? There is no easy answer to this question, which is one of the fundamental reasons that the principal-agent problem of moral hazard is so difficult to successfully overcome.

3.4.1.3. Contract Incentives

There are several common approaches to attempt to address the principal-agent problem. One of the mostly widely used is contract incentives. A contract can be structured to incentive the agent to achieve maximum possible utility for the principal. Amongst other applications, this is extremely common in U. S. government major systems acquisitions contracts. When describing the desired outcomes of the principal, major systems contracts typically specify two values. The first is the “threshold” value, which must be achieved for an outcome to be acceptable. However, there is often a “target” value which represents a state of higher utility for the principal. If the agent can achieve a target value (or some percentage thereof), there are contract incentives such that the agent realizes additional gain (i. e., profits) as well. In this way, the priorities of the principal and priorities of the agent are brought into closer alignment.

3.4.1.4. Contract Penalties

Wherever there is a carrot (contract incentives), there is also usually a stick. Just as the principal provides additional rewards for outcomes that increase his utility beyond a baseline level, contracts generally often include penalties if expected outcomes are not realized as agreed. In more primitive times, these penalties could be quite severe, including death if the agent did not deliver as promised. While modern contracts have thankfully moved beyond that sanction, many contracts can and do contain provisions for liquidated damages. Unlike actual damages where

monies are paid based on an actual loss (the agent pays to replace an item he broke, for example), liquidated damages tend to reflect the consequences of the principal not realizing his expected utility. For example, because the retail store construction was not completed in time, the store could not open on time, thereby causing the principal to lose expected sales revenue, hence liquidated damages are due.

3.5 Complete vs. Incomplete Contracts

There are two prevailing views of how contracts both should be and are actually constructed. The two viewpoints are complete contracts and incomplete contracts (Hart and Moore, 1998, p. 1).

3.5.1. Complete Contracts

From a complete contract standpoint, everything covered by the contract, including all contingencies, is written in the contract itself. If it isn't written down as part of the contractual agreement, it doesn't exist. A proponent of complete contracts would argue that the initial agreed upon price is also the final price, absent any pre-defined options or contingencies that were exercised, also agreed upon up front. If either party fails to perform under a complete contract, it will be litigated in a court of law, with the outcome dictated by adherence or non-adherence with contract terms. A complete contracting view tends to be very formal, with everything either black or white.

Government contracting officers often typically prefer for a contract to be "complete". There are fewer arguments this way, and when there are disagreements, right and wrong tend to be much easier to discern. Unfortunately, complete contracts are rare, and in practical application, seldom (if ever) exist.

3.5.1.2. Limitations of Complete Contracts

First, complete contracts are unduly expensive, both in terms of preparation and execution (Tirole, 1999, p. 746). The effort and labor to prepare a contract is not free. Terms and specifications must be written, typically by the principal. The more detailed these become, the more planning and scoping is required, the more expensive the contract documents are to prepare. It is inefficient and expensive to spend time planning and scoping for hundreds of possible contingencies when only a small number of them will prove relevant. Next, complete contracts will also typically cost more to execute. A primary purpose of completeness on the part of the

principal is often the elimination of risk from the perspective of the agent. If there is already a prescribed contractual solution for everything that can possibly happen, unexpected costs can be eliminated for the principal. However, it is inaccurate to view this as the “elimination of risk”. More accurately, it is the transference of risk from the principal to the agent. Risk transference is never free. The greater the number of contingencies that the agent will be expected to respond to, the higher the upfront cost will be. Moreover, because there is a small probability that the agent will have to respond to many contingencies, costs must reflect the assumption of many risks that will likely never materialize. A very complete contract is a very expensive one.

Disregarding costs for a moment, there are also practical considerations of just how complete a contract can actually be. By definition, uncertainty is probabilistic and unknown. While many uncertainties can be anticipated based on prior experience and past knowledge of what could happen, the very nature of uncertainty means that absolutely everything can never be anticipated. When the previously unanticipated event does occur, the contract does not have provisions to deal with it and can no longer be considered complete. For this reason, complete contracts are largely theoretical. In the real world, almost all contracts are considered incomplete.

3.5.2. Incomplete Contracts

An incomplete contract is one that does not plan for every possible contingency, and both principal and agent recognize in advance that further agreements and negotiations will be necessary as conditions emerge (Hart, 2002, p. 2). Another form of incompleteness comes from difficulties in measurement (Klein, 2002, p. 61). For example, while a requirement might specify that something “look good” and most people know it when they see it, it is contractually difficult to define exactly what that means to a degree where a breach will be clear and enforceable. Furthermore, there are instances where a misguided attempt at being complete can create unintended consequences resulting from a literal (but unintended) interpretation of what’s written. Like patents and intellectual property protection, the most enforceable contracts are often those that are the most general in nature and specify the least.

Obviously, contracts where every precise detail is not highly specified can be more difficult to formally enforce as compared to instances where contractual requirements were complete and understood by all. Here, the concept of “self-enforcing contracts” becomes important (Klein, 2002, p. 59).

3.6 Self-Enforcing Contracts

Self-enforcing contracts refer to social mechanisms besides the threat of legal action or court-enforced outcomes to assure contract compliance. Both principal and agent conform to the terms of the contract because it is in their best interest to do so or they have other reasons for wanting to conform.

3.6.1 *Reasons for Self-Enforcement*

The most common reason for self-enforcement is the desire amongst all parties to continue with future business and contracting relationships. If either agent or principal is unsatisfied, there will be no future relationships, even if all terms of the current contract have been met. Businesses (and future needs) cannot be built or fulfilled on the basis of one completed contract. Multiple, recurring relationships are required. In analyzing the value, each party compares any gains they might achieve by delivering less than optimal performance on the current contract with any gains they expect to receive from future relationships. Mathematically, this can be written:

$$W_1 < W_2 \quad \text{(Klein, 2002, p. 62)}$$

Where W_1 is the current gain from acting in a suboptimal manner and W_2 is the future expected gain from future business relationships. As long as $W_1 < W_2$ (which it almost always should be), it is in the best interest of parties to perform to the expected standard or better, and the contract will be self-enforcing. It is also important to note that the “ W_2 ” in question does not necessarily have to be limited to future relationships with just the current party. This equation also captures the importance and effect of reputation. When a suboptimal transaction occurs, it damages not just the relationship between the two parties involved, but the reputation of the party perceived to be more at fault. The party with the damaged reputation may have trouble entering into business relationships with other parties, not just the one with whom the bad transaction occurred.

3.6.2 *Self-Enforcement in Federal Government Contracts*

The federal government’s contract evaluation system is built upon the principles of self-enforcement. Contract evaluations are not completed with a primary goal of providing constructive feedback from the government (principal) to the agent (contractor). If this were the case, the evaluations would be private documents between the two parties involved in the

transaction. The reality is quite different. The contract evaluations are entered into a government-wide system, for all future prospective government principals to review and consider. Sub-optimal contract performance doesn't just impact the agent's ability to get another contract with the one office of the one agency; it impacts their ability to get future work from all federal government agencies. The government contract evaluation system is clearly set-up to foster self-enforcing behavior amongst prospective agents.

3.6.3 Why Self-Enforcement Works

Many modern transactions and business models are built entirely on self-enforcing relationships. For example, when eBay first started, there was tremendous trepidation amongst buyers and sellers regarding the mechanics of the transaction. After all, these were two parties that had never (and would never) meet, may not necessarily do business again, and were entering into an agreement that would require one or the other to send money or goods in advance of receiving the associated money or goods due in return. To address this, eBay devised a feedback mechanism that is founded entirely on the principles of self-enforcing contracts. Sellers leave feedback for buyers, confirming that they did indeed pay as agreed. Buyers leave feedback for sellers, confirming that they did indeed ship the merchandise in the condition agreed in a timely manner. All future transactors can see and evaluate all feedback. If a buyer has consistent negative feedback for failing to follow through, sellers will not accept their bids. If a seller has consistent negative feedback for failing to provide the merchandise as required, future buyers will refuse to bid. As described in the equation above, all parties are evaluating their benefit from the current transaction, as compared to the benefits from all future transactions they hope to complete. "Bad actors" on both sides of the transaction wash out of the system quickly. Where problems do occur, it can again be traced back to the same equation. Typically, frauds tend to target high dollar amounts. In this case, the amount the "bad actor" hopes to gain from the one fraud exceeds anything he may gain from future legitimate actions. For example, if a fraudster can realize \$10,000 from the fraudulent "sale" of an automobile, future legitimate transactions of CD sales at \$3/each matter little. In this case, $W_1 > W_2$, and we can no longer rely on self-enforcing behavior.

3.6.4 Self-Enforcement Complements Contract Terms and Specifications

Contracts can seldom rely entirely on self-enforcement. In practice, contracts must be

structured to both encourage self-enforcing behavior, but at the same time, be able to fall back on court-enforceable contract terms as well. Neither self-enforcing behavior nor contract terms alone are enough. They must both complement each other. For example, if incentives or penalties (contract terms) were the only force at work, these would still often not be enough to overcome the principal – agent problem. To avoid contractual penalties, an agent must provide only minimal compliance, which is a low standard. While incentives help, they can only go so far. An agent will still act in their own interest, to the extent their own interests are influenced by the incentives. Many times, the agent’s other interests will be valued more highly than the incentives; in this case the agent will be less interested in pursuing the incentives. Sole reliance on contract incentives also assumes that all desirable agent activity is appropriately incentivized, and all incentives are structured such that they encourage accomplishment of intended goals. In practice, neither of these assumptions is generally completely true.

3.6.5. Why Self-Enforcement Alone Isn't Enough

However, it is equally naïve to view self-enforcement alone as enough. There are multiple instances when the fundamental equation of self-enforcement; that $W_1 < W_2$; will not hold true. An agent’s immediate self-interest will be greater than the long term consequences in situations where the immediate self-interest is the highest concern, such as if the current contract (and consequences) are larger than the agent ever reasonably expects to see again. Construction contractors in particular (the agents in this study) have notoriously thin margins; in a situation where there may be no tomorrow (because they are bankrupt or out of business), immediate needs are often valued more heavily than more nebulous future outcomes. Therefore, the most effective view of contract performance relies on a combination of contract terms and self-enforcement mechanisms to ensure the performance desired by the principal.

3.7 Contracting Costs

Even in the best case, costs of contracting for the principal exceed the monetary cost of the contract itself. Within the federal government, there can often be a tendency on the part of many government contracting personnel to view the cost of contracting as equal to the payment given to the agent. This is inaccurate, and omits several relevant costs. As Jensen and Meckling explain in “The Theory of the Firm” (1976), the principal must in fact consider three costs of contracting. These include:

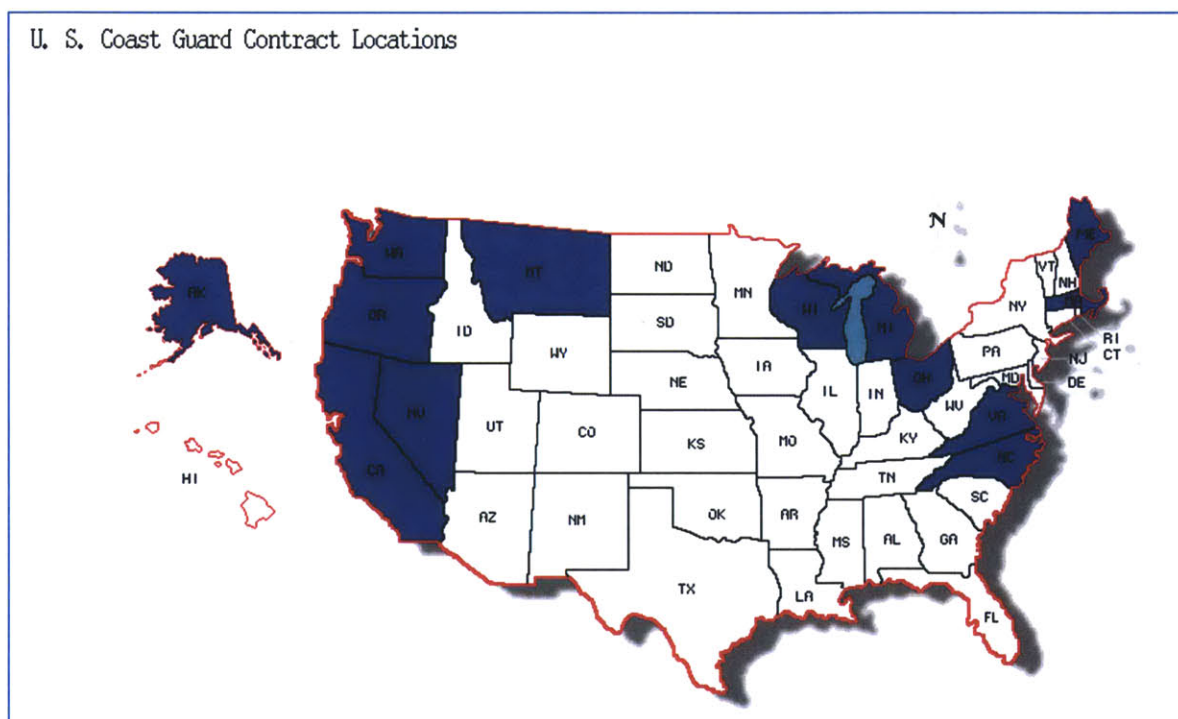
1. The cost of the contract itself (the monies paid to the contractor), including the cost the agent pays to secure bonding (yet another party to guarantee satisfactory completion)
2. The monitoring cost of the contract (government personnel to oversee and administer the contract)
3. The residual loss of the contract. The “residual loss” refers to the inefficiencies where the agent and principal priorities diverge. Regardless of how well a contract is structured, this will always exist.

Contract costs beyond just the monies paid to the agent are key factors which must be considered when evaluating the degree of completeness and contract oversight that is appropriate for a given contract action.

Chapter 4: Projects Selected for Study

4.1 Introduction of U. S. Coast Guard Project Contracts Selected for Thesis

Twenty four projects were selected for this study. The project contracts selected encompass work required to maintain and improve the United States Coast Guard's civil infrastructure. For example, projects included building renovations, marine dredging, tower inspections, wharf and pier repairs, government housing repairs and other similar work at Coast Guard facilities. This homogeneous sample allowed us to reduce the variability and size of the contracting process across Coast Guard contracting offices. To observe some variability in the execution of the contracts, the twenty four projects selected are geographically diverse in nature, with work occurring in thirteen states located throughout the United States, as illustrated in blue in the graphic below:



Graphic created at <http://monarch.tamu.edu/>

*Figure 4-1
Thesis Project Contract Locations*

4.2 Project Contract Selection Methodology

In order to minimize any potential effects of contractor rating bias by a particular office or

individual, multiple U. S. Coast Guard contracting offices provided data on projects they administered. U. S. Coast Guard contracting offices overseeing projects contained in this study include:

1. U. S. Coast Guard Facilities Design and Construction Center Atlantic
Norfolk, VA
2. U. S. Coast Guard Facilities Design and Construction Center Pacific
Seattle, WA
3. U. S. Coast Guard Civil Engineering Unit Juneau
Juneau, AK
4. U. S. Coast Guard Civil Engineering Unit Oakland
Oakland, CA
5. U. S. Coast Guard Civil Engineering Unit Cleveland
Cleveland, OH
6. U. S. Coast Guard Civil Engineering Unit Providence
Providence, RI

Each of the above offices contributed contract data from one to five projects administered by that office. In order to ensure freshness and currency, only recently completed contracts were selected for study. The oldest of the contracts (Project #20, per the list that follows) was completed in September 2008. The most recent of the contracts (#19) was completed in October 2010.

The prime contractors completing the work were also diverse. Contractors ranged from sole proprietorships with only \$50K of estimated annual revenue (Project #18) to large, multi-national contractors, established world leaders in their field, with over half a billion dollars in estimated annual revenue (Project #11). The website www.manta.com was used as the primary source for obtaining annual contractor revenue history.

Likewise, the selected projects also represent a broad spectrum of values. The smallest of the projects (#21) encompassed a mere \$48K of work. The largest (#9) was valued at \$2.8 million.

In summary, projects were selected with the intent of providing the broadest possible spectrum of project location, project size, contractor size and administering office diversity while sharing a common framework (civil infrastructure and repair) to provide a basis for valid

comparisons. Figure 4-2 below summarizes the twenty four projects by contract award amount.

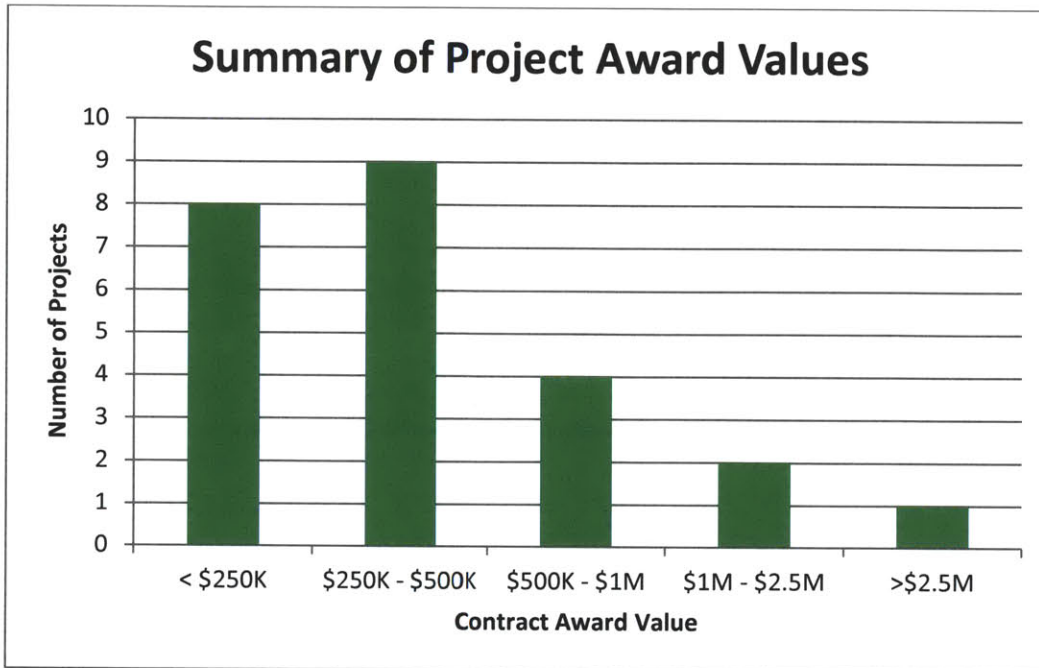


Figure 4-2
Summary of Project Award Values

Details on each of the twenty four projects selected for this study are included on the pages that follow.

4.3 Profile of Projects Selected for Study

Project #1:

Contract Profile:

Description: Abate, prep and paint firing range baffles and all structural steel in the range building.

Award amount: \$256,170

Award date: 09/09/2009

Work location: Virginia

Contractor Profile:

Estimated annual revenue: \$10 to \$20 million

Estimated employees: 50 to 99

Project #2:

Contract Profile:

Description: Replace front light tower on marine Aid to Navigation range

Award amount: \$210,846

Award date: 03/22/2010

Work location: Michigan

Contractor Profile:

Estimated annual revenue: \$1 to \$2.5 million

Estimated employees: 1 to 4

Project #3:

Contract Profile:

Description: Perform inspection and minor maintenance at various Coast Guard towers in California and Nevada. Tower heights ranges from 40 to 300 feet. Evaluate the condition of the structures and identify any maintenance requirements. This includes checking approximately 10% of bolts and all structural elements of the tower and foundation. Minor maintenance includes touch-up coating and replacement of any deteriorated fasteners.

Award amount: \$208,907

Award date: 11/05/2008

Work location: California and Nevada

Contractor Profile:

Estimated annual revenue: \$2.5 to \$5 million

Estimated employees: 20 to 49

Project #4:

Contract Profile:

Description: Repair broken fuel farm facility in response to a casualty report (emergency fix).

Award amount: \$103,950

Award date: 03/04/2008

Work location: California and Nevada

Contractor Profile:

Estimated annual revenue: \$800K to \$1 million

Estimated employees: 1 to 4

Project #5:

Contract Profile:

Description: Replace aircraft hangar clerestory and associated lean-to roof.

Award amount: \$788,069

Award date: 05/28/2009

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #6:

Contract Profile:

Description: Pavement repairs at Coast Guard station

Award amount: \$475,252

Award date: 06/23/2010

Work location: Massachusetts

Contractor Profile:

Estimated annual revenue: \$10 to \$20 million

Estimated employees: 50 to 99

Project #7:

Contract Profile:

Description: Marine dredging at Coast Guard station

Award amount: \$315,400

Award date: 07/15/2009

Work location: Massachusetts

Contractor Profile:

Estimated annual revenue: \$1.4 million

Estimated employees: 6

Project #8:

Contract Profile:

Description: Furnish all labor material, transportation, supervision and disposal to perform small boat mooring improvements. The work includes removal of the existing timber floating dock including moorings, chains and associated hardware; installation of steel pipe piles; installation of concrete floating dock, fender system and utilities; installation of an aluminum gangway and steel support platform; removing, replacing and re-setting existing electrical conduit and incidental related work.

Award amount: \$410,295

Award date: 02/17/2009

Work location: Maine

Contractor Profile:

Estimated annual revenue: \$10 million

Estimated employees: 44

Project #9:

Contract Profile:

Description: Repair cargo wharf

Award amount: \$2,812,479

Award date: 03/26/2009

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #10:

Contract Profile:

Description: Replace siding on government housing units.

Award amount: \$1,812,099

Award date: 12/30/2008

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #11:

Contract Profile:

Description: Replace aircraft hangar EPDM (rubber) roof with new TPO (polypropylene) roof.

Award amount: \$354,690

Award date: 08/21/2009

Work location: Massachusetts

Contractor Profile:

Estimated annual revenue: \$547 million

Estimated employees: 3,000

Project #12:

Contract Profile:

Description: Renovate first floor of Coast Guard Air Station building.

Award amount: \$295,435

Award date: 05/26/2009

Work location: Massachusetts

Contractor Profile:

Estimated annual revenue: \$2.5 to \$5 million

Estimated employees: 10 to 19

Project #13:

Contract Profile:

Description: Remodel government housing units.

Award amount: \$388,000

Award date: 02/24/2009

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #14:

Contract Profile:

Description: Perform inspection and minor maintenance at various Coast Guard towers in Washington, Oregon and Montana. Tower heights ranges from 40 to 300 feet. Evaluate the condition of the structures and identify any maintenance requirements. This includes checking approximately 10% of bolts and all structural elements of the tower and foundation. Minor maintenance includes touch-up coating and replacement of any deteriorated fasteners.

Award amount: \$225,597

Award date: 09/11/2008

Work location: Washington, Oregon and Montana

Contractor Profile:

Estimated annual revenue: \$2.5 to \$5 million

Estimated employees: 20 to 49

Project #15:

Contract Profile:

Description: Repair government housing units.

Award amount: \$96,570

Award date: 12/18/2009

Work location: Wisconsin

Contractor Profile:

Estimated annual revenue: \$410K

Estimated employees: 5

Project #16:

Contract Profile:

Description: Install aircraft wash rack and hot water system.

Award amount: \$458,407

Award date: 07/14/2009

Work location: California

Contractor Profile:

Estimated annual revenue: \$46 million

Estimated employees: 50

Project #17:

Contract Profile:

Description: Asphalt cap, underground storage tank closure and oily water separator replacement

Award amount: \$445,171

Award date: 03/25/2009

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$500K to \$1 million

Estimated employees: 1 to 4

Project #18:

Contract Profile:

Description: Replace lighting in aircraft hangar bay.

Award amount: \$75,346

Award date: 04/21/2008

Work location: North Carolina

Contractor Profile:

Estimated annual revenue: \$45K

Estimated employees: 1

Project #19:

Contract Profile:

Description: Dredge boat basin at Coast Guard station

Award amount: \$186,958

Award date: 01/29/2010

Work location: Michigan

Contractor Profile:

Estimated annual revenue: \$1 to \$2.5 million

Estimated employees: 4 to 10

Project #20:

Contract Profile:

Description: Rehabilitate government housing units

Award amount: \$894,642

Award date: 03/26/2008

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #21:

Contract Profile:

Description: Dredging of small boat berth at Coast Guard station and disposal of the dredge spoils.

Award amount: \$48,375

Award date: 03/22/2010

Work location: Ohio

Contractor Profile:

Estimated annual revenue: \$5 to \$10 million

Estimated employees: 10 to 19

Project #22:

Contract Profile:

Description: Repair exterior of government housing units.

Award amount: \$845,022

Award date: 10/16/2008

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Project #23:

Contract Profile:

Description: Install fire suppression system and 400 Hz power supply system in aircraft hangar

Award amount: \$924,680

Award date: 06/29/2009

Work location: California

Contractor Profile:

Estimated annual revenue: \$46 million

Estimated employees: 50

Project #24:

Contract Profile:

Description: Remodel firehouse berthing

Award amount: \$1,591,236

Award date: 07/01/2008

Work location: Alaska

Contractor Profile:

Estimated annual revenue: \$2.5 million

Estimated employees: 1 to 4

Chapter 5: Research Methodology and Tools

5.1 Data Collection Sources and Methodology

Data collection for each of the twenty-four selected projects was primarily based upon contract performance evaluations in the form of a completed General Services Administration (GSA) Standard Form (SF) 1420 or Defense Department (DD) Form 2626. One is the GSA numbered version of a Defense Department form. As a military service in the Department of Homeland Security, the U. S. Coast Guard tends to use both interchangeably, depending on the preferences of each particular field office. The two forms are identical in purpose, although do have some slight nuances in content. In particular, the DD version of the form provides some additional detail in the rating areas which the GSA version does not. In all cases, the forms are entitled “Performance Evaluation – Construction Contracts” and are directly comparable. These forms provide a comprehensive evaluation of contractor performance on each contract. Per Federal Acquisition Regulation Subpart 42.15, a performance evaluation is required to be completed on all government construction contracts that exceed \$550K, or any construction contract that is terminated for default (i. e., because of unsatisfactory contractor performance leading to an unrecoverable breach of contract terms). Completion of a contractor performance evaluation is optional for projects valued at less than \$550K. By policy, all Coast Guard Civil Engineering Units (CEUs) complete performance ratings for all construction projects they complete, including those less than \$550K. Both the GSA and DD version of the rating forms used by the projects in this thesis are included in Appendix A.

5.2 Contractor Evaluation Areas

Contractors are evaluated in five areas: Quality of Work, Effectiveness of Management, Timely Performance, Compliance with Labor Standards and Compliance with Safety Standards. An overall rating mark is also provided. It is important to note that the marks in the five areas do not directly compute to the overall mark. The rater is free to assign any rating for the overall mark, regardless of the ratings in the specific areas. The overall rating is the single most important box on the form, as it can influence (or potentially disqualify) a contractor from future work. On the GSA version of the form, the overall rating and each of the five areas are rated as “Outstanding”, “Satisfactory” or “Unsatisfactory”. The DD version utilizes the same system, but provides greater fidelity. Each of the five areas is further broken down into by sub-categories,

which are also rated. Furthermore, there is higher fidelity in the ratings themselves. In addition to the three ratings used by GSA, “Above Average” (between Outstanding and Satisfactory) and “Marginal” (between Satisfactory and Unsatisfactory) are options under the Defense Department system.

5.3 Contract Evaluation Completion Responsibilities

Completion of the contractor performance evaluation is initially the responsibility of the Contracting Officer’s Technical Representative (COTR), or if one is not assigned, the Contracting Officer. In general, the government representative that works most closely with contractor personnel in the daily execution of the contract is responsible for completing the performance evaluation. Once a draft evaluation is completed, it is then reviewed by a second individual, generally the Contracting Officer (if a COTR was utilized) or a Supervisory Contracting Officer if a subordinate contracting officer completed the evaluation directly. Following government approval, the draft evaluation is then sent to the contractor being evaluated for their review before final entry into the government wide system.

5.4 Contractor Review and Concurrence with Evaluation

5.4.1 Ramifications of Poor Contract Performance Evaluations

The contractor’s review of their own evaluation is an important step in the process, and one that undoubtedly influences the ratings assigned. If contractor ratings are consistently low, they can be disqualified or otherwise made ineligible in competitions for future contracts, including with other federal government agencies (not just the one rating them). Given these stakes, there is an exhaustive appeal process which a contractor can pursue if he believes a rating has been unfairly assigned. Formal evaluation appeals are relatively unpleasant and time consuming processes for the government, requiring government personnel to provide thorough documentation to support their ratings to an outside source, directly confront contractors with facts, and otherwise consume time and energy that may be better applied administering contracts currently in progress.

5.4.2 Undesirability of Appeals Leads to Inaccurate Ratings

Because the contractor gets to review and appeal an evaluation before final entry into the government system and the appeal process is arduous for the government, there is definitely an often-raised valid criticism that many government raters “go along to get along”. That is to say,

they award an overall evaluation mark that is higher than it legitimately should be, as they know a very low mark will almost certainly generate an unwanted appeal. In fact, this very situation appears to have occurred in one of the projects selected for study. In this case, all responses on the entire form are typed, with the exception of one - the overall rating. For purposes of eligibility for future work, this is the only rating that matters. On this particular performance evaluation, it is possible to see where the originally assigned “Unsatisfactory” mark (which could have led to ineligibility for future work) was (mostly) erased (you can still see the remnants of the left part of the typed “X” in the “Unsatisfactory” box) and replaced by a hand-marked “X” in the “Satisfactory” box. This is shown in Figure 5-1 below.

PART II - PERFORMANCE EVALUATION OF CONTRACT (Check appropriate box)			
9. PERFORMANCE ELEMENTS	OUTSTANDING	SATISFACTORY	UNSATISFACTORY
A. QUALITY OF WORK			X
B. TIMELY PERFORMANCE		X	
C. EFFECTIVENESS OF MANAGEMENT			X
D. COMPLIANCE WITH LABOR STANDARDS		X	
E. COMPLIANCE WITH SAFETY STANDARDS		X	
10. OVERALL EVALUATION			
<input type="checkbox"/> OUTSTANDING (Explain in Item 13, on page 2)	<input checked="" type="checkbox"/> SATISFACTORY	<input type="checkbox"/> UNSATISFACTORY (Explain in Item 14 on page 2)	
11. EVALUATED BY			

*Figure 5-1
Example of an initial “Unsatisfactory” mark being changed prior to issuance*

In all likelihood, the lower mark was assigned by the person most familiar with the contractor performance and later overruled by the supervisory contracting officer who realized that it would be hard to document to an outside reviewer’s satisfaction and/or that it would likely lead to an unwanted appeal.

The tendency to “go along to get along” can present a problem for research and analysis, as it has the potential to skew the data upwards, particularly at the lower end of the spectrum. This thesis addresses this potential problem in several ways.

5.5 Addressing Rating Bias

First, it is important to note that this potential bias is equally shared by the raters of all projects in the study. While many different individuals and offices completed the evaluations, the overall culture of U. S. Coast Guard contracting personnel is shared. If a bias exists in one place, it is a reasonable conclusion that it equally exists in all others. In this research, projects are not

being evaluated on an absolute basis. There are no attempts made to determine whether a particular project was good or bad. Instead, project and contract performance are being evaluated only on a comparative basis, relative to all the other projects and contracts in the research. On a relative basis, any potential bias will generally cancel out, as long as the same potential bias exists on each sample, as is likely the case here.

Next, as explained earlier, the potential for an inaccurately biased rating is greatest on one box of the evaluation, the overall rating. As this is the only rating that impacts future work potential, it is generally the one that contractors most care about and the one most likely to generate a challenge. There is also no requirement to link the overall assigned rating to any of the more specific subcategory ratings on the evaluation. For example, it is permissible to rate a contractor as “outstanding” overall, even if every more specific rating was something less. This phenomenon occurs relatively frequently as well. Since there is a greater potential bias in the overall rating and because it does not naturally correlate with the sub-ratings, the way to avoid a strong bias in this research is to not use the overall assigned rating as a primary basis for comparison, as explained below.

5.5.1 Computing Overall Performance Rating in Lieu of Assigned

Instead of using an overall rating assignment that may be subject to inordinate rater bias, the subcategory ratings can be used to construct a more accurate and higher fidelity depiction of the contractor performance rating. In order to do this, some judgment is required regarding the most important aspects of contract performance. As a former Contracting Officer’s Technical representative, an experienced U. S. Coast Guard construction project manager and licensed professional engineer, I am relatively well qualified to make these subjective judgments regarding compiling subcategory ratings into a calculated overall rating. The methodology applied is as described below.

5.5.1.1 Weighting Performance Dimension Subcategories

All subcategories within a rating area were initially assumed to be of equal importance with a weighting factor of 1. If a particular subcategory was deemed to be of higher importance than another, it was assigned a higher weighting factor.

The first rating area is “Quality”. Subcategories include:

- a. Quality of Workmanship
- b. Adequacy of the Quality Control Plan
- c. Implementation of the Quality Control Plan
- d. Quality of Quality Control Documentation
- e. Storage of Materials
- f. Adequacy of Materials
- g. Adequacy of Submittals
- h. Adequacy of Quality Control testing
- i. Adequacy of As-Builts
- j. Use of Specified Materials
- k. Identification/Correction of Deficient Work in a Timely Manner

The most important factor in the “Quality” area is clearly “Quality of Workmanship”. Many of the other factors speak to process, whereas “Quality of Workmanship” speaks to results. The single most important factor in judging contract success is the quality of the product. For this reason, “Quality of Workmanship” was assigned a weighting factor of “5”, indicative of being 5 times more important than the standard factor.

Adequacy of As-Builts is another factor that is worthy of above baseline importance. Following job completion, the As-Built drawings are the customer’s primary tool to maintain the facility or work. If the As-Builts are inadequate (or wrong), this can be very difficult to do. For this reason, “Adequacy of As-Builts” was assigned a weighting factor of “2”.

Regardless of how good a contractor may be, some mistakes will always occur. It is the nature of the business in large construction contracts. The true mark of quality can be found in how a contractor reacts and responds to mistakes. Does the contractor actively seek to identify and self-correct any mistakes before they cause an impact, or does he seek to hide them as best he can, then argue about how it’s not a mistake at all once discovered? A contractor’s approach to mistakes directly impacts both the quality of the final product, and the experience of administering the contract. For these reasons, “Identification/Correction of Deficient Work in a Timely Manner”, was assigned a weighting factor of “3”.

All other subcategories were left with a weighting factor of 1. The rating in each subcategory was averaged (multiplied by its weighting factor, if applicable) for a rating within the quality category. For purposes of quantification, the following numerical scale was used:

Outstanding = 5
Above Average = 4

Satisfactory = 3
Marginal = 2
Unsatisfactory = 1
Not Applicable = Not factored in rating

The second rating category is “Effectiveness of Management”. Within this category, there are the following subcategories:

- a. Cooperation and Responsiveness
- b. Management of resources/personnel
- c. Coordination and control of subcontractor(s)
- d. Adequacy of site clean-up
- e. Effectiveness of job-site supervision
- f. Compliance with laws and regulations
- g. Professional conduct
- h. Review/resolution of subcontractor’s issues
- i. Implementation of subcontracting plan

Each of these subcategories was judged roughly equal in importance, leaving the weighting factor for each at “1”. No weighting was used within the Effectiveness of Management category.

The third rating category is “Timely Performance”. Within this category, there are the following subcategories:

- a. Adequacy of initial progress schedule
- b. Adherence to approved schedule
- c. Resolution of delays
- d. Submission of required documentation
- e. Completion of punchlist items
- f. Submission of updated and revised progress schedules
- g. Warranty response

Within “Timely Performance”, each of these subcategories was judged roughly equal in importance, leaving the weighting factor for each subcategory at “1”. No weighting was used in this category.

The fourth performance rating category is “Compliance with Labor Standards”. Subcategories include:

- a. Correction of noted deficiencies
- b. Payrolls properly completed and submitted

c. Compliance with labor laws and regulations

The fifth rating category is “Compliance with Safety Standards”. Subcategories include:

- a. Adequacy of safety plan
- b. Implementation of safety plan
- c. Correction of noted deficiencies

Within the Compliance with Labor and Compliance with Safety categories, all subcategories were again weighed equally. No weighting was used in this category. It is also important to note that neither of these categories generally represents a significant performance differentiator. In all instances of the projects under study, all “Compliance with Labor” and “Compliance with Safety” subcategory ratings on all projects were rated at “Satisfactory” or higher. Compliance with labor and safety law tends to be a pass/fail activity – a contractor either does it or they don’t. As non-compliance with labor and safety law can often lead to termination, non-compliance tends to be rare and is not typically a performance differentiator for completed contracts.

Within the five performance categories, the only category that required a weighted average within the subcategories to more accurately reflect the importance of the subcategory ratings was “Quality”. Within all other categories, straight averages of the subcategory performance ratings can be used. Once a rating for each of the five performance categories has been tabulated, an overall rating can be computed.

5.5.1.2 Weighting Performance Dimension Categories

As with the subcategories within each, each of the five categories varies in importance with regard to overall contract performance. The top measure of performance on any contract is the quality of the product produced, as this is the tangible result. If the product is of low quality, it matters not whether it was done quickly or managed effectively. More than anything, the customer expects, deserves, and pays for quality. After quality, timeliness is next in importance. Projects are planned and executed in order to meet an emergent need. If the project is not completed on time, emergent needs can be left unfilled pending completion. Timeliness is important as well. After timeliness, effectiveness of management is next in order of importance. However, management effectiveness often manifests itself in quality and timeliness, with results already reflected there. Where management effectiveness does not directly manifest in quality or

timeliness, it is only reflective of the relationships between the contractor and government contracting personnel, which are relatively invisible (and unimportant) to the end-user of the project. As a stand-alone category, management effectiveness is less important than quality and timeliness.

As mentioned earlier, “Compliance with Labor” and Compliance with Safety” are not typically differentiators when comparing completed construction contracts. As such, neither factor was used in determining the overall computed contract rating. Further discussion follows in the sensitivity analysis.

Consistent with the explanations above, the following weightings were assigned to each performance area to determine an overall computed contract rating:

- 50%: Quality
- 30%: Timeliness
- 20%: Effectiveness of Management
- 0%: Compliance with Labor
- 0%: Compliance with Safety

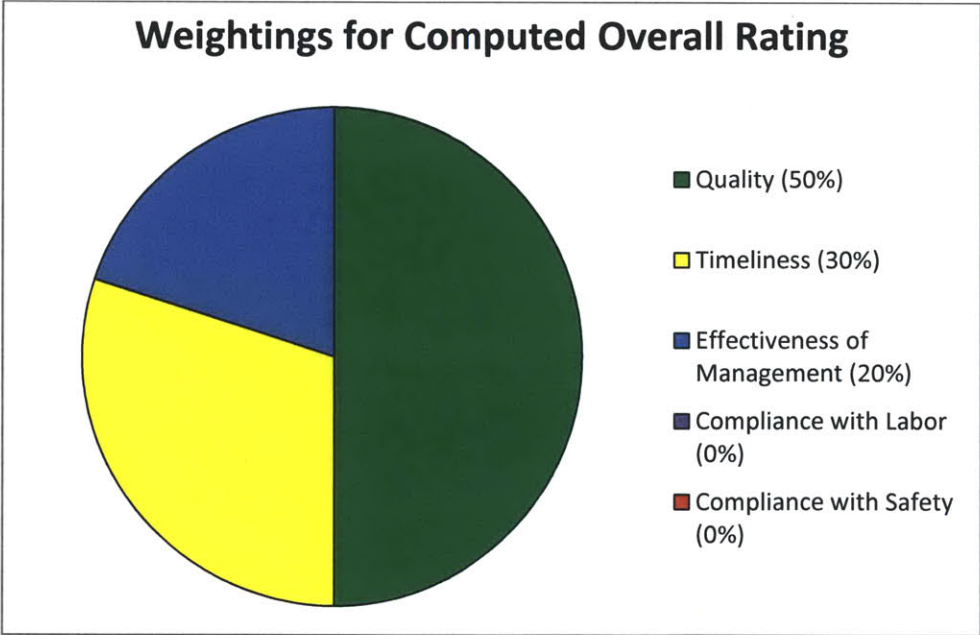


Figure 5-2
Weightings for Computed Overall Rating

As stated earlier, part of the intent behind the computed performance rating (vice simply using the overall rating assigned by the contracting officer) was to remove the “go along to get along” rating bias. However, it is equally important to not lose the character and intent of the originally assigned rating either. Another reason for the computation of an overall rating was to provide a higher fidelity basis for comparison. The overall rating provides but one data point, in all cases either a “3”, “4” or “5” which are discrete values that do not provide sufficient variability. However, the proposed weighting method converts these scores into continuous variables which provide a higher level of fidelity without significantly altering the results. Incorporation of all data into a numerically computed overall rating provides more differentiation and more basis for comparison across projects. That said, care must be taken to assure that the computationally determined overall ratings provide a realistic assessment of contractor performance and rater intent.

5.5.1.3. Sensitivity Analysis and Validation of Computed Rating

A brief sensitivity analysis can provide insight and validation for the weighting and methods used.

The average of the contracting officer assigned rating across all projects in the study was 4.21 with a standard deviation of 0.91. The average computed rating using the methods described above was similar at 4.09 with a standard deviation of 0.90, generally indicating both an accurate capture of the rater’s intent and a near exact preservation of the range of differences between the ratings. The average absolute value of the difference between the assigned and computed ratings was 0.26, again relatively small. Additionally, the weightings chosen were varied (also including Compliance with Labor and Safety) in order to see if the relative rankings of the projects by the overall computed rating changed significantly; they did not. It is fair to say the methods used to model an overall rating are consistent with both the assigned ratings and rating intent.

However, it is equally important to determine that the computational method eliminated some of the “go along to get along” bias, as was the original goal. This can best be seen by more closely examining the

example cited in Figure 5-1 where the overall rating was obviously changed from “Unsatisfactory” (equates to a 1 on the numerical scale) to “Satisfactory” (3). Examining this example, the computational rating is only 1.6, as compared to the official assigned overall rating of 3. The difference of 1.4 is the only data point where the difference between the computational and assigned rating exceeds twice the standard deviation (0.3) of the absolute value of the difference between the two. In other words, the computational system worked by devaluing what

*Table 5-1
Computed Performance Rating
Sensitivity Analysis*

	Overall Rating (Eval)	Overall Rating (Comp)	Delta (Abs Value)
	3	3.00	-
	5	4.43	0.57
	5	4.46	0.54
	5	5.00	-
	3	3.40	0.40
	5	4.97	0.03
	5	4.59	0.41
	5	4.71	0.29
	5	4.51	0.49
	5	4.67	0.33
	4	4.39	0.39
	5	4.82	0.18
	3	1.60	1.40
	3	3.01	0.01
	4	4.35	0.35
	3	3.00	-
	5	5.00	-
	5	5.00	-
	4	4.03	0.03
	5	4.89	0.11
	5	4.82	0.18
	3	2.94	0.06
	3	3.03	0.03
	3	3.54	0.54
Average	4.208333	4.09	0.26
Std Dev	0.91192	0.901761	0.30

appears to be a “go along to get along” rating in favor of one computed using subcategory ratings that are more indicative of the rater’s true intent.

As seen by Figures 5-3 and 5-4 below, the distribution of the assigned and computed ratings are identical, with the exception of the “go along to get along” rating falling from “Satisfactory” to “Unsatisfactory”, as desired.

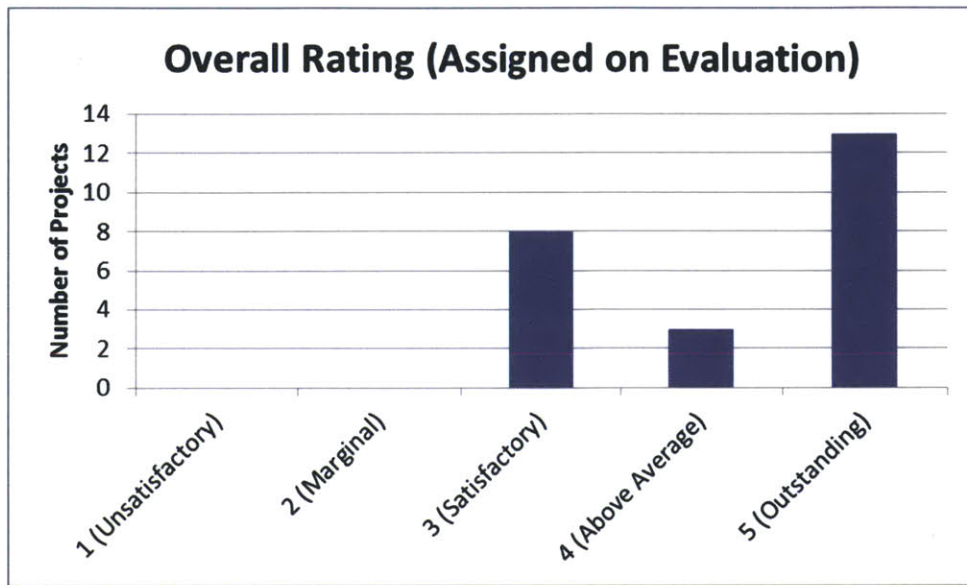


Figure 5-3
Overall Rating (Assigned on Evaluation)

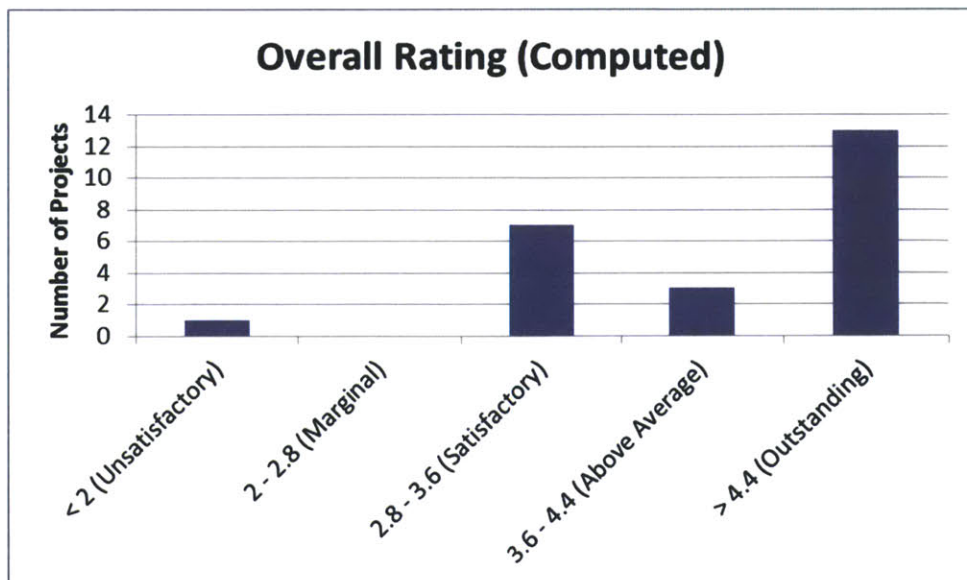


Figure 5-4
Overall Rating (Computed)

The substitution of the computationally determined overall rating for the assigned rating accurately captures the rater's intent, provides greater fidelity for comparison, and appears to eliminate some "go along to get along" bias. Therefore, the computationally determined rating is a valid and more accurate basis for comparison across project contracts.

Chapter 6: Research Results

6.1 Contract Performance Metric Introduction

Once the overall contract performance rating has been computed, that and other contract performance metrics can be compared and plotted against contract demographical information. Contract performance data can be measured or expressed using the following metrics:

1. Overall Contract performance rating
2. On time performance (contract award days as compared to actual contract performance time)
3. On-budget performance (contract award amount as compared to total final contract price, including all modifications)

6.2 Contract Demographic Metric Introduction

Each of these performance factors is then compared to contract demographical information, to include:

1. Contractor size (as measured by revenue)
2. Contractor size (as measured by total employees)
3. Relative contract size (ratio of contract value to overall contractor revenue)
4. Contractor employee efficiency (total revenue per employee)

6.3 Twelve Points of Thesis Comparison

In the sections that follow, each of the three expressions of contract performance will be compared to the four characterizations of contract demographic information (12 total means of comparison) in a search for trends and correlations that can serve as predictors for contract success as defined by higher than average performance dimensions, based on the demographic being considered.

Statistical regression techniques were used to determine trends and their strength. Specifically, the coefficient of determination (the R squared value) will be used as a metric of the degree of correlation.

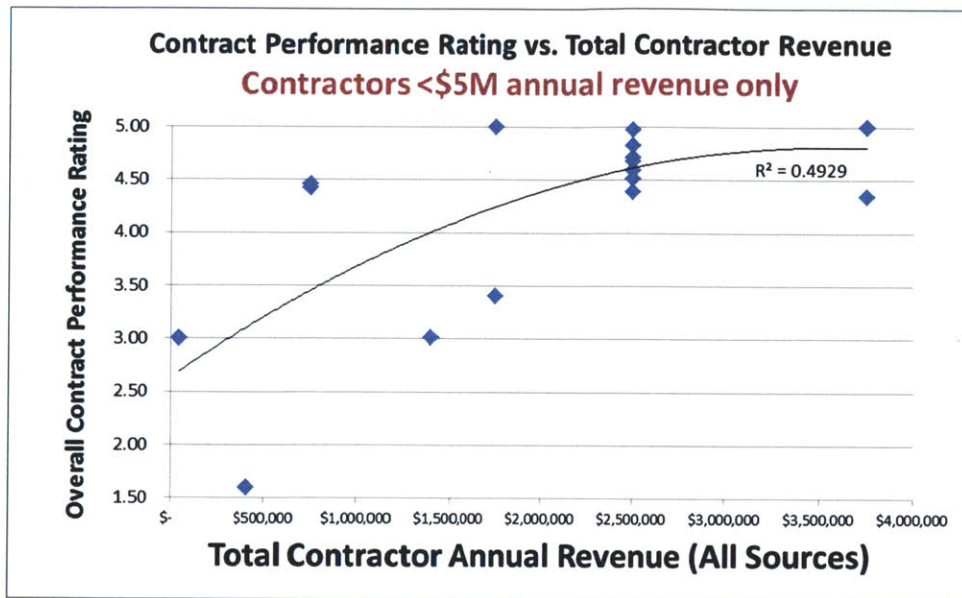


Figure 6-2
Contract Performance Rating vs. Total Contractor Revenue
(Small Contractors Only)

The results are much different when only small contractors are considered. There is a strong trend (spanning more than 2 points in performance rating, the difference between not quite satisfactory and outstanding) that is also strongly correlated. The worst performers were those contractors with very low revenues, the best performers tended to be at the higher end of “small” (between \$2M and \$4M in annual revenue). While it is not possible to say “bigger is better” with respect to contract performance (see the results of Figure 6-1), it is entirely fair to say that there is such a thing as too small. Amongst small contractors, the ones with at least \$2.5M in estimated total annual revenue returned overall higher performance as a group, and were shown to perform significantly better than very small contractors.

6.4.2. Contract Performance Rating vs Contractor Size (as measured by total employees)

Contract performance rating as compared to total contractor employee is shown in Figure 6-3 below.

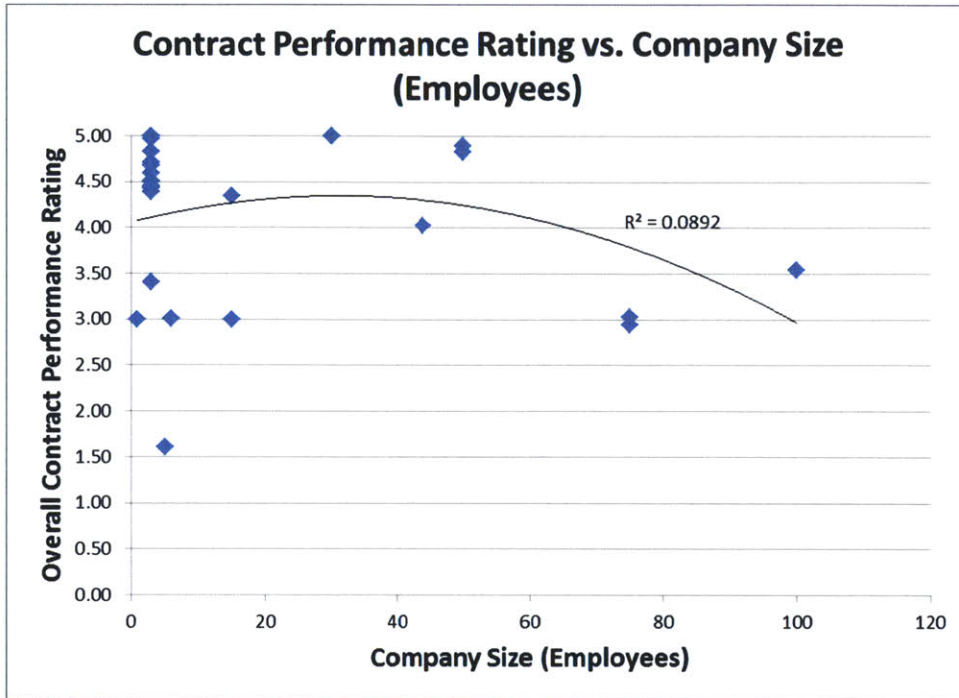


Figure 6-3
Contract Performance Rating vs. Company Size (Employees)

Similar to the results as measured by revenue, Figure 6-3 suggests that a company can indeed be too small. The overall performance rating of very small companies (1 or 2) employees is slightly less than that of larger companies, with an optimum size of around 30 employees, as shown in the above graphic. Performance ratings tail off in larger companies, perhaps suggestive that some of the “personal touch” may be lost. Also note that the strength of the correlation ($R^2 = 0.09$) is relatively weak. As before when making comparison based off revenue, the majority of the contractors in this study are small, and some fidelity is lost by comparing contractors of all sizes. The comparison is run again below, this time including only contractors with 3 to 15 employees. Results are shown below in Figure 6-4.



*Figure 6-4
Contract Performance Rating vs. Company Size (Employees)
3-15 Employees Only*

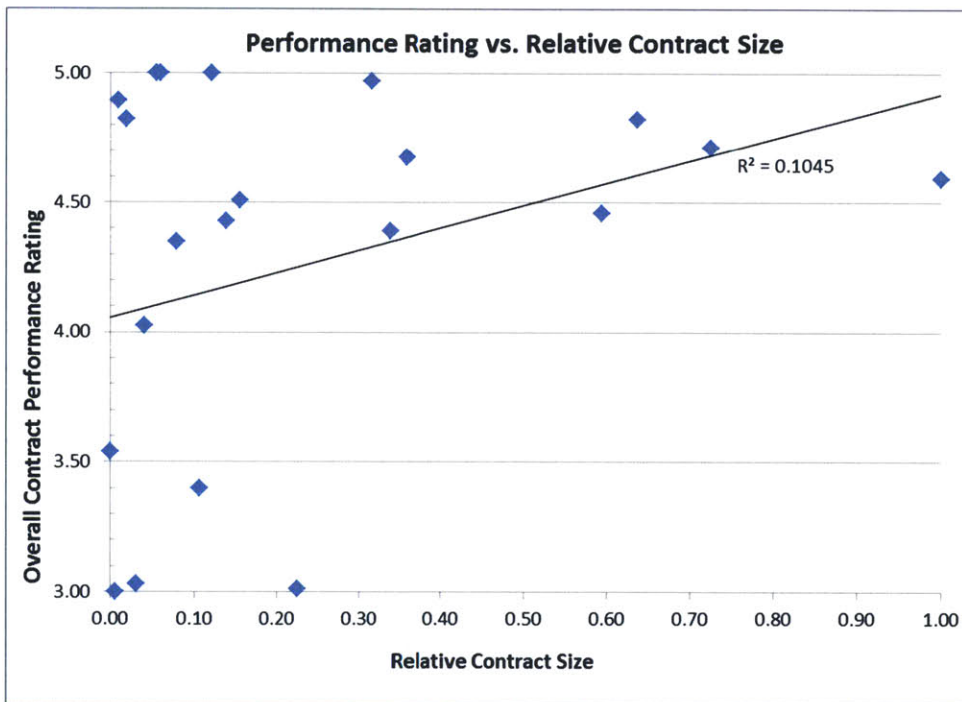
It is clear from Figure 6-4 that the majority of the high performers in this study were found in companies with 3 people. While performance does appear to initially tail off before climbing again, it is also important to note the small size of the sample (only four companies where employee size is greater than three).

6.4.3. Contract Performance Rating vs Relative Contract Size (ratio of contract value to overall contractor revenue)

The preceding two sections made comparisons based on absolutes. Instead of using absolutes, it may be more insightful to compare contracts on a relative basis. That is to say, not just performance based on total contract revenue or total employees, but rather performance as compared to the contract revenue or employees *relative* to that company and contract. A \$1M contract for a company with \$2M in annual revenues (representing half of the annual business) is much different in terms of impact (and ostensibly, how it is approached) than the same \$1M contract for a company with \$500M in annual revenues. In order to make comparisons on this level, the “relative contract size” metric is introduced.

“Relative Contract Size” is defined as the size of the contract, relative to the size of the

company. In terms of revenue, this equates to the ratio of the contract value as compared to all other revenue for a contractor in a given year. For example, a \$1M contract awarded to a company with \$10M in annual revenues has a relative contract size of 0.1 (\$1M/\$10M). The relative contract size is the percentage of business that a particular contract represents for a company, which may be indicative of the relative amount of attention that contract receives from the company. Relative contract size is also a useful metric for comparing companies and contracts of varying sizes, since the absolute size does not matter, only the relative size. The correlation of performance and relative contract size is shown in Figure 6-5 below.



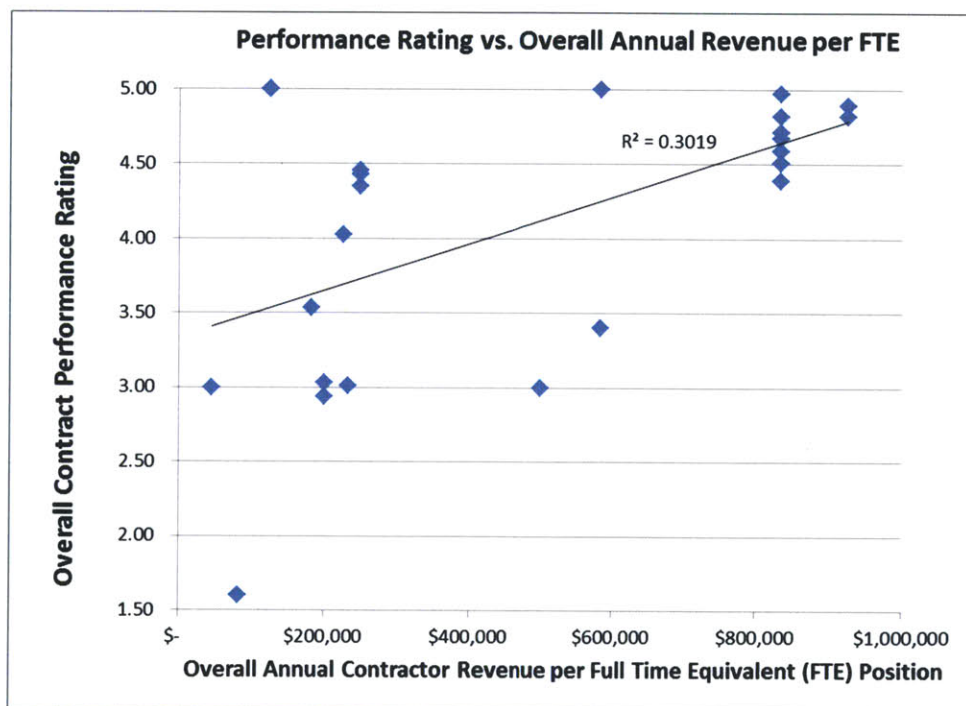
*Figure 6-5
Contract Performance Rating vs. Relative Contract Size*

Figure 6-5 illustrates a rather compelling upward trend for increased performance with increasing relative contract size. When a contract represented a very small percentage of overall revenue, performance was often “satisfactory” (i. e., average). This can be characterized by meeting all contract terms and requirements, but falling far short of the level of delight. As relative contract size increased, so did performance. Performance ratings where a contract represented all or most of company’s revenue were nearly a full point higher than in instances where the revenue contributions were minimal. As might be surmised, the data support that bigger customers (relative to what constitutes “big” for the company) matter and often benefit

from a higher level of performance.

6.4.4. Contract Performance rating vs Contractor employee efficiency (total revenue per employee)

Just as revenue can be measured on a relative basis, employees can as well. Rather than thinking in terms of absolutes, it may be more insightful to compare employees in terms of how many full time positions are required to achieve revenue. Employee efficiency is defined in terms of total revenue per employee. Employee efficiency as compared to the contract performance rating is shown in Figure 6-6 below.



*Figure 6-6
Contract Performance Rating vs. Overall Annual Revenue per FTE*

The overall contract performance rating improves considerably as employee efficiency improves, with an observed difference of nearly a rating point and a half. Companies with healthier revenue per employee perform better.

6.5 On-Time Performance

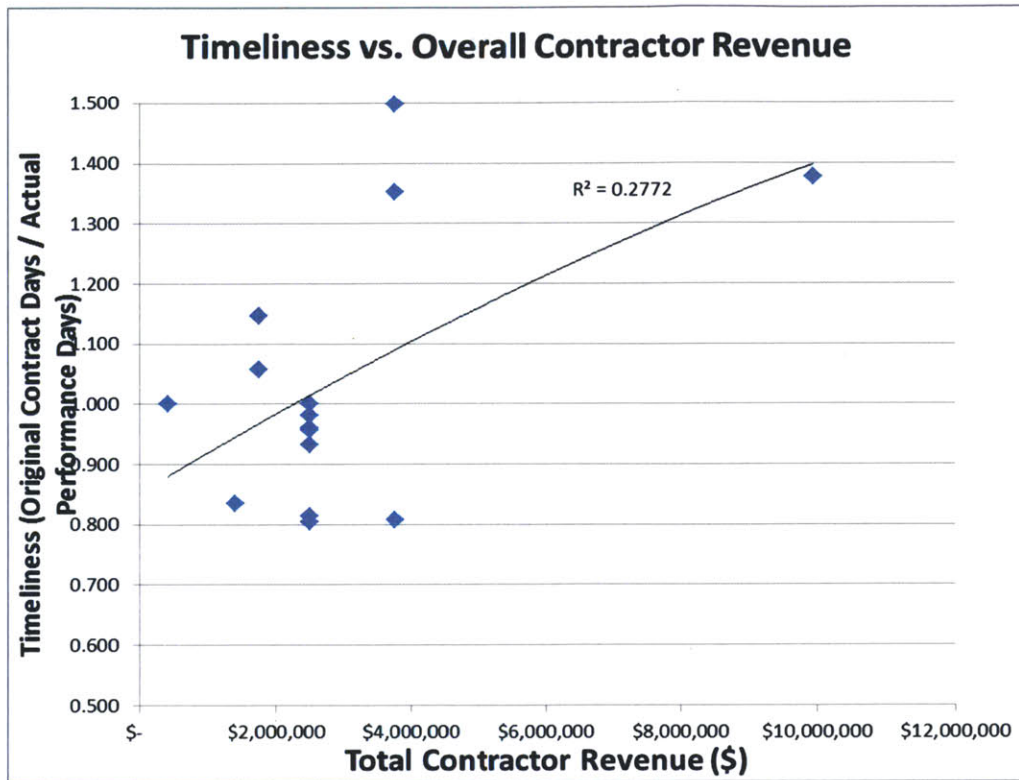
In addition to using an overall performance evaluation rating as a metric of performance, there are other quantitative metrics available that provide insight into contract performance. When a firm fixed price contract (i. e., all contracts in this study) is initially awarded, it is

awarded at a given price, with completion to occur by a given date. When the work is completed, the owner (the U. S. Coast Guard in this case) approves and accepts the work, noting the acceptance date, which is often different than the initially agreed upon completion date. Over the course of the contract, both parties will occasionally agree to extend the acceptance date. There can be many reasons for extension, including additional work added to the contract, unexpected site conditions that were discovered once work had begun, or very often, indifference (the deadline wasn't that important in the first place). Because reasons for extension differ, are sometimes granted for valid reasons (i. e. added scope after award) and sometimes not (indifference), any extensions were ignored in the following analysis. "On time" has been defined simply as whether the work was accepted by the initially agreed upon date.

The degree to which a project is completed on time is expressed as the ratio between the original award time and actual performance time. A ratio of "1" indicates that the project finished exactly on time, ratios greater than "1" indicate a late project (for example, a ratio of "2" means the project took twice as long as agreed) and ratios less than "1" indicate the project finished before the contractually agreed due date (for example, a ratio of 0.5 means the project was completed in half the agreed upon time).

6.5.1. On time performance vs. Contractor Size (as measured by revenue)

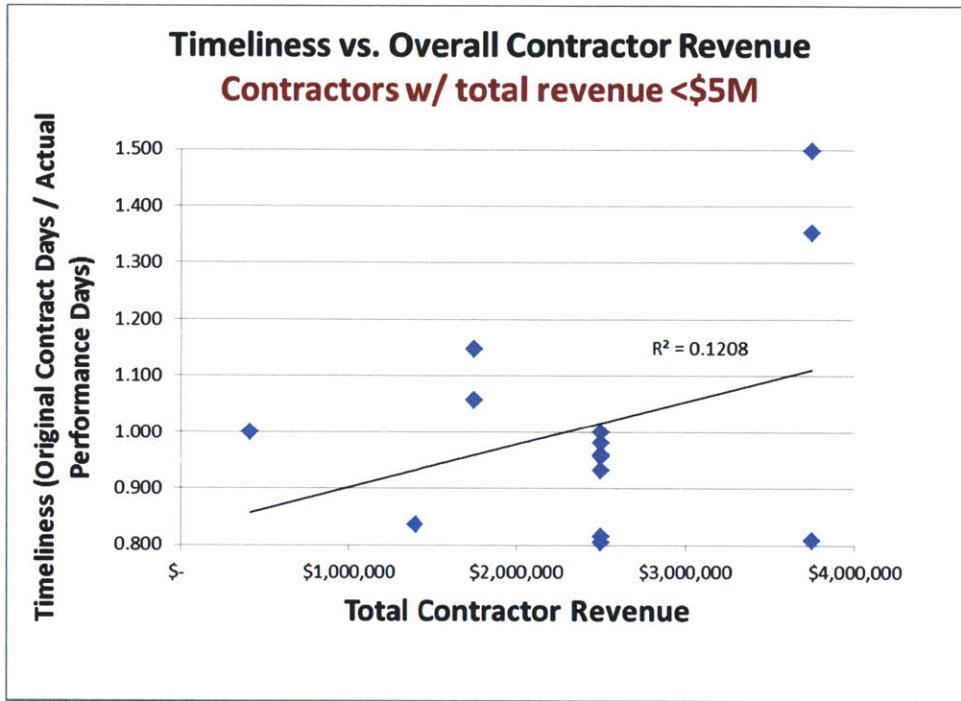
As shown in Figure 6-7 below, there is an inverse correlation between overall contractor revenue and propensity to finish on time. Small contractors of \$2.5M in revenue or less were likely to finish early, whereas larger contractors were shown to finish late. Intuitively, this makes sense. Small contractors are unable to keep expensive capital equipment and resources tied up on a job site – they need it back in order to move on to the next job. Larger contractors are likely to have more equipment and more capital, and may not feel the same time pressure to complete a given job. The link between time and money is much more defined and precious when deployed capital is important.



*Figure 6-7
Timeliness vs. Overall Contractor Revenue*

As before, it is again worthwhile to see if the trends illustrated in Figure 6-7 are present when only very small contractors are examined. The same analysis, only limited to contractors with \$5M or less in annual revenue is shown below in Figure 6-8.

As Figure 6-8 illustrates, the results are exactly the same when only small contracts are included. If on time performance is a goal, the smaller contractors perform better than larger ones.



*Figure 6-8
Timeliness vs. Overall Contractor Revenue
Contractors w/ Total Revenue < \$5M*

6.5.2. On time performance vs. Contractor Size (as measured by total employees)

In addition to comparing to size as measured revenue, on-time performance can also be compared to size in terms of total employees. That comparison is shown in Figure 6-9.

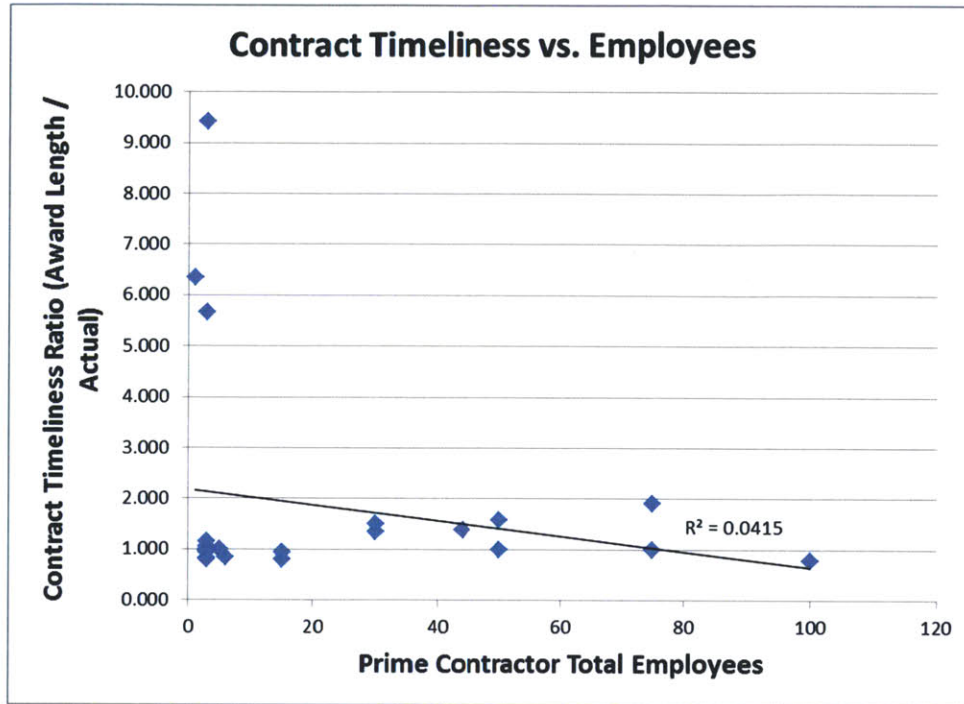


Figure 6-9
Contract Timeliness vs. Employees

Interestingly enough, while the correlation is not strong (indicated by the weak coefficient of correlation), timeliness with regard to size as measured by employees is the opposite as timeliness as size measured by revenue. Timeliness is better amongst companies with more employees. Again, this intuitively makes sense. In larger companies, there is more of a “bench” of employees that can step in to complete the work if a project starts to fall behind of the primarily assigned employees are unavailable.

The trends of higher revenue companies being less timely and higher employee companies being more timely seems to present an apparent contradiction, as it is natural to equate high revenue companies with high employee companies. To help resolve this, section 6.5.3 below will evaluate timeliness based on *revenue per employee*.

6.5.3. On time performance vs. Relative Contract Size (ratio of contract value to overall contractor revenue)

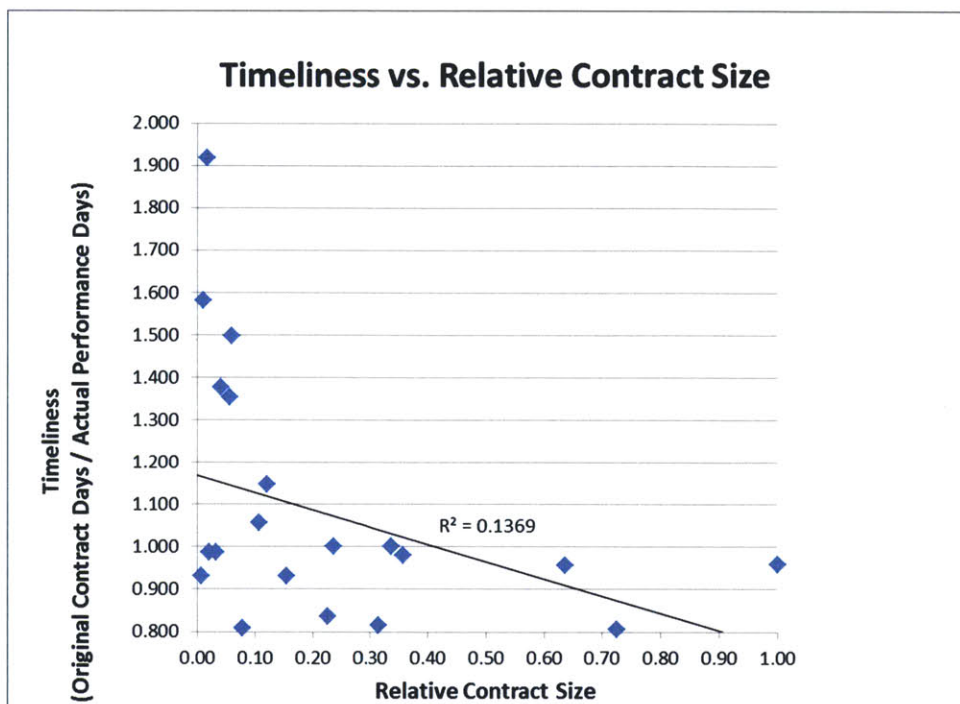


Figure 6-10
Timeliness vs. Relative Contract Size

Relative contract size is a measure of the percentage of total revenue constituted by the project being evaluated. As Figure 6-10 illustrates, timeliness improves as the relative contract size grows. This trend is very apparent in the data above, even lacking statistical analysis – the data is concentrated in left corner of the graph in a triangular distribution. A contract of large relative size is important to a company’s bottom line. As such, it is equally important that the customers be satisfied, and one key way to deliver customer satisfaction is to deliver on time or earlier.

There are also network effects regarding total revenue as well. When one relatively small project (most projects in this study) comprises a large percentage of revenue, that also suggests that the total revenue is relatively modest as well. When revenues are small, it is important to finish the work to regain use of the capital equipment, as discussed in Section 6.5.1 above.

6.5.4. On time performance vs. Contractor employee efficiency (total revenue per employee)

To help resolve the apparent contradictions between size as measured by revenue and size as measured by employees as discussed in Sections 6.5.1 and 6.5.2, it is also insightful to measure timeliness against *revenue per employee*, effectively combining the two size metrics.

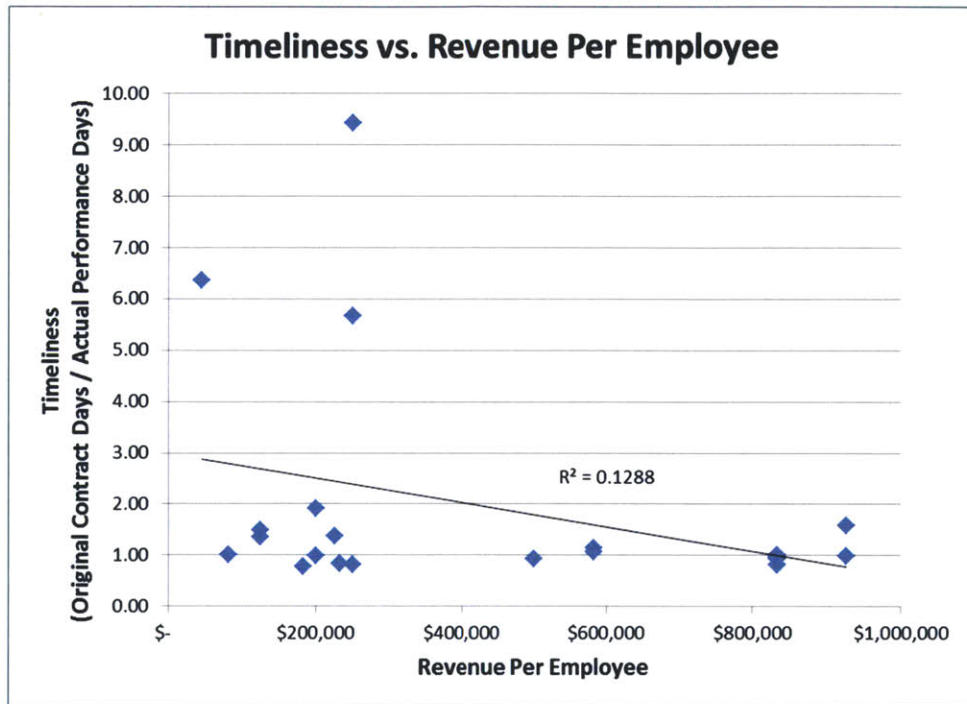


Figure 6-11
Timeliness vs. Revenue per Employee

As illustrated by figure 6-11, timeliness improves as revenue per employee increases. Regardless of whether a company has many employees or few, large revenue or small, being late eats into profit margins. Being late means that personnel are taking longer than expected, being paid for those hours, which means being paid more than planned. Being late means that capital equipment is tied up longer than expected, preventing it from being used to earn money in other places.

Finishing on-time or early is both a requirement for companies to be profitable, and a mark of profitable companies. Efficiently run, profitable companies would also expect to have a higher revenue per employee, as compared to other companies in the same industry.

It is important to note the strong differences in timeliness between low revenue per

employee companies and high revenue per employee companies. As measured in this study, a low revenue company per employee company takes 3 times as long as agreed to finish, whereas a high revenue per employee company typically finishes on time or early. This range is much, much greater than the range of timeliness when dealing in absolutes (as compared to the difference between 0.9 and 1.4 when comparing by absolute revenue and the difference between 1 and 2 when comparing by total employees). In other words, the concept of revenue per employee is highly important when examining the likelihood of timely performance.

6.6 On-budget performance

The final contract performance metric that will be discussed is the degree to which a project is completed at the initially agreed upon price. The firm-fixed-price contracts in this study were initially awarded at a set price, either as a result of an agreed-upon negotiation (22 projects in the study) or by having the lowest price amongst a field of offerors in a sealed bidding environment (2 contracts). As with extensions for time, there are many reasons the price of a contract can be increased after award, some good, some bad. Good reasons for a price increase include new scope added to the contract after initial award or site conditions that could not have been reasonably anticipated prior to beginning work. Bad reasons for price increases include a mistake in bid, poor planning or lack of understanding regarding the work involved to the point where the project owner (government) feels it would be unreasonable to require the contractor to perform in accordance with the previously agreed terms. As with time extensions, this study does not attempt to differentiate contractual price increases based on a level of perceived justness, but rather simply compares the initially agreed upon contract amount to the final price paid. As with time extensions, this is expressed as the ratio between final price and initial price. Anything higher than 1 indicates a contract that cost more than initially agreed. While somewhat rare, anything less than 1 indicates a contract that cost less than initially agreed. In the terms of the construction industry, the ratio of final price to initial price is referred to as the “modification ratio”, or “mod ratio” for short.

6.6.1. On-budget performance vs. Contractor Size (as measured by revenue)

As illustrated by Figure 6-12 below, on budget performance of small contractors gets better as total contractor revenue increases (there is no strong correlation amongst contractors of all sizes). This is likely indicative of higher revenue contractors being more able to absorb unplanned costs, and being less likely to be judged as a “hardship case” by a government contracting officer. Also, higher revenue contractors are typically more experienced and use more sophisticated estimation tools, which result in a better estimation of true job costs up-front and less likelihood of needing to ask for increases later. The difference in the mod ratio between very small and larger contractors is relatively large (~30% of total project costs, a very significant amount) .

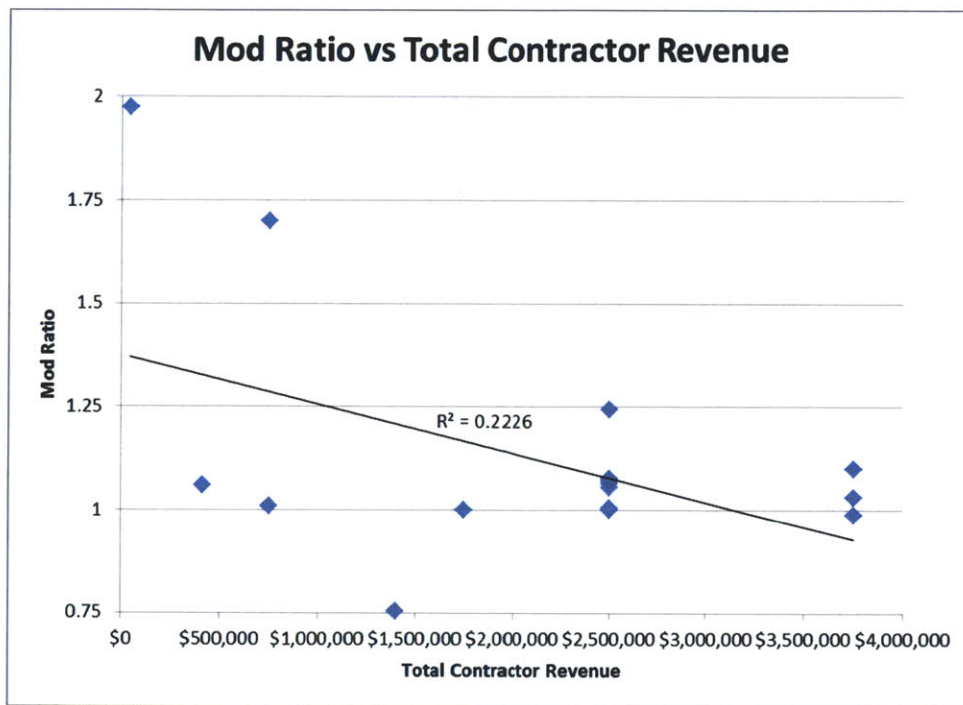
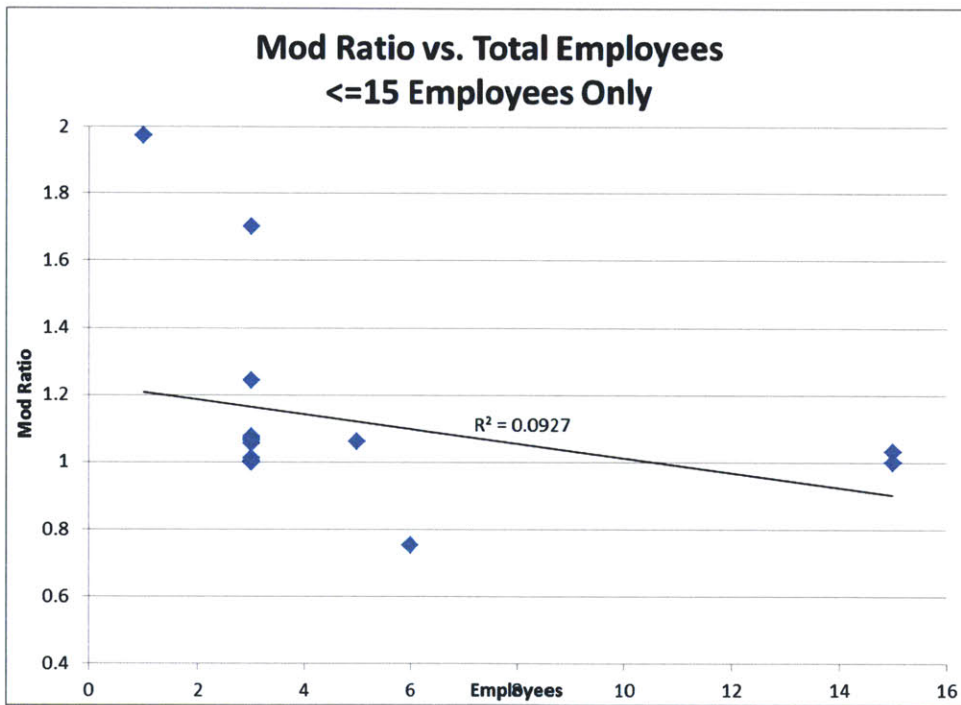


Figure 6-12
Modification Ratio vs Total Contractor Revenue

6.6.2. *On-budget performance vs. Contractor Size (as measured by total employees)*

As illustrated by Figure 6-13 below, on-budget performance as a function of total employees tracks largely the same as on-budget performance as a function of total revenue, for largely the same reasons. As the number of employees increases, on budget performance improves in a relatively identical manner as seen when on-budget performance is compared against revenue. Note that the coefficient of correlation is relatively weak.



*Figure 6-13
Modification Ratio vs Total Contractor Employees
< 15 Employees Only*

6.6.3. On-budget performance vs. Relative Contract Size (ratio of contract value to overall contractor revenue)

As illustrated by Figure 6-14 below, the relative contract size does not appear to be an important factor in the likelihood of a contract modification.

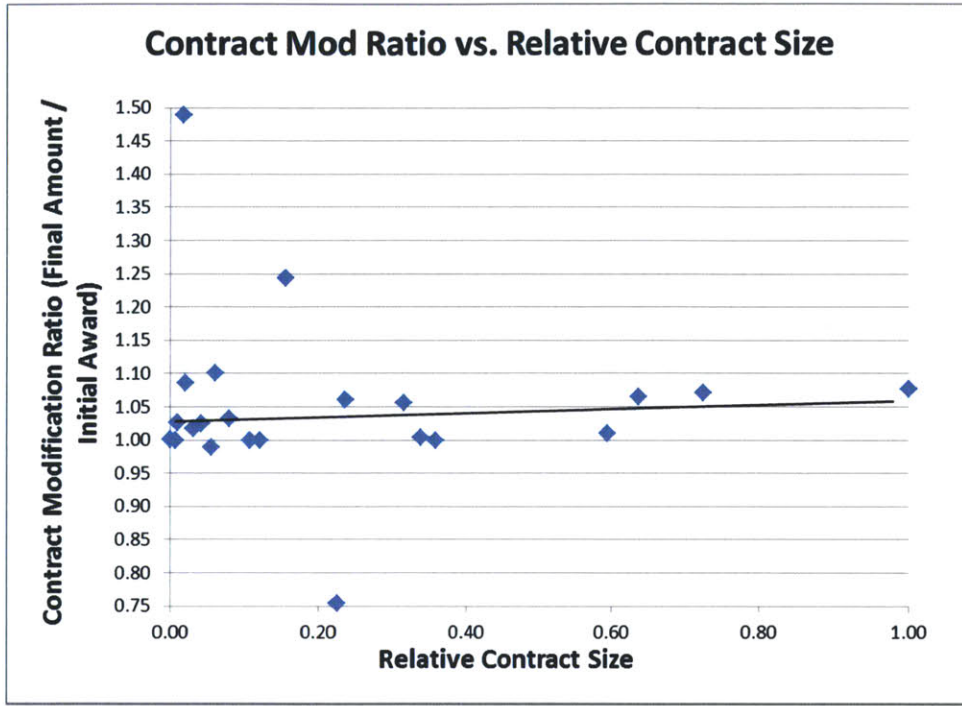


Figure 6-14
Contract Mod Ratio vs. Relative Contract Size

6.6.4. On-budget performance vs. Contractor employee efficiency (total revenue per employee)

As one might expect, the higher modification ratios appear to be associated with companies where the revenue per employee is comparatively weak, as illustrated in Figure 6-15 below. As shown, the extreme cases of high mod ratios (40% above base or greater) all occurred in companies with comparatively weak revenues per employee. In low revenue per employee companies, every dollar counts, and the company is relatively more likely to aggressively seek out modifications that increase the baseline contract amount.

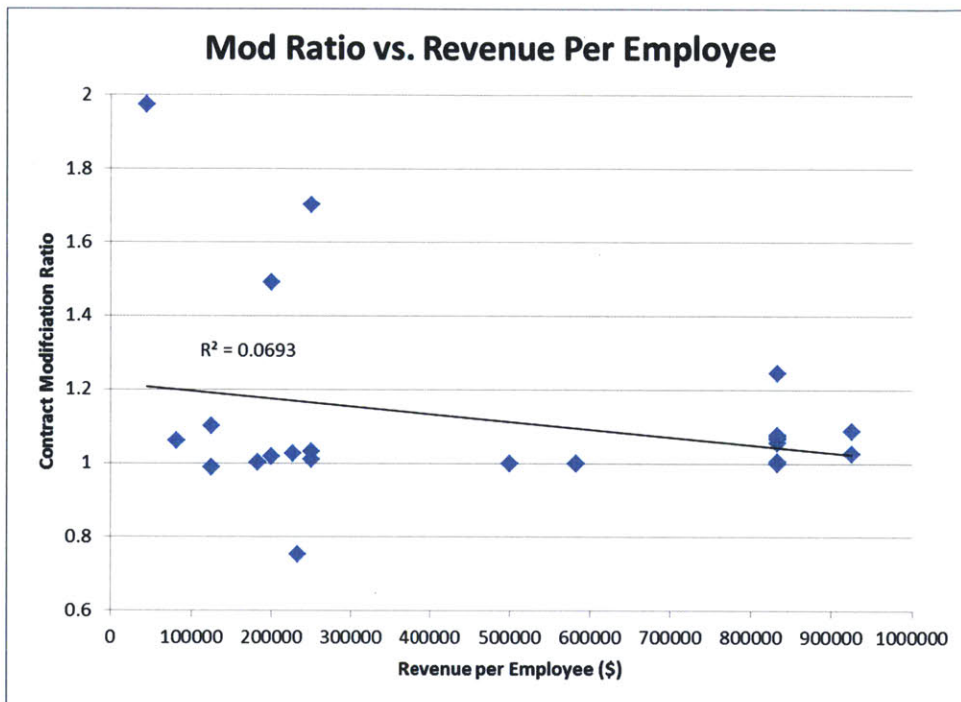


Figure 6-15
Modification Ratio vs Revenue per Employee

Chapter 7: Discussion

7.1 Research Findings Summary

Whereas Chapter 6 presented the results of the research, this chapter will be spent examining where the conclusions are strongest, separating the important from the less so, and getting to the heart of what really matters. In general, total contractor revenue, relative contract size and revenue per employee are the best predictors of contract performance, as measured by performance ratings, on-time performance and on-budget performance. Research findings are summarized in Table 7-1 below:

*Table 7-1
Demographic and Performance Factor Correlations*

As (Demographic Factor A) increases, (Performance Measure B) (as shown in chart):				
		Performance Measure "B"		
		Overall performance rating	On time performance	On budget performance
Demographic Factor "A"	Overall revenue	Increases ¹	Decreases ²	Increases ¹
	Total employees	Decreases	Increases ³	Increases ⁴
	Relative contract size	Increases	Increases	No correlation
	Revenue per employee	Increases	Increases	Increases
<div style="background-color: #fff9c4; width: 20px; height: 10px; display: inline-block; margin-right: 5px;"></div> = Strongest correlations				
<u>Comments:</u>				
1. Strongest amongst small contractors, less important for contracts > \$5M				
2. Equally applies for both large and small contracts.				
3. Weak correlation				
4. Weak correlation, applies to small contracts only (no correlation for all contracts)				

The key conclusions that can be drawn include:

7.2 Well Correlated Factors

1. Amongst small contractors, performance ratings of the “somewhat small” (annual revenues between \$2.5M and \$5M) considerably exceed ratings of the “very small” (annual revenues less than \$2.5M). This is strongly correlated, and was the best predictor of performance in the study. As annual contractor revenue increases (> \$5M), the correlation becomes less significant.

2. Overall contractor revenue per full time employee (regardless of the value of the contract under study) was also an excellent predictor of contract performance. Contractors with higher revenue per employee earned significantly higher overall contract ratings than those where revenue per employee is lower.
3. For contracts that are relatively insignificant for a contractor's bottom line (relative size < 0.10), performance is unpredictable. While some contracts with small relative size fared poorly, an equal number fared well. However, where the relative size was comparatively large (0.30 or greater), performance was universally high. In general, contracts of higher relative size are more likely to outperform contracts of low relative size.
4. On time performance is well correlated with total contractor revenue. As total contractor revenue grows, timeliness falls.
5. Revenue per employee was the strongest correlation amongst the timeliness metrics. As revenue per employee grows, timeliness improves by a factor of 3.
6. On budget performance is most strongly correlated with total contractor revenue, for small contractors only. As total contractor revenue increases, the propensity for money adding modifications decreases. Once a critical level of revenue is reach (~\$5M annually), revenue and monetary modifications are no longer well linked.

7.3 Factors with Poor or Insignificant Correlations

1. Amongst large contractors, there appears to be no clear linkage between total revenue and performance ratings. Whether a contractor does \$10M in business per year, or \$100M, it does not appear to matter. While the sample size of large contractors in the study was limited, it is important to note that none performed poorly. In other words, there are reasons large contractors are large; they deliver at least the expected level of performance.
2. Correlations between total number of employees and contract performance ratings, contract timeliness and contract budget performance are relatively weak. Total number of employees does generally not appear to be a good factor on which to make comparisons.

On the other hand, revenue per employee (a relative scale, not an absolute) DOES correlate strongly with performance ratings and timeliness.

3. On budget performance is relatively difficult to predict and correlate, particularly amongst contractors of all sizes. Unlike schedule extensions which are often granted somewhat arbitrarily, modifications for additional money receive much closer scrutiny from government contract personnel. Generally, the reasons for the monetary modifications are better founded, and are indeed due to changed site conditions, an increase in scope, or other legitimate factors. As such, monetary modifications do not correlate well with the basic demographics of the contract, that are independent of other actual jobs themselves. However, amongst small contractors, it is possible to correlate total revenue and performance, as discussed above.

7.4 Further Discussion

7.4.1. Performance ratings vs Revenue, Small Contractors:

Amongst small contractors, performance ratings increase as total contractor revenue increases. There are several explanations for this.

1. Very low revenue contractors are either not yet proven or not high quality. When revenues are very low (less than \$1.5M/annually) as compared to competitors, this is generally indicative of several things. It could mean that the contractor is new, and has yet to establish its business. If this is the case, performance is both unknown and highly variable. Some new contractors will be good, some poor. The effect of averaging the good and the poor yields an “expected value” of no better than average for new contractors. Of course, another possible explanation for low revenues is that the contractor just isn’t very good or doesn’t have the required resources, and no one wants to do business with them. In this case, performance ratings will likely be poor.
2. As small contractors reach a certain level of revenue (>\$1.5M/annually in this study), it is indicative of having achieved a certain measure of past success. Based on the prior performance history, it is reasonable to expect a continuation of good performance. Small, successful contractors also tend to be very customer focused. Each job is important, customer satisfaction is required to continue to grow the

business. As a group, small contractors outperform both the “micro-small” and the large. The definition of “micro-small” and “large” will vary with respect to competitors and industry. In the government construction industry studied in this thesis, “micro-small” is defined as annual revenues of less than \$1.5M, large is defined as annual revenues greater than \$5M.

7.4.2. *Performance ratings vs Revenue per employee:*

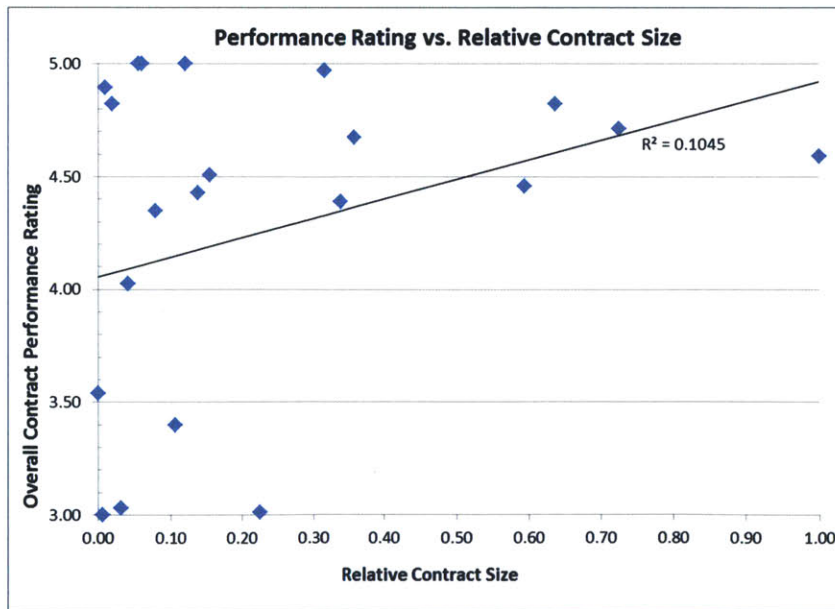
There is a strong correlation observed between performance ratings and overall contractor revenue per employee. As revenue per employee increases, so does performance. This applies equally for both large and small companies. There are several possible explanations for this.

1. Higher revenue per employee contractors are less near the edge: When operating near the edges of profitability, it can be very difficult to say “yes”. Any unplanned expense can represent catastrophe, the customer may feel like they are being “nickel and dimed” over every small thing. If equating revenue per employee as a rough measure of profitability (relatively accurate, as labor is the major variable expense in the construction industry), it is also reasonable to equate profitability with success. Companies are achieving profits (indicated by high revenue per employee) because they have highly satisfied customers.
2. Higher revenue per employee contractors are more expensive for the customer: While related to the last factor (companies farther from the edge have an easier time of saying “yes” to the customer), another potential way of expressing the point is simply that higher revenue per employee contractors are more expensive. All but two contracts in this study were awarded on a negotiated basis, which means that simply having the lowest price (which should generally be indicative of lower margins and operating closer to the edge) was not the only factor considered. It is also important to remember that all contracts are considered in the revenue per employee comparison, not just the one being evaluated. In other words, it is likely that a higher revenue per employee contractor has priced a higher level of responsiveness and service into his negotiated contract price. The old adage, “you get what you pay for” holds true. Looking back at the data, some prices do indeed appear quite high. For example, a siding job for 17 housing units cost \$1.9M, or over \$111K per unit. While there was undoubtedly complicating and extenuating factors in the

price and the job likely included more involved work than that indicated by the contract title, I think it is also fair to say that \$111K to replace siding on a housing unit can be characterized as quite expensive. It leads to very high revenue per employee totals, and as should be expected, very high performance ratings. It can be acceptable to be expensive only if performance is known to be very high. If performance is low, no one will pay the performance premium.

7.4.3. *Performance ratings vs Relative Size:*

The concept of “relative size” is a powerful one when it comes to predicting performance. The importance of a given contract to different contractors can vary quite a bit depending on its relative size as compared to the remaining volume of business. For example, it is reasonable to assume a contractor with \$2M in annual revenue would approach a \$2M contract (all of his business) quite differently than a \$100M/yr contractor with the same \$2M contract (just 2% of total business). The fraction of business a contract represents is referred to as its “relative size”. As shown below, all contracts in the study with subpar ratings had low relative size, and all contracts with high relative size (0.30 or more) were rated well above average.



*Figure 7-1
Performance Rating vs. Relative Contract Size*

While it would be inaccurate to say that low relative size means low performance (note that some contracts of low relative size were rated highly), it is accurate to say that the risk of

experiencing low performance decreases as relative contract size increases. In other words, if a contract is important to a contractor's bottom line, the chances of good performance are higher.

7.4.4. Timeliness vs Total Revenue:

Timeliness is an interesting metric in that it is both qualitatively included in the overall performance rating, and can be quantitatively measured simply by comparing the contract work acceptance date to the originally agreed upon completion date. Whereas the overall performance rating includes consideration for the customer's *perception* of timeliness, measuring timeliness against contract dates is a much more accurate measure, which may yield different results. Perception and reality are not always the same thing.

As discussed previously, timeliness can also be a difficult thing to measure, particularly in government contracts. Unlike commercial work, there is no significant loss of profit related to delay. In government work, there is no store that can't open for business, no offices that can't be rented. Deadlines for government work are loosely set based upon perceived need. Many government projects are planned and budgeted years in advance, and typically speaking, a month or two on completion date doesn't make that much of a difference. This is not always the case of course, but government work tends to be less time sensitive than commercial work. If deadlines are not critical, contract extensions are often freely given.

In order to evaluate the importance of timeliness as a performance metric, it helps to understand how timeliness is being evaluated. In the qualitative method used by overall contract performance ratings, timeliness is generally rated in terms of "was the work completed by the time I really needed it?". This may or may not equal the contract completion date. This is much different (and arguably more important) than the timeliness metrics expressed in this section, which are "was the project done by the time we initially agreed?".

A good predictor for timeliness in the absolute sense is overall contractor revenue. As contractor size increases, timeliness decreases. This appears true for contracts of all sizes. At first glance, this may seem counter-intuitive. After all, a contractor with more revenue should have more resources in order to bring a job in on time. However, when viewed from the first perspective (timeliness is a matter of perception and meeting customer needs), higher revenue contractors being less timely makes much more sense.

For government contracts without strong deadline pressure, timeliness is often a function of how much a contractor needs or wants to get a job done. Construction is a capital intensive business, often requiring heavy equipment (backhoes, cranes, barges) that can cost hundreds of thousands, even millions of dollars. The longer the capital equipment is kept sitting on a job site, the less it can be employed elsewhere. Again, a contractor's ability to keep equipment idle relates back to their size and revenue. If a contractor has three backhoes (as might be expected of a \$10M/yr contractor), any single one is less important. He can afford to let one sit idle on a job site for a little while. If nothing else, it may be seen as free storage. On the other hand, if a contractor is small (like a \$2.5M/yr contractor), he likely does not have the same reserve of capital equipment. The next job cannot start until the previous one is completed. It is in the small contractor's best interest to complete the work as quickly as possible. While the same is also in a large contractor's best interest, it is generally not as imperative. As such, larger contractors were generally observed to end up taking much more time than small ones.

Timeliness with respect to overall revenue is the ONLY metric where bigger does not equal better, at least to some degree. If timeliness is important, a lower revenue contractor may be a much better fit for the job.

7.4.5. Timeliness vs Revenue per employee:

While the absolute number of employees does not correlate well with timeliness, the revenue per employee does. The higher the revenue per employee, the more timely the contract performance. Just as with the higher performance ratings when revenue per employee is high, the reasons here are much the same. Timeliness is a service. At high revenue per employee (indicative of a company that likely has higher profit margins or higher costs passed on to the customer), premium service is expected. In this study, all contracts (three) with very poor on time performance (5 times or longer than the original performance period) had relatively low revenue per employee (\$250K/annually or less). Amongst companies with revenue per employee of \$500K/annually or greater, the average timely completion ratio was 1.01 (as shown in Table 7-2 below), meaning that the average contract took only 1% longer than originally awarded. In fact, the typical contract (8 of 12) where the contractor had \$500K or greater of annual revenue per employee was completed in less than the time allowed.

This contrasts sharply with contracts where the contractor revenue per employee is under \$500K annually. In this case, the average timely completion ratio was 2.67, meaning contract completion took over 2.5 times as long as it was originally supposed to, as shown in Table 7-3. The difference here is huge, significant even at relatively small sample sizes. Here, 7 of 12 contracts took at least 35% longer than originally agreed, almost the exact opposite of companies with higher revenue per employee.

<i>Table 7-2 Timely Completion Ratio, Revenue per FTE >= \$500K</i>		
Revenue Per FTE	Time Comp Ratio (from orig)	
\$ 925,920	0.99	
\$ 925,920	1.58	
\$ 833,333	0.80	
\$ 833,333	0.81	
\$ 833,333	0.93	
\$ 833,333	0.96	
\$ 833,333	0.96	
\$ 833,333	0.98	
\$ 833,333	1.00	
\$ 583,333	1.06	
\$ 583,333	1.15	
\$ 500,000	0.93	
Average:	1.01	

<i>Table 7-3 Timely Completion Ratio, Revenue per FTE < \$500K</i>		
Revenue Per FTE	Time Comp Ratio (from orig)	
\$ 250,000	0.81	
\$ 250,000	5.67	
\$ 250,000	9.42	
\$ 233,333	0.84	
\$ 226,280	1.38	
\$ 200,000	0.99	
\$ 200,000	1.92	
\$ 182,434	0.78	
\$ 125,000	1.35	
\$ 125,000	1.50	
\$ 82,000	1.00	
\$ 45,000	6.35	
Average:	2.67	

For timely completion, the best contractors are those with lower overall revenue, but high revenue per employee.

7.4.6. On-budget performance vs Revenue, Small Contractors:

Of the three possible ways of evaluating performance (by performance ratings, by timely completion, by on-budget performance), on-budget performance is the least correlated and most troublesome to draw significant conclusions about. That said, there are correlations that can be drawn for low revenue contractors. When revenue is very low, on-budget performance is poor. For low revenue contractors, any overage can constitute an emergency, and government contracting officers are more likely to be sympathetic. As revenue grows, correlation between

revenue and on-budget performance disappears.

7.4.7. Performance ratings vs Revenue, Large Contractors:

There is no good correlation between performance ratings and revenue for large contractors, although it is notable that all are relatively acceptable. However, there is no evidence that suggests a contractor with \$100M/year in annual revenues performs better (or worse) than a contractor with \$50M/year. Once minimal revenue standards are met, there is no strong linkage between performance ratings and revenue.

7.4.8. Total employees:

As a whole, comparisons based on total employees were not shown to be an extraordinarily relevant predictor of contractor performance, as measured by performance ratings, on time performance or on budget performance. Of the four demographic points of comparison (revenue, total employees, relative contract size or revenue per employee), total employees is the only one that does not correlate well with at least one of the three performance metrics. While it is possible to draw some general conclusions, they are much more weakly correlated than comparing by other metrics. In particular, revenue per employee (a relative measure of both employees and revenue) is much more strongly correlated with performance, and should instead be used as the employee comparison metric.

7.4.9. On budget performance:

As mentioned above in section 7.4.6, on budget performance is generally a problematic way by which to compare. While it is possible to draw conclusions in certain limited cases (contractors of very small size), no conclusions should be drawn about on-budget performance differentiations amongst contractors above minimum revenue. On-budget performance is typically closely scrutinized by the government, and is highly variable based on the needs of the particular job. If scope is added and site conditions were different than advertised, on budget performance will be poor. Neither of these factors has anything to do with the demographics of the contract and contractor, hence it is impossible to draw meaningful demographic conclusions based on budget performance of a diverse group of contractors.

7.5 Research Analysis Summary

As discussed above, the demographic profile of the “best” contractor is dependent upon which metric of performance is most valued. If judging by performance ratings, the answer may be somewhat different than if judging based upon on-time performance or on-budget performance. The profiles of the most successful contractors can be summarized as follows:

If judging based on high performance ratings: Overall contractor revenues will not be amongst the lowest of the peer group, although relatively small is still acceptable. The relative size of the contract being considered for award should be high as compared to the rest of the contractor’s work. The contractor should have a high revenue per employee, relative to his peer group.

If judging based on high on-time performance: The contractor should be small, but have high revenues per employee, relative to his peer group.

If judging based on high on-budget performance: Overall contractor revenues will not be amongst the lowest of the peer group, although relatively small is still acceptable.

While there is some nuance regarding what is important (namely whether a contractor has to be small or not), none of the desirable factors are inconsistent with each other. It is therefore possible to draw general conclusions regarding a contract/contractor profile that maximizes potential for contract success.

7.6 Research Analysis Conclusions

Synthesizing these, the ideal Coast Guard construction contractor profile for optimum performance is as follows:

1. Qualifies as a small business relative to others in the industry (maximizes on time performance), but with high revenue as compared to other small businesses (maximizes performance ratings, on budget performance).
2. Has a high revenue per employee (maximizes performance ratings, on time performance).
3. The contract being considered constitutes high relative size (i. e., significant portion of overall revenue) for that contractor (maximizes performance ratings).

Chapter 8: Implications for Government Acquisition

8.1 Practical Application Introduction

In the preceding chapters, we have reviewed the basic theory of contracts and the context of the U. S. Coast Guard acquisition environment under which these contracts operate. We have analyzed twenty four U. S. Coast Guard construction contracts in an effort to extract performance predictors. Given these results, how can U. S. Coast Guard contracts be structured and sources be selected in order to maximize the probability of a successful outcome? There are several areas which should be further evaluated, including how contracts are structured, how contracts are awarded and to whom they are awarded.

8.2. The Case for Incomplete Contracts

Examining the structure of U. S. Coast Guard contracts, the notion of “incomplete contracts” is undoubtedly an uncomfortable one for government contracting officers because they live by the written word. However, there can be little doubt that almost all U. S. Coast Guard contracts, and certainly all twenty four of those contracts contained in this study, are fundamentally incomplete. By definition, a complete contract is one that has planned for all contingencies in advance. Of the twenty four representative contracts studied here, all of them required oversight and guidance from a contracting officer’s technical representative. If everything the agent needed to know was fully described by the written word of the contract, no additional technical guidance from the principal would be required during the execution of the contract – the agent could simply go do it. Of the twenty four contracts, only four were completed without additional financial modifications. For the remaining twenty, a negotiated modification mid-contract is another sure sign of incompleteness. If everything is fully specified in advance, there is never a need to negotiate modifications during performance of the contract. Clearly, these contracts cannot be classified as complete.

In response to this revelation, one potential reaction would be “We therefore need to make our contracts more complete”. For some perspective, the Federal Acquisition Regulations stretch for over 1,900 pages regarding the rules and administration of federal contracts. Verbosity, and the desire to cover all possibilities, is the cultural norm within federal contracting. While well planned and well written contract specifications should always be the standard for which to strive, it is also a mistake to seek to make contracts totally complete.

It is important to remember that contract specification and contract oversight are not free. There is a finite number of government personnel available to work on contract specification. A Coast Guard contracting officer oversees many contracts at a single time. If extraordinary efforts were made to get a given contract entirely complete in a theoretical sense, this either comes at the expense of other contracts becoming less complete, work being left undone or creating a need to hire additional contracting staff, which is typically infeasible. Clearly, a balance must be struck such that the level of completeness is commensurate with the level of complexity and risk in a given contract. Small contracts with carefully selected contractors can often be scoped and specified in a page or two. Major systems acquisitions contracts with tens of millions at stake will typically require much more care, due to the greater amount of money at risk and higher consequences of failure.

8.3 The Importance of Self-Enforcement

Even if U. S. Coast Guard contracts could be made more complete, it is not entirely necessary due to the principles of self-enforcement. The U. S. government contracts for over half a trillion dollars of goods and services annually (www.USAspending.gov). All federal agencies are required to report performance on all large contracts. Recalling the self-enforcement equation, performance is assured when $W_1 < W_2$ (Klein, 2002, p. 62) where W_1 is the current gain from acting in a suboptimal manner and W_2 is the expected future gain from ongoing business relationships. Because of the recurrent nature of government contracts and because of the near infinite potential for future work, rational contractors realize that it is always in their best interest to try to completely satisfy the government in the performance of the contract. This is a very different situation than a contract between individuals. In that situation, likelihood of future business may be low, and the amount of future business could certainly be less than what's already in hand. This will almost never be the case in government contracting, particularly if viewing the federal government as a whole, across agency boundaries. In government contracts, the principle of self-enforcement is potentially more powerful than the actual contract terms and conditions.

8.4 The Need for Better Performance Information

However, for self-enforcement to be a powerful force, the government must recognize and harness its power. The Past Performance Information Retrieval System (PPIRS) was set up with

exactly this in mind. As the Government Accountability Office found in an April 2009 report (Lasowski, 2009, p. 12), the federal government currently does a poor job of harnessing past performance information. In a February 2008 review, the Defense Department Inspector General found that for DoD contracts in excess of \$5M, 82% of the reports did not contain sufficient detail to justify the performance ratings assigned. 68% of the required reports had submissions that were overdue, and 39% were submitted a year or more late. As GAO found, only 31% (consistent for both 2006 and 2007) of contracts that required an assessment had one completed, as shown in the table below.

*Table 8-1
Required Contract Assessment Completion*

Table 3: Estimated Contracts Requiring an Assessment and Number of Assessments in PPIRS for Selected Agencies, Fiscal Years 2006 and 2007

Department/Agency	Estimated contracts requiring an assessment 2006	Contracts with assessment 2006	Estimated percent	Estimated contracts requiring an assessment 2007	Contracts with assessment 2007	Estimated percent
Air Force	2,563	1,432	56	2,795	1,300	47
Navy	3,985	1,833	46	3,879	1,622	42
Army	6,595	2,606	40	6,145	1,971	32
Other DOD	1,601	330	21	1,408	303	22
Homeland Security	4,487	324	7	4,131	535	13
NASA	4,285	1,009	24	3,706	1,093	29
Energy	893	136	15	840	183	22
Total	24,409	7,670	31	22,904	7,007	31

Source: Federal Contractors: Better Performance Information Needed to Support Agency Contract Award Decisions. GAO-09-374

By not sufficiently recording contract performance data, the government is missing the opportunity to utilize a significant amount of information vital to encouraging self-enforcing behavior. Contractors, knowing that the government does not do an adequate job recording and using past performance information, may then feel emboldened to deliver less than superb performance, as the likelihood of current performance (W_1 in the self-enforcement equation) endangering future work W_2 is now lower.

While more complete contracts are always admirable, this is not the way to an overall higher level of contract performance. Instead, the government must recognize and accept that contracts possess some degree of incompleteness. As the largest contracting authority in the world, the U. S. government should be strongly positioned to harness the powers of self-enforcement, due to the desire of all agents to continue to win future contracts. While the system

is in place, the government is not currently doing an adequate job of recording performance information and harnessing its power. Knowing that the information is incomplete or suspect, government contracting officials are less likely to rely on it when evaluating past performance, and in general, will devalue past performance information as a whole. Knowing that the information is incomplete and government contracting personnel are reluctant to rely upon it, earning strong performance evaluations to increase chances of future business becomes less important for the agent. The self-enforcement equation begins to tip, and much of the federal government's tremendous potential power of utilizing self-enforcement as a means to ensure outstanding performance is lost.

8.5 Tailoring Contract Methodology to Leverage Self-Enforcement

The means by which most contracts are awarded is also tremendously important when considering how self-enforcement operates. The most traditional method of awarding government contracts is through a competitive, sealed-bid process where the lowest bidder wins the job. All prospective agents place their bid in a sealed envelope, and at the appointed time, the contracting officer publicly opens all bids. The contract is then awarded to the lowest qualified bidder.

8.5.1. Problems with Sealed-Low Bid

The U. S. Coast Guard often attains poor results through the low bid process. Examining contract theory, it is easy to understand why. By the very nature of the process, agent margins in sealed low-bid contracting are very small. In order to win the work, an agent has to be willing to work at lower margins than anyone else. In a highly competitive environment, margins can approach zero. In this environment, the moral-hazard problem is very high. The agent is almost compelled to act contrary to the best interests of the principal in order to secure his own. A well understood bidding tactic becomes to submit a very low bid to secure the job, with the intent of picking apart the contract later to search for incompleteness and ways of getting additional (negotiated at higher margins) work added to the job once secured. Low bid contracting often results in an "us" versus "them" mentality, with predictably poor results.

Sealed bid contracting also does a poor job of harnessing the power of self-enforcement. When the government has the power to select a specific contractor and negotiate an agreement, it is in the agent's best interest to make the government as happy as possible. After all, it isn't just

about the current contract, it's also about the upside of all potential future contracts yet to come, as only high performers are chosen. In sealed-bid contracting, this all-important element of the power of choice is lost. The government simply accepts the lowest bid from a qualified source. In this situation, not only is the moral-hazard problem strong for the current contract as described above, self-enforcing behavior is also low because there is no longer a strong need to build reputation. If the agent knows that all future work will likely be awarded by sealed low-bid as well, performance no longer matters, to the extent that it at least meets the very minimal standard necessary as to not be disqualified in the future. There is no future benefit for above average performance now, and the self-enforcement equation again inverts. Sealed low-bid is an invitation for low performance from a contract theory perspective, both because of the high moral hazard it creates for the current contract, and the lack of a self-enforcement mechanism when performance no longer has a strong impact on the ability to gain future work.

8.5.1.1. U. S. Coast Guard Awareness of Sealed Low Bid Limitations

While most U. S. Coast Guard contracting personnel would be unable to explain “why” in terms of contract theory (I'd count myself as a member of that group, prior to this thesis work), the good news is that there generally does now seem to be widespread understanding that sealed-low bid processes often lead to suboptimal results. When I first started in U. S. Coast Guard construction contracting approximately 15 years ago, the majority of contracts were awarded by sealed-low bid. Even then, we knew that low bid was not a great way of doing business, and actively sought contract vehicles where a negotiated agreement was possible. While I was aware that the primary methods the U. S. Coast Guard uses to award contracts have shifted over the years, I was surprised by how much. The twenty four projects for this study were gathered from six separate U. S. Coast Guard contracting offices. Of the twenty four projects, only two (8%) were awarded on the basis of sealed-low bid. While sealed-low bid contract award is not entirely dead, it is clearly the exception in the current world of U. S. Coast Guard construction contracting. Because of the contract theory reasons explained above, this is undoubtedly a good thing. The theory unequivocally supports the probability of a higher outcome when contracts are negotiated with a selected party, as opposed to the outcomes realized from sealed-low bid.

8.5.2. Selecting Partners for Negotiated Contracts

Now that it has been established that negotiated contracts have a higher probability of delivering better results, the question now becomes how to select which contractors to negotiate with.

8.5.2.1. Value of Direct Past Performance Information

The best way of selecting a high performing contractor is based upon your own past experiences with the same contractor. If prior experiences have been good and the contractor has proven themselves to be a fair partner, they will likely make a fair partner again. This is the purest form of realizing the gains of self-enforcing behavior. The U. S. Coast Guard frequently utilizes this method using a negotiated form of contract known as Indefinite Delivery, Indefinite Quantity (IDIQ). In an IDIQ contract, a contractor is selected through a best value process, typically using small business award or procedures other than sealed low bid. The contract itself usually contains no specific work, but is rather a shell, providing a (typically very small) lower limit and (typically very large) upper limit for the work yet to come. If experiences are good, future work continues to be awarded under this contract, hence the “indefinite delivery, indefinite quantity” moniker. If experiences are bad, the contract is allowed to expire, meeting only the minimum obligation from the first project or two. Good active IDIQ contracts are valued commodities in government contracting offices. Over time, the best IDIQ contracts tend to dominate and consume most of the projects and work, while underperforming IDIQ contractors fade away. IDIQ contracts embrace the principles of self-enforcing contracts at their purest, and are generally extremely effective because of it.

8.5.2.2. When Personal Past Performance Experience Does not Exist

While past personal experience directly with a given contractor is a great approach to finding a contract that will lead to high probability of success for projects, there is a fundamental flaw with this approach. Namely, it is only possible to judge on past personal experience if you have past personal experience with that contractor. Many times, the U. S. Coast Guard will need to work in a location or accomplish a type of work for which contractors they have existing relationships have no presence or capability for that type of work. As mentioned earlier, the Small Business program is an effective and often used mechanism for IDIQ contractor selection. Unfortunately, success has a price. The impact of funneling a high volume of work to a high

performing small contractor is to make them a high performing large contractor, no longer for eligible for future awards under the small business program. Finally, just because a given office has no experience with a given contractor, it does not mean that the contractor is either good or bad; they could be either. A fundamental principle underlying government contracting is to provide a fair chance for all. Ruling out a contractor simply because you have no experience with them is fundamentally unfair. Because it is not always possible or fair to select a contractor with whom the U. S. Coast Guard has positive past experience, this brings us to our next question, and crux of the research of this thesis. How then, is it possible to make an informed judgment regarding the probability of success in the absence of information regarding prior experience or other specific information? The answer will be addressed in the following section.

8.6 Application of Thesis Research to Source Selection

As discussed and demonstrated by the research results and analysis of Chapters 5 and 6, the profile of a contractor that returns the best chance for high performance on U. S. Coast Guard construction contracts is as follows:

1. Qualifies as a small business relative to others in the industry (maximizes on time performance), but with high revenue as compared to other small businesses (maximizes performance ratings, on budget performance).
2. Has a high revenue per employee (maximizes performance ratings, on time performance).
3. The contract being considered constitutes high relative size (i. e., significant portion of overall revenue) for that contractor (maximizes performance ratings).

How well a given contractor matches this particular profile can be determined by comparing their overall revenue, revenue per employee and relative contract size, as compared to others in the industry.

As a quick aside, we need to be clear that the above profile applies only for U. S. Coast Guard contractors engaged in infrastructure construction work. These were the only projects contained in this study, and any other conclusions regarding other types of contracts or work would be overly broad and unsupported by the research here. Clearly, a small business relative to others in the industry is not necessarily the best choice for a multi-billion dollar Department of Defense major systems acquisition. For purposes of this discussion, the focus and conclusions are

based upon U. S. Coast Guard facilities maintenance and construction contracts.

8.6.1. Source Selection within the FAR Context

Back to the original question, how then can contractors that fit the “success profile” be legally and appropriately secured within the confines of the existing federal acquisitions environment? To answer this question, we must return to the highlights of the Federal Acquisition Regulations discussed in Chapter 2.

At the highest level, the FAR exists to “prescribe policies and procedures to promote full and open competition in the acquisition process.” (FAR, 6.1-1) It is counter to the principles of the FAR to award a contract to a specific agent simply because they are favored, for whatever reason. The basic concepts of fairness and competition must apply. One particularly rich area of the FAR that allows targeted acquisition is small business set-asides, as described by Part 13 of the FAR. For the general construction industry, the term “small business” can apply up to \$33.5M in annual revenue. This encompasses the contractors in all but three of the (randomly selected) twenty four projects in this study, and over half (by number of projects) of Coast Guard construction work in general. Since the target description of a contractor likely to perform well includes being smaller than the large players in the industry, the ability to directly select small businesses becomes extremely important. In U. S. Coast Guard contracting, small business set asides are largely viewed as a social program, the equivalent of doing a favor for small businesses because they are too small or not capable enough to compete on an equal basis on their own. The reality is quite different. As shown by the results of the research, larger small construction contractors are likely to outperform large construction contractors. Capable small contractors should be selected not simply as a matter of conformance to a social program, but because the expected results are higher. Fortunately, Part 13 of the FAR makes it extraordinarily easy to set-aside projects up to \$5M (inclusive of every project in this study) for small business concerns. While competition is still required, it can be restricted to contractors within the following categories:

- (1) Small business.
- (2) Small disadvantaged business.
- (3) Women-owned small business.
- (4) HUBZone small business.
- (5) Service-disabled veteran-owned small business.
- (6) Veteran-owned small business.

Part 15 of the Federal Acquisition Regulations describes the procedures for contracts by negotiation. As mentioned earlier, contracting by negotiation is already a well understood and well-used tools, with over 90% of the contracts in this study being awarded on that basis. However, this study makes a case for re-defining the criteria by which offers are evaluated. The key part of the FAR concerning evaluation factors is subpart 15.304:

15.304 Evaluation factors and significant subfactors.

- (d) The award decision is based on evaluation factors and significant subfactors that are tailored to the acquisition.
- (e) Evaluation factors and significant subfactors must—
 - (3) Represent the key areas of importance and emphasis to be considered in the source selection decision; and
 - (4) Support meaningful comparison and discrimination between and among competing proposals.
- (f) The evaluation factors and significant subfactors that apply to an acquisition and their relative importance, are within the broad discretion of agency acquisition officials, subject to the following requirements: *(emphasis added)***
 - (7) Price or cost to the Government shall be evaluated in every source selection.
 - (8) The quality of the product or service shall be addressed in every source selection through consideration of one or more non-cost evaluation factors such as past performance, compliance with solicitation requirements, technical excellence, management capability, personnel qualifications, and prior experience; and
 - (9) (i) Except as set forth in paragraph (c)(3)(iv) of this section, past performance shall be evaluated in all source selections for negotiated competitive acquisitions expected to exceed \$1,000,000.
 - (ii) Except as set forth in paragraph (c)(3)(iv) of this section, past performance shall be evaluated in all source selections for negotiated competitive acquisitions issued on or after January 1, 1999, for acquisitions expected to exceed \$100,000. Agencies should develop phase-in schedules that meet or exceed this schedule.
 - (iii) For solicitations involving bundling that offer a significant opportunity for subcontracting, the contracting officer must include a factor to evaluate past performance indicating the extent to which the offeror attained applicable goals for small business participation under contracts that required subcontracting plans.

- (iv) Past performance need not be evaluated if the contracting officer documents the reason past performance is not an appropriate evaluation factor for the acquisition.
- (10) The extent of participation of small disadvantaged business concerns in performance of the contract shall be evaluated in unrestricted acquisitions expected to exceed \$500,000 (\$1,000,000 for construction) subject to certain limitations.
- (11) For solicitations involving bundling that offer a significant opportunity for subcontracting, the contracting officer must include proposed small business subcontracting participation in the subcontracting plan as an evaluation factor.
- (12) If telecommuting is not prohibited, agencies shall not unfavorably evaluate an offer that includes telecommuting unless the contracting officer executes a written determination.

Specifically, Subpart 15.304(c) provides that factors for evaluation are “within the broad discretion of agency contracting officials”, as long as they include cost, quality, past performance and are fair to small businesses. There is no prohibition on including factors this study has shown to be predictive of higher performance (contractor revenue, revenue per employee and relative contract size) as additional factors for source selection evaluation for negotiated contracts. The primary factors such as cost, quality and direct information regarding past performance should undoubtedly be weighed heavier than contractor revenue, revenue per employees and relative contract size as the latter are merely predictive of higher performance while the former impact the contract more directly, these additional factors could indeed add points of additional differentiation, leading to a better informed contract source selection.

8.7 Implications for the Acquisition Community:

In order to maximize the chances for success on U. S. Coast Guard construction contracting, the following recommendations apply:

- 1) Improve the collection and utilization of past performance data.
- 2) Minimize sealed-low bid contracting.
- 3) Maximize contracts by negotiation.
- 4) Maximize the usage of small businesses, above the “micro small” level, which incorporates findings that demonstrate smaller revenue contractors (above minimum levels) outperform larger ones.

- 5) Consider adding the following source selection evaluation factors to award decisions for negotiated contracts, as this research indicates they are likely indicative of better performance outcomes (all existing “standard” source selection criteria should also be maintained)
- a) Contractor revenue per employee (higher is better)
 - b) Contract relative (higher is better)

Summarizing the above, the profile of a U. S. Coast Guard construction contractor that has the highest probability of achieving the most desirable performance outcomes is a small contractor (not micro-small) with high revenue per employee for whom the contract being considered represents a significant percentage (30% or more preferred) of their annual revenue. It is important to note that high revenue per employee often translates to expensive. While not an absolute requirement for high performance, the evidence does support that “you get what you pay for”.

Chapter 9: Thesis Summary and Conclusions

9.1 Summary of Overall Recommendation and Conclusions

This thesis has made the case for better targeting United States Coast Guard facilities construction contracts in order to maximize the opportunity for highly successful performance outcomes. There are five key recommendations and conclusions that, if implemented, will help accomplish this goal:

- 1) Improve the collection and utilization of past performance data.
- 2) Minimize sealed-low bid contracting.
- 3) Maximize contracts by negotiation.
- 4) Maximize the usage of small businesses, above the “micro small” level.
- 5) Consider adding the following source selection evaluation factors to award decisions for negotiated contracts, as this research indicates they are likely indicative of better performance results (all existing “standard” source selection criteria should also be maintained):
 - a. Contractor revenue per employee (higher is better)
 - b. Contract relative (higher is better)

9.2 Chapter Summaries

9.2.1. Chapter 1 Summary

In the opening chapter, I outlined my own background, thesis motivations and personal observations made over 15+ years of involvement with U. S. Coast Guard contracting. I have frequently served as a Contracting Officer’s Technical Representative (COTR), working closely with both contractor personnel and government Contracting Officers (KOs) in daily contract administration. I have observed many contracts that have gone well, and many that have gone poorly. When contracts have not gone well, I have theorized that the following forces are at work:

- (1) The contractor is too small to be capable. Sealed-low bid contractors are awarded to the lowest-price qualified contractor. Unfortunately, what constitutes “qualified” is highly subjective. The government generally takes grants the benefit of the doubt to a contractor that claims to be capable. The assumption is that if they claim to be

capable, they are, until they demonstrate otherwise. This logic is applied even when the evidence suggests the contractor's chances for success will be low. When contractors are very small, they have neither the manpower, expertise or capital resources to handle complex construction contracts. While their intentions may often be good, the results are often predictably poor.

- (2) The contractor is too big to care. Being too big to care is the opposite of being too little to be capable. For very large contractors, the outcome of the one job just doesn't matter that much to them. Furthermore, the one-on-one personal service is often lost or de-emphasized in contracts with large, bureaucratic contractors.

- (3) The size of the project is a bad fit for the size of the contractor. This can be related to contractor being either too big or too small. If a relatively small contractor attempts a relatively large job, they can often find themselves over their head and without the required resources, even if they are well intentioned and have demonstrated high performance on small jobs. Likewise, if a relatively large contractor attempts a relatively small job, the importance to the organizational bottom line is not there, and the organizational incentive to care about the smaller job (particularly in the face of competing demands from larger, more important work) is small. In all cases of size mismatch, outcomes are often predictably poor.

There are often reasons that are highly specific to a given contract as to why the contract goes poorly or well. For example, if the contract was bid or negotiated poorly, if one of the parties was operating from a position of significant distress (financial, time, or otherwise), if otherwise unforeseen circumstances develop, all of these factors can also lead to suboptimal outcomes. However, each of these is specific to a situation, and can often not be seen in advance. In this thesis, we were more concerned with the general predictive factors that CAN be observed in advance, such as size or "fit". The remaining chapters explore these factors, relative to the three hypotheses above.

9.2.2. Chapter 2 Summary

In Chapter 2, we analyzed the foundation upon which all government contracts are built, the Federal Acquisition Regulations. The dominating theme of the Federal Acquisition

Regulation is to create a system of government contracting that provides reasonable cost, high quality and timely performance of government contracts in a way that maximizes fairness and competition amongst all potential contractors. There are two parts of the FAR that are particularly relevant to this thesis.

Part 13 of the FAR outlines Simplified Acquisitions Procedures that detail available processes to limit competition to small business concerns. Small business contracting is a mandate where possible for all contracts of less than \$100,000, and an available option for contracts up to \$5M. With the exception of major systems acquisitions, the overwhelming majority of Coast Guard contracts can be set aside for small business concerns.

Part 15 of the FAR details the process for Contracts by Negotiation. While some form of competition must nearly always exist, the option for negotiated contracting means that contracts do not have to be awarded solely on the basis of lowest cost and sealed bids. The FAR provides the ability for agencies to award contracts by negotiation. Furthermore, agencies have broad powers in deciding which factors to include when evaluating potential contractors. These powers open the door for inclusion of additional non-traditional evaluation factors, as suggested by this thesis.

9.2.3. Chapter 3 Summary

In Chapter 3, we introduced the prevailing theories of contracting, with a focus on agency theory. Agency theory describes the process and complications encountered when a “principal” (the U. S. Coast Guard) hires an “agent” (a construction contractor). Problems generally stem from the fact that while the principal hires the agent to complete a job, the agent also has their own set of motives and priorities which may or may not align with the principal’s. This is referred to as the “principal-agent problem” or “moral hazard”. While contracts can be incentivized to help address the principal-agent problem, incentives (or penalties) do not change the fact that the agent has self-interests, but rather can only seek to align those self-interests more consistently with those of the principal.

Contracts can be viewed as “complete” or “incomplete”. A complete contract can be described as one in which all possible contingencies and possibilities are addressed in advance. Generally, this is unachievable from a practical standpoint. More complete contracts also require more expense and up-front work on the part of both the principal and agent to investigate all

possibilities. In the real world, almost all contracts, including those in this thesis, should be viewed as incomplete.

Incomplete contracts are those in which both parties have an explicit or implicit understanding that further agreements and negotiations will be required after the contract is initially awarded to deal with contingencies as they arise.

If a contract was entirely complete, it would be possible to rely solely on the written contract terms for contract enforcement. Since contracts are incomplete, the concept of self-enforcing contracts becomes particularly important. Self-enforcement refers to situations where it is in the best interest of both the principal and agent to deliver a high level of performance, based on reasons other than just the desire to avoid legal intervention arising from failure to adhere to contract terms. Self-enforcement usually arises from the desire to continue doing business in the future. While contract terms can assure minimum compliance, the principle of self-enforcement explains high performance.

Self-enforcement is particularly powerful in government contracts that are awarded by negotiation (or any means other than sealed low-bid) and for which performance information is reported. In these cases, it is in the self-interest of the agent to deliver strong performance, in order to win future negotiated contracts.

9.2.4. Chapter 4 Summary

In Chapter 4, we introduced the projects selected for study under this thesis. Twenty four recent Coast Guard construction projects were randomly selected by six geographically diverse Coast Guard contracting offices for analysis. The selected projects encompass a broad spectrum of values, spanning from \$48K to \$2.8M and were spread throughout 13 states. In summary, the intent of the project selection methodology was to provide the broadest possible spectrum of project location, project size, contractor size and administering office diversity while sharing a common framework (civil infrastructure and repair) to provide a basis for valid comparisons.

9.2.5. Chapter 5 Summary

Chapter 5 discussed the research methodology used to evaluate the performance on each of the 24 contracts in the study. There were four bases for demographic comparison amongst the contracts and contractors in this study. Those four bases include:

1. Contractor size (as measured by revenue)
2. Contractor size (as measured by total employees)

3. Relative contract size (ratio of contract value to overall contractor revenue)
4. Contractor employee efficiency (total revenue per employee)

Estimates for contractor size as measured by both revenue and total employees were obtained through the website www.manta.com, which uses publically available data to provide revenue and employee estimates on over twenty three million companies, including all those in this study. Relative contractor size was defined as follows:

$$\text{Relative Contract Size} = \frac{\text{Contract Award Amount}}{\text{Estimate of Total Annual Contractor Revenue (all sources)}}$$

Contractor employee efficiency was defined as follows:

$$= \frac{\text{Estimate of Total Annual Contractor Revenue (all sources)}}{\text{Estimate of Total Contractor Employees}}$$

These four factors were used as the bases of comparison by which to compare the performance of the twenty four contractors.

The primary source of data for performance information was the information contained on each project's completed General Services Administration (GSA) Standard Form (SF) 1420 or Defense Department (DD) Form 2626. This form, entitled "Performance Evaluation – Construction Contracts" is completed by the Contracting Officer or Contracting Officer's Technical Representative and provides contract performance evaluation in five areas. These five areas are:

1. Quality
2. Effectiveness of Management
3. Timely Performance
4. Compliance with Labor Standards
5. Compliance with Safety Standards

Within each of these five areas and associated subcategories, one of five performance ratings is possible. These include:

1. Outstanding (assigned a numeric rating of "5" for analysis purposes)
2. Above average (assigned a numeric rating of "4" for analysis purposes)
3. Average (assigned a numeric rating of "3" for analysis purposes)

4. Marginal (assigned a numeric rating of “2” for analysis purposes)
5. Unsatisfactory (assigned a numeric rating of “1” for analysis purposes)

While the contract performance evaluation also includes an “overall” mark, it generally lacks the required fidelity to serve as an accurate basis for comparison. Furthermore, the overall mark suffers from a higher degree of rating bias than do the category marks, as the overall mark is the one that matters the most to the contractor’s being rated. As such, there can be a tendency for government personnel to occasionally inflate the overall mark in order to avoid a time consuming appeal process.

Not all subcategory marks are created equal. For example, the quality of the product produced will be more important than the effectiveness of management. While management effectiveness is an internal metric to the project that ends at product delivery, quality is the “leave behind” that persists throughout the product lifecycle. As the products in these contracts are buildings and other infrastructure, life cycles can stretch for 25 years (or more). In order to weight the impact of each of the category ratings on an overall computed performance rating, the following weightings were used:

- 50%: Quality
- 30%: Timeliness
- 20%: Effectiveness of Management
- 0%: Compliance with Labor
- 0%: Compliance with Safety

The compliance factors were not included in the overall rating, as these represent minimum standards of contract performance and are binary yes/no type of factors. In all projects of this study, all contractors complied and these factors were not a differentiator. Hence, they were not used.

In order to check the fidelity and sensitivity of the computed performance rating, results were compared for consistency with the contracting personnel assigned rating. The standard deviations of the computed rating and contracting personnel assigned rating were identical, indicating high consistency. In the only instance where the computed rating was significantly

(more than one standard deviation) different than the assigned rating, there was visible evidence of the assigned rating being raised, likely due to just the type of rating bias the computed ratings sought to avoid. In short, the computed ratings worked, eliminating the overall rating bias and providing a more accurate and more defined comparison of the field.

In addition to the performance rating information, the “Performance Evaluation – Construction Contracts” forms also provide information regarding on time performance and on budget performance. On time performance is defined as the ratio between initial award period and actual performance period. Mathematically, it can be expressed as follows:

$$\text{On time performance ratio: } \frac{(\text{Agreed Contract Completion Date}) - (\text{Initial Award Date})}{(\text{Contract Acceptance Date} - \text{Initial Award Date})}$$

The on budget performance ratio is defined as the ratio between the initial contract value and final contract value. Mathematically, it can be expressed as follows:

$$\text{On budget performance ratio: } \frac{(\text{Initial Contract \$ Amount}) + (- \text{Contract \$ Modifications})}{\text{Final Contract \$ Amount}}$$

The computed performance ratings, the on-time performance ratio and the on-budget performance ratio provide three bases of performance comparison. Once the three bases of performance comparisons and four bases of demographic comparisons were established and the performance ratings calculated, the twenty four projects were then compared and analyzed.

9.2.6. Chapter 6 Summary

Chapter 6 presented the results of the research and the comparison amongst the projects. Statistical curve fitting techniques were used to compare each demographic factor against each performance factor, for a total of 12 points of comparison. The 12 points of demographic and performance comparisons are:

Contractor Performance Rating:

1. Contractor Performance Rating vs. Total Contractor Revenue
2. Contractor Performance Rating vs. Company Size (Employees)
3. Contractor Performance Rating vs. Relative Contract Size
4. Contractor Performance Rating vs. Overall Annual Revenue per FTE

Contract Timeliness:

5. Timeliness vs. Total Contractor Revenue

6. Timeliness vs. Company Size (Employees)
7. Timeliness vs. Relative Contract Size
8. Timeliness vs. Overall Annual Revenue per FTE

Contract On-Budget Performance:

9. Modification Ratio vs. Total Contractor Revenue
10. Modification Ratio vs. Total Contractor Employees
11. Modification Ratio vs. Relative Contract Size
12. Modification Ratio vs. Overall Annual Revenue per FTE

9.2.7. Chapter 7 Summary

Chapter 7 analyzed the results of the 12 points of comparison amongst the contracts. The table below summarizes the results:

*Table 9-1
Demographic and Performance Factor Correlations*

		As <u> </u> (Demographic Factor A) <u> </u> increases, <u> </u> (Performance Measure B) <u> </u> (as shown in chart):		
		Performance Measure "B"		
		Overall performance rating	On time performance	On budget performance
Demographic Factor "A"	Overall revenue	Increases ¹	Decreases ²	Increases ¹
	Total employees	Decreases	Increases ³	Increases ⁴
	Relative contract size	Increases	Increases	No correlation
	Revenue per employee	Increases	Increases	Increases
		= Strongest correlations		
<u>Comments:</u>				
1. Strongest amongst small contractors, less important for contracts > \$5M				
2. Equally applies for both large and small contracts.				
3. Weak correlation				
4. Weak correlation, applies to small contracts only (no correlation for all contracts)				

Performance ratings increase as overall revenue increases, particular amongst small contractors. This is supportive of the hypothesis that contractors can be too small too capable. Interestingly enough, performance ratings were also seen to decrease as the number of employees increased, generally supportive of the hypothesis that a contractor can be “too big to care”, losing either (or both) of the personal touch or strong desire to please the government. While somewhat of a weak correlation (contractors with more employees can’t be entirely unsuccessful), it is still noteworthy. More importantly, contract performance increased as the relative contract size increased. This is directly supportive of the thesis hypothesis that relative

size is an important factor, and “right sized” contracts that represent a significant portion of the contractor’s revenue will generally outperform those where the total portion of revenue is much smaller. Contractors with a higher revenue per employee also received better overall performance ratings than those that did not. While not a thesis hypothesis, a high revenue per employee is likely representative of a contractor with profitable margins who is well positioned to cater to the desires of the customer. It should also be noted that a contractor with a higher revenue per employee may also be more expensive than one who operates at lower margins.

On time performance decreased as total contractor revenue increased. This is interesting, in that the performance ratings concurrently were observed to increase. Clearly, on-time performance was not valued as highly as other factors when assessing contractor performance. Larger contractors typically have more capital equipment and resources than smaller contractors. For contracts where the government does not apply heavy schedule pressure (often true), a larger contractor has the ability to idle capital resources and equipment on one project site in order to focus on another project. Smaller contractors do not have this luxury. For this reason, it is theorized that lower revenue contractors have higher incentive to finish more quickly.

Timeliness correlates strongly with revenue per employee. The 12 contractors with the highest revenue per employee averaged a timely completion ratio of 1.01. The 12 contractors with the lowest revenue per employee averaged a timely completion ratio of 2.67, over two and a half times worse. If viewing timeliness as a service, higher margin (and higher cost) contractors are well positioned to provide a higher level of service. If they do not, the principal would likely be unwilling to pay the higher margins, and the contractor would not be selected for award.

9.2.8. Chapter 8 Summary

In Chapter 8, these results were synthesized and further discussed. In general, the profile of a high performing construction contractor is as follows:

1. Qualifies as a small business relative to others in the industry (maximizes on time performance), but with high revenue as compared to other small businesses (maximizes performance ratings, on budget performance).
2. Has a high revenue per employee (maximizes performance ratings, on time performance).

3. The contract being considered constitutes high relative size (i. e., significant portion of overall revenue) for that contractor (maximizes performance ratings).

Additionally, the contract theories discussed in Chapter 3 suggest the following:

1. Sealed-low bid contracting should be minimized as it not conducive to the self-enforcement mechanisms that are required for high performing, incomplete contracts.
2. Contracting by negotiation should be maximized, as it is conducive to the self-enforcement mechanisms that are required for high performing, incomplete contracts.

The Federal Acquisition Regulations currently allow for direct incorporation of these findings into the solicitation and award of U. S. Coast Guard construction contracts. Small business set-asides can be used for Coast Guard contracts up to \$5M, which encompasses the vast majority of U. S. Coast Guard construction. These contracts can be awarded by negotiation, vice sealed-low bid. The Coast Guard has discretion in determining the factors to be evaluated in making the award. In addition to the standard factors of cost, quality and direct information regarding past performance, it is also permissible and advisable to include relative contract size (higher is better) and revenue per employee (higher is indicative of higher and more timely performance) as evaluation factors. While there are no guarantees, doing so will provide the highest chance of contract success.

9.3 Next Steps

After completing this research, I began informal discussions with current U. S. Coast Guard contracting personnel to ensure that the research findings were wholly consistent with their own empirical observations and experiences. This was indeed the case, and nothing I uncovered was a large surprise to them. However, like myself prior to the beginning of this thesis, none of those I spoke with understood why much of this was true, or had any quantitative data to support their empirical observations. Agency theory, particularly the concepts of moral hazard, incomplete contracts and self-enforcing contracts provide explanation for the empirically observed behaviors and outcomes. The research of the thesis quantitatively demonstrates that the expected trends do indeed exist. Moving forward from here, I can now advocate and share these findings with U. S. Coast Guard contracting personnel. Through application of this research, I expect U. S. Coast Guard construction contracts can be better solicited and awarded in order to maximize the opportunity for the most successful performance outcomes.

Bibliography

- Baker, G., Gibbons R., & Murphy, K. (2002). *Relational Contracts and the Theory of the Firm*. The Quarterly Journal of Economics, February 2002.
- Brousseau, E. & Glachant, J. M. (2002). The Economics of Contracts and the Renewal of Economics. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 1-44), Cambridge, UK: Cambridge University Press.
- Charreaux, G. (2002). Positive Agency Theory: Place and Contributions. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 251-272), Cambridge, UK: Cambridge University Press.
- Federal Acquisition Regulation*. Volumes I and II. Issued March 2005 by the General Services Administration, Washington DC.
- Gotleib, D. (2009). *Essays on Contract Theory and Behavioral Economics*. (Doctoral dissertation, Massachusetts Institute of Technology).
- Hart, O. (2002). Norms and the Theory of the Firm. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 180-192), Cambridge, UK: Cambridge University Press.
- Hart, O. & Moore, J. (1998). Foundations of Incomplete Contracts. MIT Department of Economics Working Paper 6726. Cambridge, MA: National Bureau of Economic Research.
- Hart, O. & Holmström, B. (2002). A Theory of Firm Scope. MIT Department of Economics Working Paper No. 02-42. Available at SSRN: <http://ssrn.com/abstract=355860> or doi:10.2139/ssrn.355860
- Jensen, M. & Meckling, W. (1976). *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure*. Journal of Financial Economics, October, 1976, V. 3, No. 4, pp. 305-360.
- Keser, C. & Willinger, M. (2002). Experiments on Moral Hazard and Incentives: Reciprocity and Surplus-Sharing. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 293-314), Cambridge, UK: Cambridge University Press.
- Klein, B. (2002). The Role of Incomplete Contracts in Self Enforcing Relationships. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 59-71), Cambridge, UK: Cambridge University Press.
- Klein, B. (1992). Contracts and Incentives: The Role of Contract Terms in Assuring Performance. In L. Werin & H. Wilkander (Ed.), *Contract Economics*. (pp. 149-180), Cambridge, MA: Blackwell Publishers.

Lasowski, A. (2009). *Federal Contractors: Better Performance Information Needed to Support Agency Contract Award Decisions*. GAO-09-374. Washington, DC: Government Accountability Office.

Masten, S. & Saussier, S. (2002). Economics of Contracts: An Assessment of Developments in the Empirical Literature on Contracting. In E. Brousseau and J. M. Glachant (Ed.), *The Economics of Contracts*. (pp 272-292), Cambridge, UK: Cambridge University Press.

Salanie, B. (2005). *The Economics of Contracts* (2nd Edition). Cambridge, MA: The MIT Press.

Schanze, E. (1987). Contract, Agency, and the Delegation of Decision Making. In G. Bamberg & K. Spremann (Ed.), *Agency Theory, Information and Incentives* (pp 461-472), Berlin, Germany: Springer-Verlag.

Schneider, D. (1987). Agency Costs and Transaction Costs: Flops in the Principal-Agent Theory of Financial Markets. In G. Bamberg & K. Spremann (Ed.), *Agency Theory, Information and Incentives* (pp 461-472), Berlin, Germany: Springer-Verlag.

Schwartz, A. (1992). Legal Contract Theories and Incomplete Contracts. In L. Werin & H. Wilkander (Ed.), *Contract Economics*. (pp. 76-113), Cambridge, MA: Blackwell Publishers.

Spremann, K. (1987). Agent and Principal. In G. Bamberg & K. Spremann (Ed.), *Agency Theory, Information and Incentives* (pp 3-35), Berlin, Germany: Springer-Verlag.

Tirole, J. (1999). Incomplete Contracts: Where do We Stand? *Econometrica*, Vol. 67, No. 4 July, 1999., (pp. 741-781).

Twain, M. (1885). *The Adventures of Huckleberry Finn*. Referenced at Free EBooks at Planet EBook.com.

United States Coast Guard Major Systems Acquisition Manual. (2009). COMDTINST M5000.10A Version 2.1, 16 March 2009.

Valerdi, R., Friedman, G. & Marticello, D. (2011). *Diseconomies of Scale in Systems Engineering*. Publishing Pends.

www.USASpending.gov

www.manta.com

Appendix A – Construction Contract Evaluation Forms

FOR OFFICIAL USE ONLY (WHEN COMPLETED)

PERFORMANCE EVALUATION (CONSTRUCTION)		1. CONTRACT NUMBER	
		2. CEC NUMBER	
IMPORTANT: Be sure to complete Part III - Evaluation of Performance Elements on reverse.			
PART I - GENERAL CONTRACT DATA			
3. TYPE OF EVALUATION (<i>X one</i>)		4. TERMINATED FOR DEFAULT	
<input type="checkbox"/> INTERIM (<i>List percentage</i> %) <input type="checkbox"/> FINAL <input type="checkbox"/> AMENDED		<input type="checkbox"/>	
5. CONTRACTOR (<i>Name, Address, and ZIP Code</i>)		6.a. PROCUREMENT METHOD (<i>X one</i>)	
		<input type="checkbox"/> SEALED BID <input type="checkbox"/> NEGOTIATED	
		b. TYPE OF CONTRACT (<i>X one</i>) <input type="checkbox"/> FIRM FIXED PRICE <input type="checkbox"/> COST REIMBURSEMENT <input type="checkbox"/> OTHER (<i>Specify</i>)	
7. DESCRIPTION AND LOCATION OF WORK			
8. TYPE AND PERCENT OF SUBCONTRACTING			
9. FISCAL DATA	▶ a. AMOUNT OF BASIC CONTRACT \$	b. TOTAL AMOUNT OF MODIFICATIONS \$	c. LIQUIDATED DAMAGES ASSESSED \$
			d. NET AMOUNT PAID CONTRACTOR \$
10. SIGNIFICANT DATES	▶ a. DATE OF AWARD	b. ORIGINAL CONTRACT COMPLETION DATE	c. REVISED CONTRACT COMPLETION DATE
			d. DATE WORK ACCEPTED
PART II - PERFORMANCE EVALUATION OF CONTRACTOR			
11. OVERALL RATING (<i>X appropriate block</i>)			
<input type="checkbox"/> OUTSTANDING <input type="checkbox"/> ABOVE AVERAGE <input type="checkbox"/> SATISFACTORY <input type="checkbox"/> MARGINAL <input type="checkbox"/> UNSATISFACTORY (<i>Explain in Item 20 on reverse</i>)			
12. EVALUATED BY			
a. ORGANIZATION (<i>Name and Address (Include ZIP Code)</i>)		b. TELEPHONE NUMBER (<i>Include Area Code</i>)	
c. NAME AND TITLE	d. SIGNATURE		e. DATE
13. EVALUATION REVIEWED BY			
a. ORGANIZATION (<i>Name and Address (Include ZIP Code)</i>)		b. TELEPHONE NUMBER (<i>Include Area Code</i>)	
c. NAME AND TITLE	d. SIGNATURE		e. DATE
14. AGENCY USE (<i>Distribution, etc.</i>)			

DD FORM 2626, JUN 94

EXCEPTION TO SF 1420 APPROVED BY GSA/IRMS 8-94

Reset

Adobe Professional 7.0

FOR OFFICIAL USE ONLY (WHEN COMPLETED)

PART III - EVALUATION OF PERFORMANCE ELEMENTS

N/A = NOT APPLICABLE O = OUTSTANDING A = ABOVE AVERAGE S = SATISFACTORY M = MARGINAL U = UNSATISFACTORY

15. QUALITY CONTROL							16. EFFECTIVENESS OF MANAGEMENT						
N/A	O	A	S	M	U	N/A	O	A	S	M	U		
a. QUALITY OF WORKMANSHIP						a. COOPERATION AND RESPONSIVENESS							
b. ADEQUACY OF THE CQC PLAN						b. MANAGEMENT OF RESOURCES/ PERSONNEL							
c. IMPLEMENTATION OF THE CQC PLAN						c. COORDINATION AND CONTROL OF SUBCONTRACTOR(S)							
d. QUALITY OF QC DOCUMENTATION						d. ADEQUACY OF SITE CLEAN-UP							
e. STORAGE OF MATERIALS						e. EFFECTIVENESS OF JOB-SITE SUPERVISION							
f. ADEQUACY OF MATERIALS						f. COMPLIANCE WITH LAWS AND REGULATIONS							
g. ADEQUACY OF SUBMITTALS						g. PROFESSIONAL CONDUCT							
h. ADEQUACY OF QC TESTING						h. REVIEW/RESOLUTION OF SUBCONTRACTOR'S ISSUES							
i. ADEQUACY OF AS-BUILTS						i. IMPLEMENTATION OF SUBCONTRACTING PLAN							
j. USE OF SPECIFIED MATERIALS						17. TIMELY PERFORMANCE							
k. IDENTIFICATION/CORRECTION OF DEFICIENT WORK IN A TIMELY MANNER						a. ADEQUACY OF INITIAL PROGRESS SCHEDULE							
17. TIMELY PERFORMANCE						b. ADHERENCE TO APPROVED SCHEDULE							
a. ADEQUACY OF INITIAL PROGRESS SCHEDULE						c. RESOLUTION OF DELAYS							
b. ADHERENCE TO APPROVED SCHEDULE						d. SUBMISSION OF REQUIRED DOCUMENTATION							
c. RESOLUTION OF DELAYS						e. COMPLETION OF PUNCHLIST ITEMS							
d. SUBMISSION OF REQUIRED DOCUMENTATION						f. SUBMISSION OF UPDATED AND REVISED PROGRESS SCHEDULES							
e. COMPLETION OF PUNCHLIST ITEMS						19. COMPLIANCE WITH SAFETY STANDARDS							
f. SUBMISSION OF UPDATED AND REVISED PROGRESS SCHEDULES						a. ADEQUACY OF SAFETY PLAN							
g. WARRANTY RESPONSE						b. IMPLEMENTATION OF SAFETY PLAN							
						c. CORRECTION OF NOTED DEFICIENCIES							

20. REMARKS (Explanation of unsatisfactory evaluation is required. Other comments are optional. Provide facts concerning specific events or actions to justify the evaluation. These data must be in sufficient detail to assist contracting officers in determining the contractor's responsibility. Continue on separate sheet(s), if needed.)

Reset

**FOR OFFICIAL USE ONLY
(WHEN COMPLETED)**

PERFORMANCE EVALUATION - CONSTRUCTION CONTRACTS		1. CONTRACT NUMBER
1. CONTRACTOR (Name, address, and ZIP code)	3. TYPE OF CONTRACT (Check)	A. ADVERTISED
		B. NEGOTIATED <input type="checkbox"/> CPFF <input type="checkbox"/> FIRM FIXED PRICE <input type="checkbox"/> OTHER (Specify)
		4. COMPLEXITY OF WORK <input type="checkbox"/> DIFFICULT <input type="checkbox"/> ROUTINE
5. DESCRIPTION AND LOCATION OF WORK		

6. FISCAL DATA	a. AMOUNT OF BASIC CONTRACT \$	b. TOTAL AMOUNT OF MODIFICATION \$	c. LIQUIDATED DAMAGES ASSESSED \$	d. NET AMOUNT PAID CONTRACTOR \$
7. SIGNIFICANT DATES	a. DATE OF AWARD	b. ORIGINAL CONTRACT COMPLETION DATE	c. REVISED CONTRACT COMPLETION DATE	d. DATE WORK ACCEPTED

8. TYPE AND EXTENT OF SUBCONTRACTING

PART II PERFORMANCE EVALUATION OF CONTRACT (Check appropriate box)

9. PERFORMANCE ELEMENTS	OUTSTANDING	SATISFACTORY	UNSATISFACTORY
a. QUALITY OF WORK			
b. TIMELY PERFORMANCE			
c. EFFECTIVENESS OF MANAGEMENT			
d. COMPLIANCE WITH LABOR STANDARDS			
e. COMPLIANCE WITH SAFETY STANDARDS			

10. OVERALL EVALUATION
 OUTSTANDING (Explain in Item 13, on reverse)
 SATISFACTORY
 UNSATISFACTORY (Explain in Item 14, on reverse)

11. EVALUATED BY

a. ORGANIZATION (Type or print)

B. NAME AND TITLE (Type or print)	C. SIGNATURE	d. DATE
-----------------------------------	--------------	---------

12. EVALUATION REVIEWED BY

a. ORGANIZATION (Type or print)

B. NAME AND TITLE (Type or print)	C. SIGNATURE	d. DATE
-----------------------------------	--------------	---------

FOR OFFICIAL USE ONLY
(When completed)

13. REMARKS ON OUTSTANDING PERFORMANCE - AS INDICATED BY THE CONTRACTOR'S PERFORMANCE ON THIS CONTRACT. IF YOU CONSIDER THE CONTRACTOR TO BE OUTSTANDING, SET FORTH FACTUAL DATA SUPPORTING THIS OBSERVATION. THESE DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST CONTRACTING OFFICERS IN SELECTING CONTRACTORS THAT HAVE DEMONSTRATED OUTSTANDING QUALITY OF WORK AND RELIABILITY. (Continue separate sheet, if needed.)

[Empty box for providing remarks on outstanding performance.]

14. EXPLANATION OF UNSATISFACTORY EVALUATION. FOR EACH UNSATISFACTORY ELEMENT, PROVIDED FACTS CONCERNING SPECIFIC EVENTS OR ACTIONS TO JUSTIFY THE EVALUATION (e.g., extent of Government inspection required, rework required, subcontracting, cooperation of contractor, quality of workmen and adequacy of equipment). THESE DATA MUST BE IN SUFFICIENT DETAIL TO ASSIST CONTRACTING OFFICERS IN DETERMINING THE CONTRACTOR'S RESPONSIBILITY. (Continue on separate sheet, if needed.)

[Empty box for providing explanation of unsatisfactory evaluation.]

FOR OFFICIAL USE ONLY
(When completed)

STANDARD FORM 1420 (10-83) BACK