3-16-2006

A Decision Analysis Tool for the Source Selection Process

John R. Trumm

A DECISION ANALYSIS TOOL FOR THE SOURCE SELECTION PROCESS

THESIS

John R. Trumm, Captain, USAF

AFIT/GEM/ENV/06M-16

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the United Sates Air Force, Department of Defense, or the United States Government.

AFIT/GEM/ENV/06M-16

A DECISION ANALYSIS TOOL FOR THE SOURCE SELECTION PROCESS

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Engineering Management

John R. Trumm, BS

Captain, USAF

March 2006

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

AFIT/GEM/ENV/06M-16

A DECISION ANALYSIS TOOL FOR THE

SOURCE SELECTION PROCESS

John R. Trumm, BS
Captain, USAF

Approved:

/signed/	16 Mar 06
Alfred E. Thal, Jr., Ph.D. (Chairman)	date
/signed/	16 Mar 06
Jeffery D. Weir, Lt Col, USAF, Ph.D. (Member)	date
/signed/	16 Mar 06
Vincent A. Dutter, Capt, USAF, M.Eng. (Member)	date

AFIT/GEM/ENV/06M-16

Abstract

The source selection process for choosing a contractor does not incorporate a standardized objective decision analysis tool; therefore, the process is extremely subjective and provides little guidance to distinguish between highly competitive contractors. The Air Force Simplified Acquisition of Base Engineer Requirements (SABER) program selects contractors through a Low Price Technically Acceptable (LPTA) source selection process and encounters the same problem of not being able to objectively distinguish between the competing contractors. The LPTA process rank orders the contractors based on price and evaluates the bidders in order until an "exceptional" contractor is discovered. However, the SABER source selection committee members wish to evaluate all contractors using all decision criteria with the ability to objectively compare all contractors to one another.

Since there are several factors and guidelines to consider when awarding a SABER contract, a value focused thinking approach was used to create a structured decision making model that takes into account all values along with their desired weighting as specified by members of a SABER source selection team. The model was then used to evaluate seven contractors who recently competed for a SABER contract and perform deterministic and sensitivity analysis on the recommended decision outcome. The results of this research illustrate the valuable insight and practicality of applying a quantitative, objective, consistent, and defendable tool for SABER source selections. The value gained from this model will potentially aid the SABER source selection process, as well as other government and private/public source selections.

Acknowledgments

I would like to thank several people for their support and guidance of my efforts. First I want to thank all the members of the "subject organization" who, without fail, offered their time and experience. Your contribution to this effort is appreciated more than words can say. I want to thank Dr Thal for your expertise and patience throughout this process; especially in the final hours. Thank you, LtCol Weir for your consistent understanding to help me to fully grasp and appreciate the value of decision analysis and the Value Focused Thinking process. Thank you, Capt Dutter for your valuable input and willingness to get involved.

Most importantly, thank you to my family. To my gorgeous wife, you have helped keep me on track throughout my time here. Thank you for your love and understanding during the long and odd hours spent during this effort. I will find a way to make it up to you. To my beautiful daughter, no matter how rough the days could be, you would bring me back to reality with a simple smile, hug, or kiss. You both make "career building" experiences like this worth while.

John R. Trumm

Table of Contents

Page

Page

List of Figures

Figure Page

Figure Page

List of Tables

Table Page

A DECISION ANALYSIS TOOL FOR THE

SOURCE SELECTION PROCESS

Chapter I. Introduction

The source selection process is an extremely detailed and time consuming course of action utilized to select the best offeror responding to a specific solicitation. This process, applied by both private and public sector organizations, consists of several regulations and evaluating processes. However, it does not incorporate any techniques for objective decision analysis. To focus the application of this thesis, an in-depth research effort on the process of an Air Force Simplified Acquisition of Base Engineer Requirements (SABER) contractor source selection will be accomplished. Although an Air Force SABER source selection will be the subject focus, the problems addressed and methodology applied seem relevant to all private and public sector source selection processes.

1.1 Background

Air Force guidance states that a SABER contract provides a streamlined means to complete construction projects estimated at less than $750,000. In fact, the guidance states that its main purpose is to expedite the award of civil engineer (CE) requirements for projects typically ranging from $50,000 to $500,000. As such, a SABER contract means a fixed-price, indefinite-delivery/indefinite-quantity (ID/IQ) contract (IG5336.9201, 2005). Typical ID/IQ construction contracts are for single trades,

meaning they only operate in the realm of one type of construction (i.e., pavement, roofing, or painting). ID/IQ contracts are awarded with the understanding that a large quantity of separate projects will be accomplished over a period of time (usually over 4 to 5 years); however, it is not certain when each individual project will occur. Therefore, the contract is issued using a general specification guide, pricing guide, and Request for Proposal (RFP) to fully encompass several years of potential construction work.

A SABER contract makes it quick and efficient to issue projects throughout the term of the contract. As with most ID/IQ contracts, a SABER contract usually consists of a "base year with four optional years for a total contract duration of five years" (Henry and Brothers, 2001). However, unlike a typical ID/IQ contract, SABER is unique because it is a multi-trade contract and is intended for small scale construction. Therefore, this contracting mechanism is best suited for non-complex, minor construction, and maintenance and repair projects that require minimum design; it is not an appropriate for Architect-Engineering (A-E) services (IG5336.9201, 2005).

The main components of a SABER contract include detailed specifications, Unit Pricing Guides (UPG), and coefficients. The specifications used in a SABER contract are prepared by the base civil engineer (BCE) and include the master specifications, which describe the overall scope of the contract, and the technical specifications, which define specific construction standards for tasks ordered under the contract. After developing the specifications, the BCE selects a Unit Price Guide (UPG). UPGs are commercial pricing tools, such as computer cost databases and libraries of hard copy books, that list tasks by unit of measure and unit price (IG5336.9201, 2005). Examples of commercially available UPGs are WinEstimator Inc., Timberline Software, and R.S.

MEANS, Inc. (IG5336.9201, 2005). Typically, SABER contracts utilize R.S. MEANS. Prices are general in that differing pricing rates for different parts of the country are not accounted for; therefore, UPGs must undergo localization – tailoring the prices to the specific city or general location in which the UPG will be utilized. The final element in the pricing of a SABER contract is the coefficients. Coefficients are factors multiplied against the localized unit prices in the UPG to calculate the finalized individual task order (TO) price (IG5336.9201, 2005). These coefficients, proposed by contractors in their bidding documents, are intended to represent the contractor's costs for overhead, profit, minimum design costs, general and administrative expenses, bond premiums, and gross receipt taxes (IG5336.9201, 2005).

Two main advantages gained by implementing a successful SABER program include: 1) Improved customer service and responsiveness and 2) Incentives for the contractor to work to a high standard, and complete projects in a timely manner in order to receive TOs for future projects (IG5336.9201, 2005). Other advantages include (AFPAM 32-1005, 1999)

1) Enhanced ability to accomplish backlogged work orders and commander-generated requirements – an easy way to quickly accommodate hot projects;
2) Potential for greatly improved working relationships and synergy between Base Civil Engineer (BCE), contracting, and the contractor;
3) Addition of resources to the BCE – a SABER contractor is unaffected by deployments, training, or inspections; and

4) Added fiscal flexibility – other units are more willing to fund project that are quickly responded to and completed in a timely manner with high quality performance.

The selection of a SABER contractor is conducted using an Air Force Source Selection process. A source selection committee, usually consisting of a Contracting Officer (CO) and CE personnel, is formed to evaluate and award the contract "based on the contractor that has the best capability, capacity, and coefficient mix, as determined by the contractor selection criteria" (Henry and Brothers, 2001). The Source Selection Authority (SSA), often the CO, will make the final award decision and has wide latitude and discretion in how to run a source selection. The contractor selection criteria are specified in the RFP.

The contractor's subsequent proposal will usually consist of two volumes – a cost volume and a technical volume. The cost volume will be evaluated by the cost analyst, usually the CO, and the technical volume will be evaluated by the technical analysts, the CE personnel committed to the source selection team. The justification for conducting the evaluation in two separate entities is so the technical analysts are not unduly influenced by the costs presented by the contractors.

1.2 Problem Background

Although mandatory procedures exist governing the overall source selection process, SABER contractors are usually selected under the Lowest Price Technically Acceptable (LPTA) Source Selection Process. An LPTA source selection rank orders the contractors by price (lowest to highest). Beginning with the contractor with the lowest price, their

past performance is evaluated. The first contractor with an exceptional past performance rating is awarded the contract. Under this selection technique, only the lowest bidding contractors are evaluated; in fact, it is possible that only one contractor is actually evaluated.

According to Federal Acquisition Regulation (FAR) 15.101-2 (b)(1), solicitations shall specify that award will be made on the basis of the lowest evaluated price of proposals meeting or exceeding the acceptability standards for non-cost factors. Furthermore, if past performance is to be included as an evaluation factor (as is the case for SABER source selections), it shall be evaluated in accordance with FAR 15.305. This is critical since FAR 15.305 (2005) defines proposal evaluation as "an assessment of the proposal and the offeror's ability to perform the prospective contract successfully." Under this guidance, an agency is required to evaluate competitive proposals and assess their relative qualities based solely on the factors and subfactors specified in the solicitation. A source selection committee may get the impression that they will be able to evaluate all the offerors according to this guidance; however, that is not how an LPTA source selection is conducted as previously discussed.

The format for SABER RFPs is standard across the Air Force except for base-specific information. The SABER RFP states, "For those proposals determined to be acceptable, a tradeoff between price and past performance will be conducted with past performance being significantly more important than price" (Section M, Paragraph 2.0). From this information, if past performance and price were weighted factors and all possible weighting scenarios were considered, past performance would assume at least 51% of the decision since it is supposed to be significantly more important than price.

The significance of this information will become more evident within the following chapters of this thesis. The SABER RFP also states, "If the lowest priced acceptable offer received a performance confidence assessment rating of 'exceptional/high confidence', that offer represents the best value for the Government. Award shall be made to that offeror without further consideration of any other offerors" (Section M, Subsection B, Paragraph B). This reiterates the process of an LPTA source selection and describes how only the lowest priced contractors will be evaluated.

The intent of the government is to select a SABER contractor that represents the best value; however, the current source selection process focuses on the lowest bidding contractors. The selection committee does not get to evaluate all the offerors, and the pricing influence on the decision is supposed to be outweighed by the past performance influence. However, there is no way of ensuring a weighting value of 51% or greater for past performance will hold constant throughout the source selection. Additionally, the technical evaluations are obtained from past performance reviews and simply recorded on a single evaluation sheet per contractor (overall process explained in Chapter 2). This method of consolidating all factors considered in determining a qualified SABER contractor does not allow for proper identification and analysis of how each factor potentially influences the ratings of each contractor. The technical analysts are not able to properly compare contractors to one another based on the factors used for the evaluation, nor are they able to objectively differentiate between the ratings assigned to the contractors utilizing the current source selection method.

1.3 Problem Statement

When competing contractors have similar qualities based on price and past performance, it is difficult to determine which contractor represents the true best value to the Air Force. In many source selection cases, multiple competing contractors are highly qualified, have impeccable past performance reviews, and meet pricing expectations. In a LPTA Source Selection, the lowest bidder (with an exceptional rating) will win the contract award but may not be the best contractor. Evidence that low-priced, technically acceptable contractors may not be in the best interests of the Air Force was noted by Heaps (2001):

> Recently, the Assistant Secretary of the Air Force for Acquisition's Operational Contracting Division (SAF/AQCO) identified a number of installations that are having problems with its SABER contractors. Some contractors have gone out of business and defaulted on their contracts. Other contractors have not lived up to the performance standards identified in the SABER contract. In these situations, the Government has decided not to exercise the next option of the existing SABER contract.

Unsuccessful SABER contractors are an immense waste of time and money. To select a successful contractor, source selection teams need to have a firm understanding of the attributes and criteria, beyond price and past performance, impacting their decision. Furthermore, decision makers must have the latitude to be able to analyze how the contractors compare against each another.

The decision process for source selection teams typically does not include a definitive proposal evaluation tool capable of converting qualitative judgmental criteria beyond price and past performance into measurable quantitative data which can be easily interpreted. There is a need for a tool that can provide objective, accurate, adaptable, defendable, and quantifiable analysis. Also, the tool needs to have the capability to easily

delineate between competing contractors. Therefore, the motivating factor of this thesis is to develop a decision analysis tool that can be incorporated into the SABER source selection process to illustrate the importance of fully identifying all criteria and evaluating all the alternatives through a systematic and objective model.

1.4 Research Question

Because SABER source selections are primarily based on price and past performance, other criteria and underlying measures vital to the decision process may be neglected or not fully understood by the decision makers. When a difficult contractor selection is made, the decision makers may not be comfortable or confident when having to explain and document the final outcome, especially when all the offerors may not have been evaluated. Therefore, this research is focused on the following multi-faceted question: What are all the criteria, values, and measures determined essential by the decision makers to effectively select the best contractor and why is it essential to evaluate all the alternatives?

1.5 Investigative Questions

To help facilitate an understanding of how other criteria and underlying measures can influence a decision maker, as well as adequately answer the research question, the following investigative questions will need to be answered:

- How well does the current selection process work?

- What are the criteria, to include price and past performance, that are deemed necessary to evaluate competing contractors and what are the underlying measures for these criteria?
- How are the measures weighted by the decision makers?
- How well does the model convey the true feelings of the decision makers?
- How does the model compare to the current selection process?

For the purpose of this research, several iterations and sensitivity analyses may need to be conducted to get the best representative model.

1.6 Methodology

A Value Focused Thinking (VFT) model will be used in this research to evaluate alternatives (SABER contractor proposals) using a value hierarchy and decision makers' weighted values to aid in the decision analysis of a source selection. A VFT approach was used because the values inherent in the decision process are the priority of the entire methodology, as opposed to the standard decision process of focusing on the alternatives. By switching the attention to values, the decision process now becomes proactive rather than reactive. Keeney (1996) states, "A shift to this way of thinking about decisions can significantly improve decision making because values guide not only the creation of better alternatives but the identification of better decision situations."

This research will be conducted in a two phase process. The first phase will consist of an initial questionnaire presented to a base civil engineering organization that acted as members of a SABER source selection committee and have a depth of knowledge on SABER contracts. The questionnaire will attempt to gain further insight into the current

source selection process. The members of the civil engineering organization will also be exposed to the VFT methodology and take part in the development of a VFT model to select a SABER contractor. Between the two phases of the research, the model will be developed through several iterations.

The second phase of research will present a final model and the results of analysis gained form incorporating empirical data gathered on seven contractors. The civil engineering organization will then complete a final questionnaire to gain insight into the usefulness and practicality of the VFT model. These two phases of research will help perform a comprehensive analysis on the current source selection process, the VFT process, the model's performance, and validation and insight into the usefulness of the model.

1.7 Assumptions and Limitations of Research

The assumptions involved with this research effort are that the VFT model will provide valid forms of objective analysis to the SABER source selection process. Additionally, it is assumed that the model will be able to show the importance of evaluating and analyzing all competitive alternatives and will show the flaws that stem from only evaluating lowest priced contractors in the selection process.

This research will utilize CE personnel involved with a SABER contract at one particular Air Force base; therefore, further research may have to be performed to incorporate this type of model for other locations and decision makers. The overall model will attempt to capture universal factors affecting the selection of a SABER contractor; however the weightings applied to the values within the model and value

function structures will be dependent upon the decision makers that utilize the model. Since empirical coefficient data on the contractors cannot be shared, notional data sets may be generated to illustrate the capabilities of the model. This is the first attempt to create a model and simulate a SABER source selection that evaluates all competing contractors; therefore, the focus was aimed towards the technical decision makers (CE personnel). Further research may also be performed to incorporate the thoughts and impressions of Contracting personnel.

1.8 Document Structure

There are four remaining chapters in this thesis. Chapter 2, Literature Review, will provide a detailed background of SABER and the SABER source selection process as well as a presentation of the existing knowledge base regarding Value Focused Thinking. Chapter 3, Methodology, will illustrate the development of the VFT model used to evaluate the research objective specified in Chapter 1 as well as explain the validation process inherent to VFT. The chapter will also analyze the results of the questionnaire conducted in phase one of the research. Chapter 4, Data Analysis, will discuss and review the results of the analysis conduced on the empirical data sets of the seven contractors. The impact of the analysis on a SABER source selection will also be discussed, as will the analysis of the results of the questionnaire conducted in phase two of the research. Chapter 5, Conclusions and Recommendations, will present an overall summary of this research effort and present concluding thoughts. Future research avenues and recommendations for implementation of the model will also be presented.

Chapter II. Literature Review

This chapter provides a synopsis of recent literature regarding Simplified Acquisition of Base Engineer Requirements (SABER) contracts and the current procurement process, as well as a detailed discussion of the existing knowledge base representing Value Focused Thinking (VFT). The first part of the chapter focuses on multiple aspects of SABER contracting to include the purpose, benefits, and the source selection process. The chapter further discusses problems that arise within the source selection process, which is the motivating factor for this thesis research. The second part of the chapter focuses on VFT and explains the ten-step process as proposed by Shoviak (2001).

2.1 Air Force Construction Contracts

The Air Force has two main avenues that are utilized to execute a majority of construction projects. These are Design Bid Build (DBB) and SABER contracts (Henry and Brothers, 2001). The Air Force is constantly changing and updating its facilities and base layouts to keep pace with the operational changes and technological advances of our cutting edge military. Such projects may include renovating buildings for new training personnel or equipment, demolishing obsolete structures or equipment, constructing or installing state of the art structures or equipment, abating hazardous materials, changing building configurations for different mission capabilities, and so on. Often, time is a crucial factor for implementing these small scale construction projects. The DBB method is a very detailed and lengthy process requiring 100% design, drawings, and specifications that contain enough detail to describe the construction process without any

additional explanations (Henry and Brothers 2001). This process can also be very costly as architecture-engineering (A/E) firms are required, and the design will usually be about 10% of the total construction cost for a project. With this level of detail for each project, DBB contracts can require 3 to 9 months to complete just the design phase (Henry and Brothers 2001); therefore, DBB is not a viable option for the small scale, time-critical construction conditions that the Air Force often faces. These are the conditions where SABER proves to be a valuable tool.

In contrast to DBB contracts, the design requirements for SABER are a 35% complete (not 100%) design. This greatly reduces the amount of time and effort required by base level engineering personnel, thereby expediting the project start time. Once the contract is awarded, task orders can be developed, processed, and work started in as quickly as 30 days (Furr, 1996). Not only can a SABER project be completed in an extremely timely manner, bypassing much of the contracting administrative work of DBB projects, but the SABER contractor can conduct multiple projects simultaneously.

2.2 SABER Contracts

Unlike DBB contracts where a separate contract package has to be awarded for each project, SABER is awarded as one contract which will include one basic year with four option years, making it a potential five-year contract. During this time, each project to be completed by SABER is issued as a task order (TO). Because there is a unit pricing guide (UPG) and specifications that are all encompassing in the original SABER contract, the TO packages do not require individual specifications and cost is simply based off a unit pricing guide. The coefficient that the contractor has submitted is then

utilized to determine the final price. Coefficients are factors multiplied against the standard unit prices in the UPG to calculate TO prices (IG5336.9201, 2005).

2.2.1 Purpose of SABER

As stated in IG5336.9201 (2005), the purpose of the Air Force SABER program is to expedite contract award of civil engineer requirements by reducing civil engineer design work and acquisition lead-time. SABER is to be utilized for non-complex, minor construction projects, repair work, and other projects that require minimal design. SABER can be utilized for larger projects with proper authority approval so long as it is in accordance with the Federal Acquisition Regulation (FAR).

2.2.2 Benefits of SABER

The benefits of SABER include improved customer service and responsiveness and incentives for highly motivated contractors to produce high quality work in a timely manner (IG5336.9201, 2005). Once a SABER contract is awarded, the contractor will be designated a location on base. This ensures that they will be readily accessible for issues that may arise on project jobsites. A SABER contractor will usually have several jobs occurring at the same time, so availability is essential. Air Force bases also have an immense demand for completed construction TOs. The SABER contractor realizes that the base can provide a large amount of business and that acquiring future delivery orders depends on the quality and timeliness of the projects they complete. Therefore, the contractors are highly motivated to turn out quality work in a timely fashion to ensure future business.

2.2.3 Source Selection

In order to award a SABER contract, the Government must implement a competitively negotiated source selection process. This allows the competing contractors to have equal opportunity when bidding for the contract, and allows the Government to evaluate each offeror's proposal based on price and other nonprice-related factors. "Source selection procedures are designed to (1) maximize competition; (2) minimize the complexity of the solicitation, evaluation, and selection process; (3) ensure the impartial and comprehensive evaluation of proposals; and (4) ensure selection of the source whose proposal is most advantageous and realistic and whose performance is expected to best meet stated Government requirements" (Nash et al., 1999).

2.2.3.1 Background

The process of determining the SABER contractor is conducted by a source selection committee that is directed by a Contracting Officer (CO); the committee is comprised of decision makers from the civil engineering organization (usually consisting of the SABER Chief, Construction Manager, and other engineers or project managers skilled in construction practices). A SABER Request for Proposal (RFP) states, "Offeror shall provide information on no more than ten (10) of the most recent [in the past three (3) years] contracts (either Federal, State, municipal, or commercial) considered most relevant in demonstrating the offerors ability to perform the proposed effort." (SABER RFP, 2004). Furthermore, it also states, "Offerors shall provide Attachment #9, Past and Present Performance Questionnaire (Appendix A), to those agencies/firms responsible for the solicitation and administration of those identified projects." These performance

questionnaires are utilized for the evaluation process of the offerors as described in the SABER RFP (2004):

> Using questionnaires, the contracting officer will seek performance information based on (1) the references provided by the offeror and (2) data independently obtained from other Government and commercial sources. The purpose of the past performance evaluation is to allow the Government to assess the offeror's ability to perform the effort described in this RFP based on the offeror's demonstrated present and past performance. The contracting officer will evaluate the past performance of the seven (7) lowest, technically acceptable priced offerors. This allows for efficiency in the source selection process.

Once all proposals have been received by Contracting and the Contracting Officer has acquired all necessary past performance and background information on the offerors, the decision makers will begin their evaluation process. The offerors will first be rated on price (i.e., the coefficient submitted) in rank order beginning with the lowest-priced contractor.

The competing contractors submit coefficient information which will be multiplied by each future TO project cost based on the UPG. The coefficients "must represent all costs associated with the completion of the requirements of the contract including, but not limited to, all direct costs, overhead, general & administrative, bond premiums, profit, main or home office and on site office expenses" (SABER RFP, 2004). Table 1 is an example from the SABER RFP demonstrating how offerors' coefficients can be weighted and summed to determine an overall value for evaluation purposes.

Table 1. Coefficient Ranking
(SABER RFP, 2004)

CLIN*	SAMPLE COEFFICIENT	ACTUAL ASSESSED %	TOTAL
0001	1.17	96%	1.1232
0002	1.23	3%	0.0369
0003	1.21	.5%	0.0060
0004	1.27	.5%	0.0063
Overall Coefficient Factor for Evaluation Purposes			**1.1724**

***** CLIN = Contract Line Item

After rank ordering the contractor based on the coefficient information submitted, the decision makers are provided an evaluator worksheet (Appendix B) and asked to independently rate the lowest price offeror. The decision makers then collectively rate the offeror with another evaluator worksheet. In all cases, the ratings coincide with the definitions as described in Table 2. If the lowest price offeror receives an "Exceptional" rating, that offeror will be awarded the contract. If the lowest price offeror receives a "Very Good" or below rating, the selection committee moves on to the next lowest price offeror and repeats the process. This is done until an "Exceptional" rated offeror is discovered. If the "Exceptional" rated offeror is not the lowest bidder, an analysis will be done to determine the best value contractor for the Air Force. The rational for this type of source selection is based on the guidelines of a Lowest Priced Technically Acceptable (LPTA) source selection process.

Table 2. Past Performance Ratings
(Air Force Mandatory Procedure 5315.3, 2005)

Rating	Definition
Exceptional / High Confidence	Based on the offeror's performance record, essentially no doubt exists that the successful offeror will successfully perform the required effort.
Very Good / Significant Confidence	Based on the offeror's performance record, little doubt exists that the successful offeror will perform the required effort.
Satisfactory / Confidence	Based on the offeror's performance record, some doubt exists that the successful offeror will perform the required effort.
None / Neutral Confidence	No performance record identifiable.
Marginal / Little Confidence	Based on the offeror's performance record, substantial doubt exists that the successful offeror will perform the required effort.
Unsatisfactory / No Confidence	Based on the offeror's performance record, extreme doubt exists that the successful offeror will perform the required effort.

2.2.3.2 Best Value

As observed from the selection process previously described, the Government may not always select the lowest priced bidder. The best value contractor may have a higher priced bid, but it is determined by the Government that the difference in cost is outweighed by the quality of the contractor that will be acquired. "Best value procurements focus on selecting the contractor with the offer most advantageous to the government, price and other factors considered" (Gransberg and Ellicott, 1996). Gransberg and Ellicott provide the background to this method of procurement with the following:

> Beginning in 1984 with the Competition in Contracting Act (CICA), the US congress recognized the need for improved procurement procedures. Federal acquisition regulations (FAR), developed to implement CICA, include language permitting quality- or value-based selections (1996).

The need for greater emphasis on the overall value of a contractor versus just focusing on price is reiterated by Kashiwagi and Savichy (2002):

> The low-bid, design-bid-build construction delivery system has been the standard delivery system for the last 30 years. In the last ten years, construction nonperformance problems with the low-bid system have encouraged owners to move to alternate delivery systems such as performance contracting, indefinite delivery, indefinite quantity (IDIQ), design-build (DB), and construction management at risk (CMAR).

2.2.3.3 Evaluation Criteria

The evaluation criteria, to include factors and significant subfactors, utilized in awarding a SABER contract must be described within the solicitation or RFP (FAR 15.101-2, 2005). Noted earlier, the Government will evaluate the proposals based on price and nonprice-related factors. However, nonprice-related factors are encompassed into a past performance evaluation; therefore, the factors utilized in a SABER source selection are price and past performance.

The 1994 Federal Acquisition Streamlining Act (FASA), signed into law by Congress on October 13, 1994, acknowledged that it is appropriate and relevant for the Government to consider a contractor's past performance in evaluating whether that contractor should receive future work (IG5315.305, 2005). Adversely, FAR 15.304 (2005) notes: "Past performance need not be evaluated if the contracting officer documents the reason past performance is not an appropriate evaluation factor for the acquisition." However, there is currently no literature that can produce evidence of a source selection committee not utilizing past performance for a SABER source selection.

Price is a straight forward factor to evaluate, especially for SABER since the only pricing issue is the coefficient rate (described in Section 2.3). Therefore, the offerors can be rank ordered by price from lowest to highest immediately. What about past performance? There has been a trend toward using past performance as the only non-cost evaluation factor (Nash et al., 1999). Can a past performance factor be easily assessed as well? According to Nash et al. (1999), Edwards stated that past performance is "used to assess an offeror's capability, comprising of three elements: (1) observations of the historical facts of a company's work experience – what work it did, when and where it did it, whom it did it for, and what methods it used; (2) qualitative judgments about the breadth, depth, and relevance of the experience base on those observations; and (3) qualitative judgments about how well the company performed, also based on the observations." For one evaluation factor, that is a lot of information to interpret and decipher accurately.

In addition to the Air Force guidance governing SABER contracts, other criteria may be useful to explore. In fact, numerous researchers have identified various categories and information related to selection criteria. The results of their research are summarized in the following paragraph.

All encompassing criteria were noted to include general, technical, managerial and financial criteria. Further broken down, the stability and capability aspects were explored concerning the financial and managerial criteria, and an in depth look was taken at organizational strength, and experience of comparable construction. Other issues that were addressed are relevance of experience, size of firm, and ones safety record. All

these criteria have been researched and are considered significant when selecting a construction contractor (Bransberg and Ellicott 1997).

Gransberg and Ellicott (1997) also explain that source selection panels often develop detailed evaluation criteria capable of discriminating between various proposals after an initial review of all proposals. Criteria can include:

- Technical excellence
- Management capability
- Financial capability
- Personnel qualifications
- Prior experience
- Past performance
- Optional features offered
- Completion date
- Risk to the government

This represents a much larger list than the Air Force's practice of basing decision on just two criteria (price and past performance). Stated previously by Nash et al. (1999), there are several subfactors that can be considered with past performance alone. There is an even greater potential for many more underlying subfactors to be considered in the criteria list provided by Gransberg and Ellicott.

2.2.4 SABER Source Selection Problems

With a large list of potential criteria to base a best value SABER contractor on, the fact that the Air Force is only utilizing price and past performance seems to negate the intent of the source selection process. Additionally, if all the factors and subfactors are

not fully explored and understood by the decision makers and the bidding contractors, how effective and efficient is the process really going to be? The decision makers are relying totally on subjective information to make an evaluation and cannot objectively pinpoint differences that may be evident between the contractors. Additionally, the contractors are not fully aware of all of the criteria that the decision makers value because they are not presented in the RFP. "Prior to submitting any contract proposal, companies are always well served to conduct the upfront research necessary to understand a government agency's most important requirements, which are not always readily apparent in an RFP" (Kennedy and Cannon, 2004). To add to the confusion, this whole process needs to be accurately documented and justified. "They [agency contracting officials] argue that evaluations tend to be inflated, with past performance scores offering little real discrimination among candidates" (Burman, 1997). This trend is supported by Kelman (2005), "At a conference I attended recently, a participant complained that vendors' past-performance evaluations look alike, making it hard for them to be a differentiator in source selection."

Offerors that lose out on the contract have the right to see how they rated in the process and can also challenge the final decision. "Thus, the fair and evenhanded evaluation of past performance has become a critical necessity, and there have been numerous recent protests challenging past performance assessments" (Nash et al., 1999). Thus, the issue of proper documentation becomes critical. The Assistant Secretary of the Air Force stated, "While the Source Selection Authority (SSA) has broad discretion in making the best value source selection decision, the decision must be consistent with the

evaluation factors in the solicitation. SSAs must fully document the rationale for their decisions in Source Selection Decision Documents (SSDDs)" (Sambur, 2003).

FAR 15.305 (2005) states that "evaluations may be conducted using any rating method or combination of methods, including color or adjectival ratings, numerical weights, and ordinal rankings." Smith (2004) notes that "color or adjectival ratings fail to provide a mechanism for evaluation teams to weigh each criteria with relation to the other factors making it cumbersome to determine best value." SABER Contracts are awarded on the basis of only two criteria, price and past performance, with very little guidance regarding the award process of the source selection. This combination is a double threat in that the tools and directions for a SABER source selection are not well established and defined.

The SABER source selection process should be a non-complex, impartial, objective, and easily documented process. However, without a firm understanding of the factors that are utilized in the selection process, the process will become frustrating, confusing, and misguided.

> The source selection decision is by nature a subjective one, even when the evaluation standards are made as objective as possible. The evaluations demand that judgment and tradeoffs must be made (usually between cost, performance, and risk). In Air Force source selections, relative weights of the criteria are usually established and communicated in the request for proposal – but these are usually not quantified, either in the proposal or in the actual source selection. Thus, judgmental factors in the evaluation of the proposals, the comparison of proposals one against another, and the decision by the source selection authority suggest that the process will by nature have considerable subjectivity, especially given the complex nature of the acquisitions" (Templin and Noffsinger, 1994)

2.3 Value Focused Thinking

Selection of a SABER contractor is an in-depth process of gathering, evaluating, and interpreting information. As discussed earlier, the SABER source selection process is ill-defined and there is currently no way to alleviate the subjectivity of the process; therefore, there is a need for some form of standardized clarification to the directional guides. A structured decision making process can aid in fully understanding a decision being made as well as help in choosing the best alternative (Duncan, 2004). With today's technological capabilities, computer assistance is a mere matter of application. "During the past decade, millions of business people discovered that one of the most effective ways to analyze and evaluate decision alternatives involves using electronic spreadsheets to build computer models of the decision problems they face" (Ragsdale, 2004).

Most decision-making processes focus on alternatives at hand, and then try and choose the best alternative for the situation. This form of reasoning is restricted because "it is reactive, not proactive" (Keeney, 1996). Referring to this logic as alternative focused thinking, Keeney (1996) states that the decision maker concentrates first on alternatives and only afterwards addresses the objectives or criteria to evaluate the alternatives. On the other hand, Value Focused Thinking (VFT) is a method of decision making in which the focus is on values (important criteria, preferences, and insightful information) first and alternatives only after the values or criteria for the decision have been fully addressed. VFT "aids in articulating and using your fundamental values to guide and integrate your decisionmaking activities" (Keeney, 1996).

VFT has been utilized in several corporate applications to enhance understanding and provide insight into decision and business processes. British Columbia Hydro;

Conflict Management, Inc. (CMI); Strategic Decisions Group (SDG); and the Municipality of Metropolitan Seattle to name a few have all incorporated aspects of the VFT methodology to better the capabilities of their organizations. Shoviak (2001) proposed the ten-step VFT model which is detailed in the following sections and is the foundation for the research model.

2.3.1 Step 1 – Problem Identification

Defining the problem to be solved is a seemingly simplistic step, but must be addressed carefully. The decision makers must determine their objectives fully and identify all desired outcomes completely. Once the course of the problem is wholly identified, then the decision makers will understand the intent and direction of the decision making process. If the problem is misdirected or defined improperly from the start, the analysis process will likewise be misdirected and the effort will be futile. A well defined objective question for the problem will harness the efforts of the decision makers in the proper direction, with a focused and meaningful analysis process.

2.3.2 Step 2 – Value Hierarchy Construction

A value hierarchy is a graphical representation of the values that the decision makers determine necessary to solve the decision problem. Value hierarchies allow the decision makers a visual of how their values fall within the decision process as well as how the values may influence the overall decision. Value hierarchies usually present a tree-like structure with the overall decision problem (objective) as the sole top element and layers or tiers of values branching off below. These values in turn branch down to definitive evaluation measures or measuring scales for the degree of attainment of an objective (Kirkwood, 1997).

The overall values and measures are determined by the decision makers; however, there are several techniques to help guide the building process for the value hierarchy. The most common are bottom-up and top-down value structuring (Kirkwood, 1997). The bottom-up technique is when values and measures are developed from existing alternatives. The measures are then iteratively grouped to form tiers within the hierarchy until the overall encompassing objective is defined. The top-down approach does not have clearly defined alternatives up front; therefore, it defines the objective first and develops subsequent values that are determined important to the decision. The values are then iteratively broken down to clearly defined evaluation measures. VFT models are typically developed utilizing the top-down technique (Kirkwood, 1997).

Another method is the "gold standard" and involves the review of literature that is relevant to the overall objective (Weir, 2005). Relevant literature may include regulations, guides, laws, etc. to generate valid criteria when considering the objective. This process will aid in utilizing values that have already been developed by the organization, or other entity; therefore, it will be easier to justify and defend.

Generating values can also be accomplish by using the "silver standard," which involves talking to relevant personnel who hold a vested interest in the objective and is often referred to as casual empiricism (Weir, 2005; Kirkwood, 1997). This method is usually accomplished by holding large group sessions. The groups will consist of decision makers, subject matter experts, and others who may offer valuable insight into the value creation process. A typical technique is to list ideas individually first, and then brain-storm as a group (Weir, 2005). This will open all avenues for value creation instead of focusing on one thought process. Obtaining values from the stakeholders not

only provides legitimate inputs, but it also creates “buy-in” from the relevant stakeholders since they know their values are being considered (Kirkwood, 1997).

An additional value-generating technique is the “platinum standard” (Weir, 2005). This method involves a combination of looking at relevant vision statement, objectives, and doctrinal goals along with interviews of technical experts and leadership officials. “This method will usually produce the most insightful, simple, and logical structure for the value hierarchy” (Duncan, 2004).

To aid in visualization of what a value hierarchy looks like, an example developed by Duncan (2004) will be utilized in which the fundamental objective is to by the best truck (Figure 1). The first tier of this example represents the values that the decision maker considers the most important (cost, performance, and appearance). Performance has been further broken down to a second tier of values (power and off-road capability). The example progression of this model developed by Duncan will be utilized to aid in the description of the remaining VFT steps within this chapter.

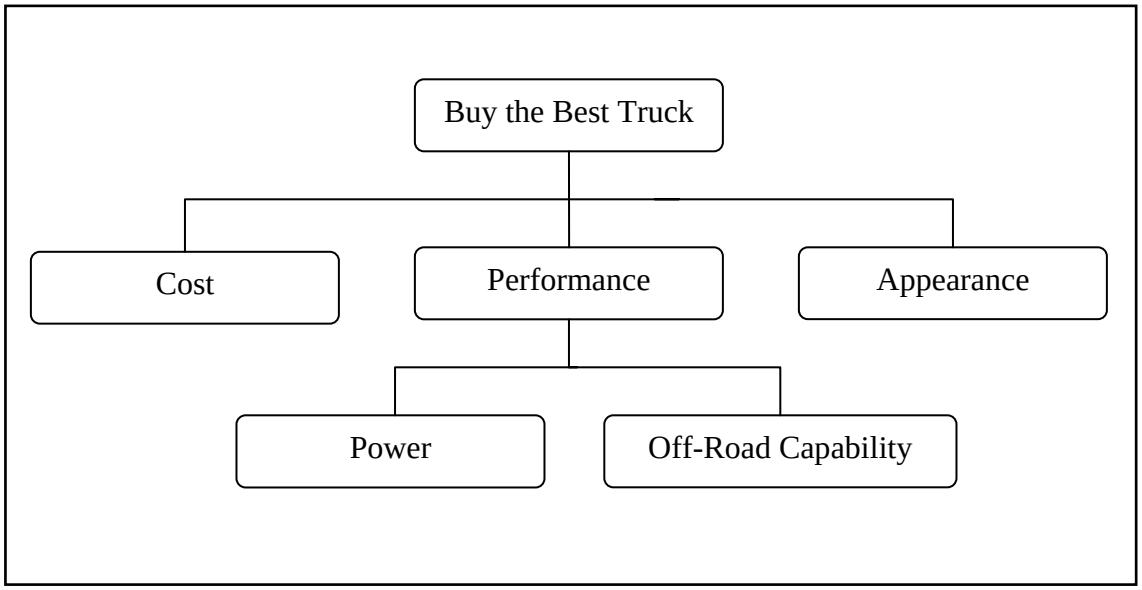


Figure 1. Example Value Hierarchy (Duncan, 2004)

The desirable properties for a value hierarchy include: completeness, nonredundancy, independence, operability, and small size (Kirkwood, 1997). Completeness of a value hierarchy ensures that all evaluation concerns necessary to the outcome of the decision are included. Completeness is also referred to as collectively exhaustive. Furthermore, the evaluation measures must adequately measure how each alternative achieves the objective based on the given measure for the value hierarchy to attain true completeness. If the value hierarchy is not complete, then false information can be derived from the final analyses due to any lacking information.

Nonredundancy means that no value or measure within the hierarchy is covered more than once. Nonredundancy is also referred to as mutually exclusive. The importance of nonredundancy is evident "if more than one evaluation measure indicates the degree of attainment for a particular objective (that is, the evaluation measures are

redundant), then that objective will probably receive more weight than was intended when the weights were assigned to the various evaluation measures" (Kirkwood,1997).

Independence simply means the score given to one measure within the hierarchy has no affect on the score of the other measures. Duncan uses the example of having the measure for power in the truck example as horsepower and the measure for off-road capability as acceleration. These measures are not independent because a higher horsepower score will always result in a higher acceleration score. The score for acceleration is dependent on the score for horsepower (Duncan, 2004).

Operability is the ability of the users to be able to easily understand and effective use the hierarchy. Ensuring that the value hierarchy falls within reasonable operability standard is a direct result of how the users decide what is most efficient. "In practice, it may be necessary to compromise with respect to some of the other desirable characteristics in order to use evaluation measures that are operable" (Kirkwood, 1997).

The final desirable property is small size. A smaller value hierarchy is easier to communicate to the end users and among the decision makers. Ensuring a concise hierarchy enables more efficient evaluations of alternatives as time and effort are not consumed by an overwhelming amount of various evaluation measures. The key to creating a complete and useful value hierarchy "must be balanced against the need to finish an analysis within a realistic time frame and budget" (Kirkwood, 1997).

2.3.3 Step 3 – Evaluation Measure Development

Evaluation measures must be developed to measure the degree of attainment each value will contribute. These evaluation measures allow for an unambiguous rating of how well the alternatives do in comparison to the overall objective (Kirkwood, 1997).

Figure 2 illustrates how evaluation measures fit into the value hierarchy. Values can be represented by a single measure (color for appearance) or by multiple measures (4WD, tire size, and suspension for off road capability). The intent is to develop all measures that are necessary to accurately measure how the alternatives will influence the values.

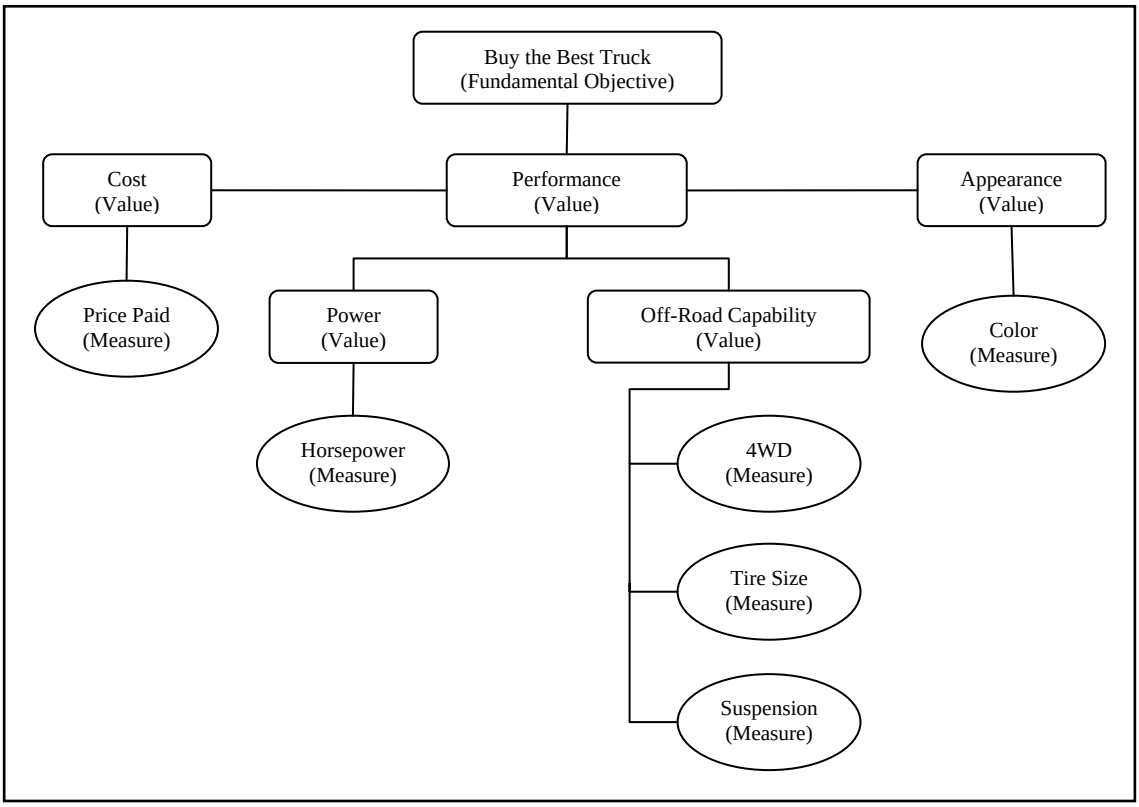


Figure 2. Example Value Hierarchy with Measures (Duncan, 2004)

Evaluation measures are classified into different scales which are either natural or constructed, and either direct or proxy (Kirkwood, 1997). A natural scale is one that is easily understood by everyone and often commonly used. Dollars to measure a price paid is an example of a natural scale. Constructed scales are used when natural scales are not suitable or available to measure the degree of attainment for a particular objective.

Constructed scales are commonly portrayed categorically to encompass a finite unit range. In reference to the truck example, a good example of a constructed scale is the suspension measure under the off-road capacity value where the categories can be defined as standard, off-road, and towing (Duncan, 2004). The differing categories are developed to meet the varying decision makers' scores for each alternative. Not only do the categories need to be developed, but they also need to be clearly defined to alleviate any subjectivity or bias from the decision makers.

Each measure scale is also classified as direct or proxy. "A direct scale directly measures the degree of attainment of an objective, while a proxy scale reflects the degree of attainment of its associated objective, but does not directly measure this" (Kirkwood, 1997). Again, dollars to measure price is a good example of a direct scale. Gross national product (GNP) is an example of a proxy scale (Kirkwood, 1997).

Evaluation measure scales can be presented in an order of preference, Figure 3, which is natural direct, constructed direct, natural proxy, and constructed proxy (Duncan 2004). This order is an important consideration when selecting a measure scale as the more highly preferred scales will provide a more comprehensive and user-friendly decision making tool. The reason for this is because if a decision maker is presented with a scale they are accustomed to using such as dollars (natural direct), they will have an immediate understanding. Kirkwood (1997) explains that the type of audience must be taken into consideration when developing measure and scales. A less technical audience may require measures that are not as technical in nature but rather more operable (Duncan, 2004). Lastly, to ensure that the scales can be communicated easily and are not ambiguous, the scales should pass the clairvoyance test (Kirkwood, 1997). As described

by Duncan (2004), Kirkwood (1997) asks, “If a clairvoyant were available who could foresee the future with no uncertainty, would this clairvoyant be able to unambiguously assign a score to the outcome from each alternative?”

Table 3. Preferred Order of Use for Evaluation Measure Scales
(Duncan, 2004; Weir, 2005)

	Natural	Constructed
Direct	1	2
Proxy	3	4

2.3.4 Step 4 – Value Function Creation

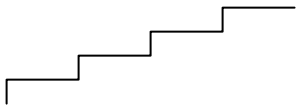
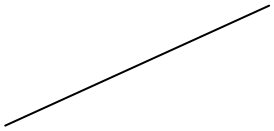
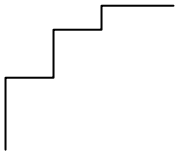
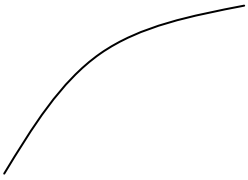
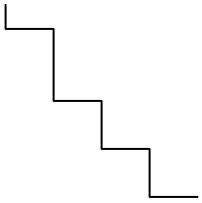
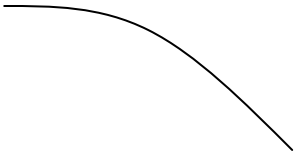
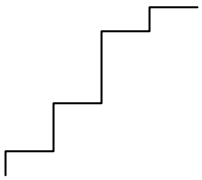
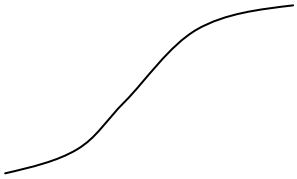
Single Dimensional Value Function (SDVFs) must be defined to allow the scales defined for the evaluation measures to be converted to a common scale so scores can be combined, compared, and analyzed (Duncan, 2004). Since there are multiple evaluation measures and multiple evaluation units, it is essential to have to have a common scale for consistency. The SDVFs convert the units of measure into value on a scale from zero (lowest attainable value) to one (highest attainable value). Therefore, an alternative that has the least preferred score for a given measure will have a value of zero, and an alternative that has the most preferred score for a given measure will have a value of one (Kirkwood, 1997). This conversion process helps turn subjective decisions into quantifiable scores that can be objectively examined by decision makers.

“Each individual SDVF is defined by its shape, which is determined by soliciting input from the decision maker of subject matter experts (SMEs) to determine how the evaluation measure scores should be converted into ‘value’ units” (Duncan, 2004).

An SDVF must be monotonic, meaning that no two scores for a given measure can be assessed the same associated value amount. Therefore, SDVFs are either positive (increasing) or negative (decreasing) across the range of the function. SDVFs with an increasing function will always prefer higher levels over lower levels for a measure. Inversely, SDVFs with a decreasing function will always prefer lower levels over higher levels for a measure.

The shape of each SDVF is determined by the returns to scale that are associated with each respective measure (Duncan, 2004). The returns of scale are split into four categories: constant, increasing, decreasing, or any combination thereof. There are two types of SDVF shapes that represent these returns of scale: piecewise linear and exponential (Kirkwood, 1997). Piecewise linear functions are used when there is a finite number of scoring levels for the measure being considered. Categorical functions are a prime example of a piecewise linear function. Exponential functions are utilized when there are infinite or continuous scoring levels for the given measure. Examples of the SDVF shapes discussed are given in Table 4. Specific examples in relation to the truck buying example are presented in Figures 3 and 4, where the color measure represents a monotonically increasing piecewise linear function and the cost evaluation measure represents a monotonically decreasing exponential function.

Table 4. Common SDVF Shapes (Duncan, 2004)

	Piecewise Linear	Exponential
Constant		
Increasing		
Decreasing		
Other		

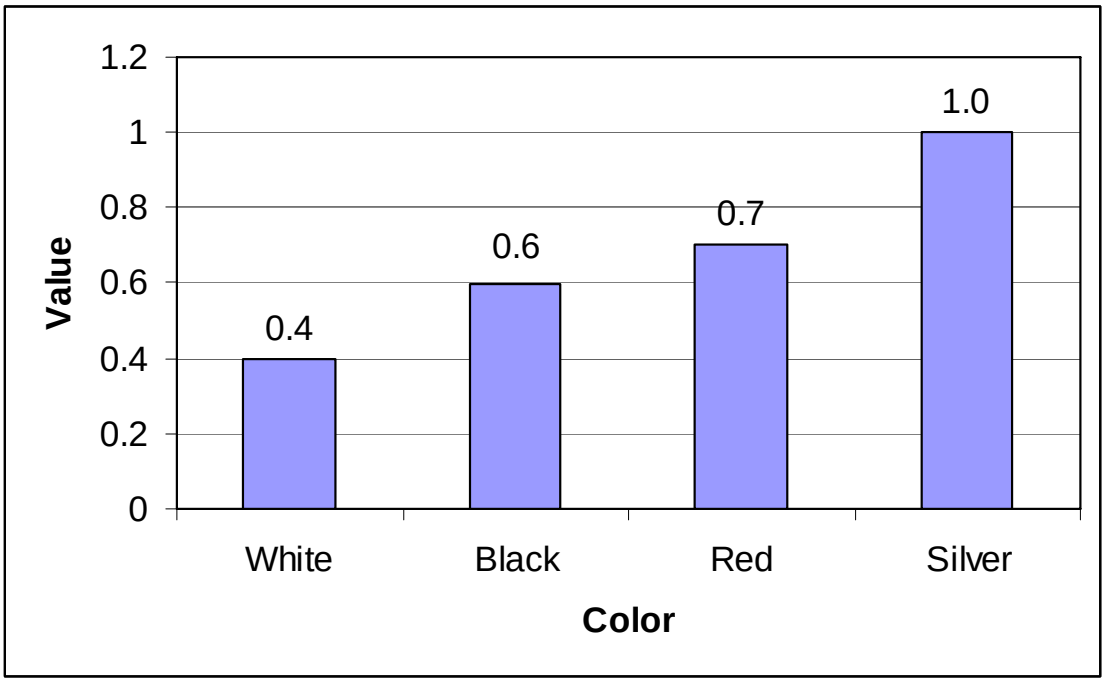


Figure 3. Monotonically Increasing Piecewise Linear SDVF (Duncan, 2004)

Figure 4. Monotonically Decreasing Exponential SDVF (Duncan, 2004)

2.3.5 Step 5 – Value Hierarchy Weighting

Once the values and measure of the decision maker are identified and clearly defined and the evaluations measures created, the relative importance of the values and measures can be determined through the process of weighting. This is important because the values that the decision maker deems the most important will become evident as weighting values are assigned. Also, weighting the value hierarchy will ensure that the intended weight that the decision maker assigns to a specific value or measure will stay constant throughout the decision making and analysis processes, eliminating any bias or other discriminating influences during the course of a decision. Weights are assigned and expressed either locally or globally.

2.3.5.1 Local Weighting

The local weighting of a value hierarchy is the relative importance of values or measures that are located on the same tier or level and same branch within the value hierarchy. The local weights of all the values or measures within the tier of any given branch of the hierarchy will sum to one. Usually, local weighting is accomplished with a top-down approach through the hierarchy using either the direct weighting or swing weighting technique. "The direct weighting method is often referred to as the 100-marble weighting system" (Duncan, 2004). The decision maker is asked to go through each branch of the hierarchy, and at each tier assume that they possess 100 imaginary marbles. The decision maker will then divide the marbles up among the values or measures to represent the amount of importance that the decision maker feels that the value or measure holds. The number of marbles given to each value or measure is then divided by 100 to give the proportion of value the decision maker has for the values and measures in

the respective branches and tiers. Again, the local weights of the values and measures within the tier of any given branch must sum to one (Figure 5). The 100-marble technique gives the decision maker a clear understanding and direct approach for weighting values and measures. They can instantly visualize and adjust the weights to reflect their preference.

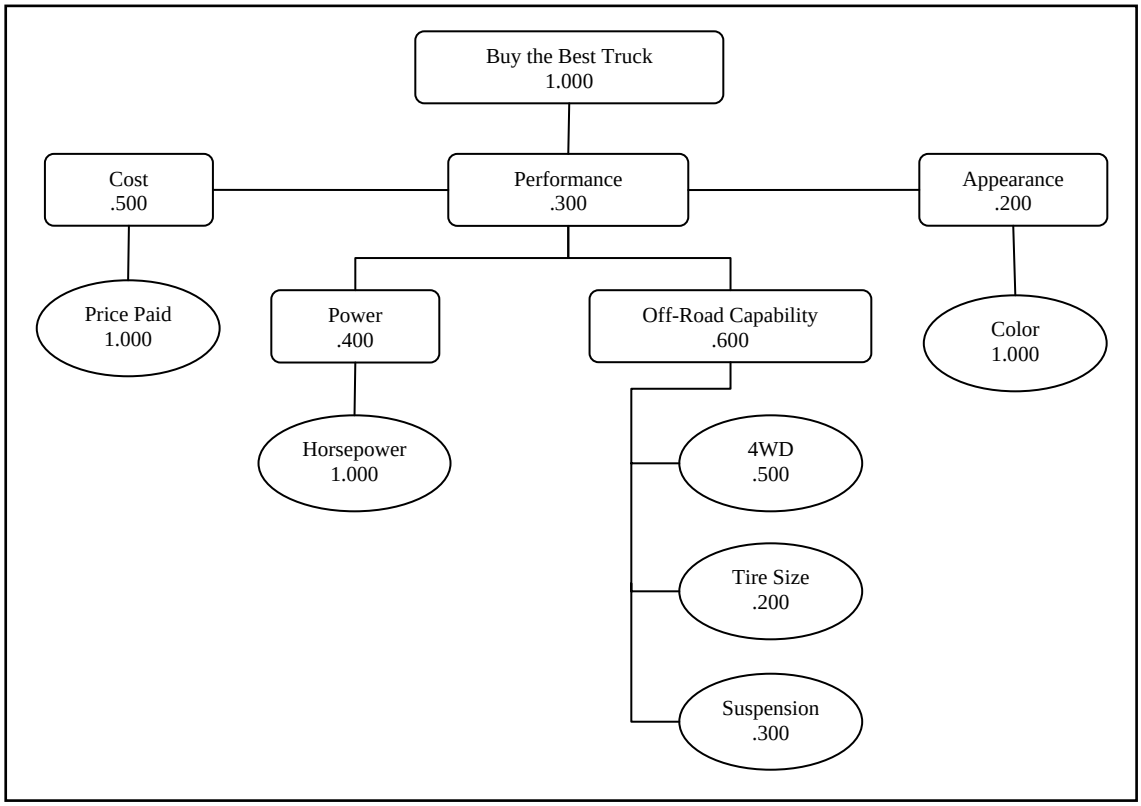


Figure 5. Example Hierarchy with Local Weights (Duncan, 2004)

Swing weighting can be accomplished using two variations of incorporating the value increments of the evaluation measures. The first technique addresses the value increment of the evaluation measures from the least preferred end to the most preferred end, then scaling each of these value increments as a multiple of the smallest value

increment (Kirkwood, 1997). The second technique is similar in nature but has the decision maker subjectively determine the least important measure within that tier of the branch (Duncan, 2004). The decision maker will then determine the importance of the other measures in multiples of the previously determined least important measure. The techniques will both us an algebraic summation equation which will sum to one (the weights within each tier of a branch must sum to one) to determine all the weighting values. The equation will be in terms of only one unknown value, the least important value increment, and will be solved for that unknown value. Once the unknown factor of the equation has been solved, the subsequent weighting values within the equation can be determined.

2.3.5.2 Global Weighting

Global weighting is used to determine the overall weight of each value or measure in relation to the entire value hierarchy. Global weighting enables the decision maker to see how each value and measure influence the overall objective to ensure that the weighting values that been have assigned (utilizing the local weighting technique) are valid. Often, the global weights of each value or measure are determined using a top-down mathematical approach of multiplying the local weights of each value above. An example of using this technique for the truck buying example is shown in Figure 6. To solve for the global weight of 4WD, its local weight of 0.500 would be multiplied by the local weight of the value of off road capability (0.600), the local weigh of performance (0.300), and the local weight of the overall objective (1.000). The resulting global weight of 4WD is therefore 0.090.

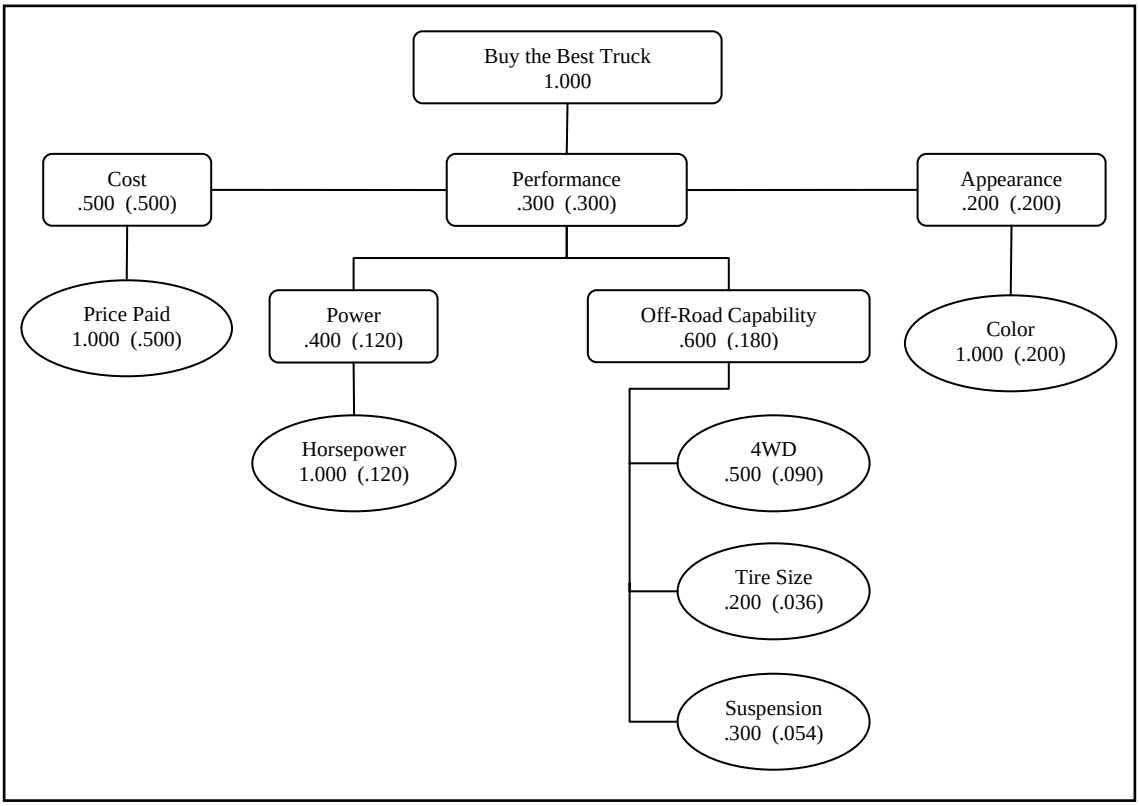


Figure 6. Example of Hierarchy with Global Weights in Parentheses (Duncan, 2004)

2.3.6 Step 6 – Alternative Generation

Once the valued hierarchy has been developed, alternatives can be generated. By exploring the values of the decision makers and creating a value hierarchy, the alternative generation process can be greatly enhanced by providing a better understanding, more insight, and a creative open-minded view toward the types of alternatives needed to solve the decision objective. Many times the decision makers will limit their alternative selection due to the associative process; making mental associations with previous

situations which will only focus their minds on those alternatives which reflect similar qualities (Kirkwood, 1997).

One technique to force an out-of-the-box thinking approach to alternative generation is to use a strategy table (Kirkwood, 1997). These tables identify different essential pieces of measures or alternatives which allows the user to develop desirable alternatives. Other techniques that can be used are identifying value gaps in current alternatives or developing a best-case scenario alternative by aggregating the measures with the highest scores from the alternatives (Weir, 2005). A value gap is identified when an alternative can improve its rating by improving a certain area. By improving these areas, new alternatives can be generated to exploit these value gaps. The best-case scenario develops the overall best-case alternative by using the best values of all the current alternatives collectively. Screening of alternatives may be utilized if too many alternatives have been identified and analysis of all of them is improbable (Kirkwood, 1997). Also, alternatives may already be presented for the decision, in which case an alternative generation technique may not be required, unless deemed necessary for further insight into the decision analysis process.

2.3.7 Step 7 – Alternative Scoring

Once the alternatives have been generated, they can be scored. The success of this process is greatly dependent upon the accurate development of the hierarchy and meeting the criteria discussed in previous sections of this chapter: collectively exhaustive, mutually exclusive, independence, operability, and small size. If the hierarchy has been carefully developed, the scoring process will progress with relative ease and accuracy. The data used to score the alternatives can be a very labor intensive process if the value

hierarchy has numerous measures, measures with difficult to obtain data, or measures with ambiguous scoring criteria (Duncan, 2004). To ensure proper scoring of the alternatives, there are three rules which need be followed. The first is to properly document where the data was generated for each alternative so that the scoring can be repeated or tested. Second, score the data blindly so that you do not know how the values will influence the overall outcome of the decision. And lastly, be sure to score one measure at a time across all alternatives considered. Following these steps will help ensure a consistent, unbiased, and precise scoring process.

2.3.8 Step 8 – Deterministic Analysis

The deterministic analysis is developed by using an equation combining the values of each alternative obtained by the scoring data translated by the SDVFs, with the weights determined by the decision makers. This equation is called the additive value function and forms a collective overall score for each alternative utilizing the cumulative paired values and weights of the measures. These overall scores can then be utilized to rack and stack the alternatives. The additive value function requires that a valid SDVF be associated with each measure, a weight be assigned to each measure, and the summation of the weights equals one (Duncan, 2004). The additive value function can be represented as:

$$v(x) = \sum_{i=1}^{n} \lambda_i \cdot v_i(x_i)$$

where $v(x)$ is the value function (the overall score of the alternative), $v_i(x)_i$ is the individual measure value obtained from the score incorporated with the corresponding SDVF, and λ_i is the global weight of the measure (Kirkwood, 1997).

2.3.9 Step 9 – Conduct Sensitivity Analysis

The sensitivity analysis is utilized to provide the decision maker further insight into the analysis of the decision and is a unique function of this model. A sensitivity analysis allows the decision maker to determine the impact on the rankings of alternatives by making changes in various model assumptions (Kirkwood, 1997). The most common form of sensitivity analysis is to analyze how different weighting values would influence the results of the deterministic analysis. "These weights represent the relative importance that is attached to changes in the different evaluation measures, and this is sometimes a matter of disagreement among the various stakeholders for a particular decision" (Kirkwood, 1997). One way to explore the varying weighting preferences of decision makers is to change the weight of one value while holding the weights of all the other values proportionally constant and ensuring that all value weights sum to one (Kirkwood, 1997). Doing so enables the decision makers to see how changes in weightings can affect the rankings of alternatives. By incorporating this type of analysis, an objective and systematic approach, accompanied by visual graphs, can be utilized to help explain subjective decision processes.

2.3.10 Step 10 – Presentation of Results

The results gained from the model will not only be rank ordered, but will be easy to present and discuss. The value hierarchy clearly defines and illustrates the values and measures that are important and the level of their importance through the globally weighted values. The SDVFs identify the manner in which the alternatives were scored, and the deterministic analysis again clearly illustrates how the alternatives rack and stack against each other. The sensitivity analysis adds further insight as to how the alternatives

clearly compare with one another and what specific attributes alternative are weak or strong on. Also, the sensitivity analysis can provide insight into the different views of decision makers and their corresponding weighting value differences. The results will be developed and presented to answer the overall objective that the model intended to help solve. The model and the results are not intended to make a final decision; that is ultimately up to the decision maker. The model is a tool to be utilized to gain greater insight into the decision making process and aid the decision maker in a thorough analysis process. Keeney emphasizes three fundamental ways VFT will aid in a decision process: 1) to recognize and identify decision opportunities, 2) to create better alternatives for your decision problems, and 3) to develop an enduring set of guiding principles for your organization (Keeney, 1996).

Chapter III. Methodology

Value focused thinking (VFT) can be utilized to determine the effectiveness of the Simplified Acquisition of Base Engineer Requirements (SABER) source selection process by exploring all the values that the Air Force deems important in a SABER contractor and converting that qualitative data to firm measurable quantitative data. Exploring a model of this magnitude not only will enable the development of a hypothetical ideal SABER contractor to perfectly meet the needs of the Air Force, but it will also facilitate comparative analysis of real world alternatives. Approaching a decision in this manner immediately eliminates initial biases as the focus and efforts of the evaluation team have been put into the needs of the Air Force and not what is simply available to the Air Force.

The current source selection process of Lowest Price Technically Acceptable (LPTA) explained in Chapter 1 may have been sufficient when SABER was in its infancy and considered a relatively small contract. However, SABER now represents a substantial effort on most bases with numerous task orders every year. The process of systematically evaluating all qualified contractors and selecting the one that represents the best value to the government is a complicated one in which many competing objectives must be considered. As explained in Chapter 2, a VFT approach was used in this research to provide a decision tool for the process. Since it would have been impractical to apply this approach to the entire civil engineering career field, one organization was selected and used throughout this research and is referred to as the subject organization. This organization was selected because of their recent experience

in selecting a SABER contractor; therefore, the members of the organization have recent exposure to the evaluation process and evaluation data is readily available.

The incorporation of a VFT methodology allows the values and measures of an Air Force SABER contractor to be identified, weighted, and analyzed. More importantly, the methodology ensures that all intended weighting values remain constant throughout the evaluation process (unless intentionally changed) and provides a method to compare and delineate between all competing contractors. The VFT methodology provides an objective, accurate, adaptable, defendable, and quantifiable analysis to aid the decision makers' final selection. This chapter explains how Steps 1 through 7 of the VFT process were applied to develop a SABER source selection model to provide an objective and quantifiable analysis tool.

3.1 Step 1: Problem Identification

The first step of the VFT 10-Step methodology is to identify the problem and then state it in the form of an objective question. The problem identification for a SABER source selection is inherently present in the RPF: select the contractor that represents the best value to the government. More specifically, the contractor selection is "based on the contractor that has the best capability, capacity, and coefficient mix, as determined by the contractor selection criteria" (Henry and Brothers, 2001).

Initial investigative questions were developed and presented to the members of the subject organization who were directly involved with SABER contracts (i.e., through source selections, negotiations, design, implementation, and construction management). These questionnaires were administered prior to any exposure to the VFT methodology to

prevent any possible biases. The results collectively show that the following areas are in need of improvement with the current source selection process.

- A need for the technical evaluators to review cost
- A clearer understanding of evaluation criteria and an objective way to evaluate – controlling personal influences and partial bias
- A method to ensure data is reliable – or be able to detect unreliable data
- A method to ensure evaluation process is only conducted once, and properly done in that one time – easily executed and documented
- A method to ensure intended weightings are applied consistently
- A method that will allow all competing contractors to be evaluated
- A method to easily differentiate between contractors with similar capabilities

The investigative questions and corresponding answers are presented in Appendix C. Answers are indicated as Subject A, Subject B, and so on for purposes of anonymity.

Throughout the research effort and in discussions with members of the subject organization, it was determined that the source selection process is flawed in several areas – with emphasis on a need to evaluate all competing contractors, a need for the entire selection committee to evaluate price, and a need to ensure intended weighting values hold constant throughout the selection process. Therefore, the VFT methodology was presented to members of the subject organization and was determined appropriate as a model to provide insight into an alternative source selection method. The overall objective question became: "Which SABER Contractor will provide the best value to Columbus Air Force Base: Contractor A, B, C, D, E, F, or G?"

3.2 Step 2: Create the Value Hierarchy

Once the problem has been clearly identified, the next step is to generate the values relevant to the overall objective and then organize them into a value hierarchy. The initial method used to identify the values was the "silver standard" in which values were obtained from subject matter experts and decision makers. The VFT methodology and purpose of values was explained to the members of the subject organization. Once they had a clear understanding, they brain-stormed to formulate the list shown in Table 5. From that list, the values of price, past performance, and technical capabilities were determined to be the most important collectively by the group. The initial layout of the first tier of the hierarchy was developed with the use of the silver standard and submitted to the decision makers within the subject organization for their approval (Figure 7).

To provide further insight into the values necessary for a SABER contractor, the "gold standard" method in which pertinent documents are referenced was implemented. The RFP, past performance questionnaires, SABER Guidance (Air Force Contracting Construction Guide IG5336.9201, 2005), and relevant literature pertaining to construction contractor criteria were all referenced. Further value creation was accomplished with implementation of the "platinum standard" in which the knowledge bases gained from literature and personnel are combined. There was close interaction with the subject organization for several months to further review the RFP, and the values generated through the previously discussed platinum standard were used to develop an initial hierarchy. The initial hierarchy underwent several iterations wherein values were either moved or deleted from the hierarchy. The final value hierarchy consisting of 12

values is shown as Figure 8 and was determined to capture the intent of selecting a best value SABER contractor.

Table 5. Potential Values Obtained Collectively

- Technical Capabilities
- Relevancy
- Time / Recency
- Business Plan
- Past Performance
- Quality-Control
- Similar Scope Work
- Price
- Manager / Team Capabilities
- On-site Capabilities / Capacities
- Dollar Value of Work
- Project Time Overruns
- Poor Performance Claims
- Corrective Action Taken for Time / Performance Issues
- Compliance with Contract Terms and Conditions
- Punch-list Items After Final Inspection
- Contractor Performs as Prime or Subcontractor

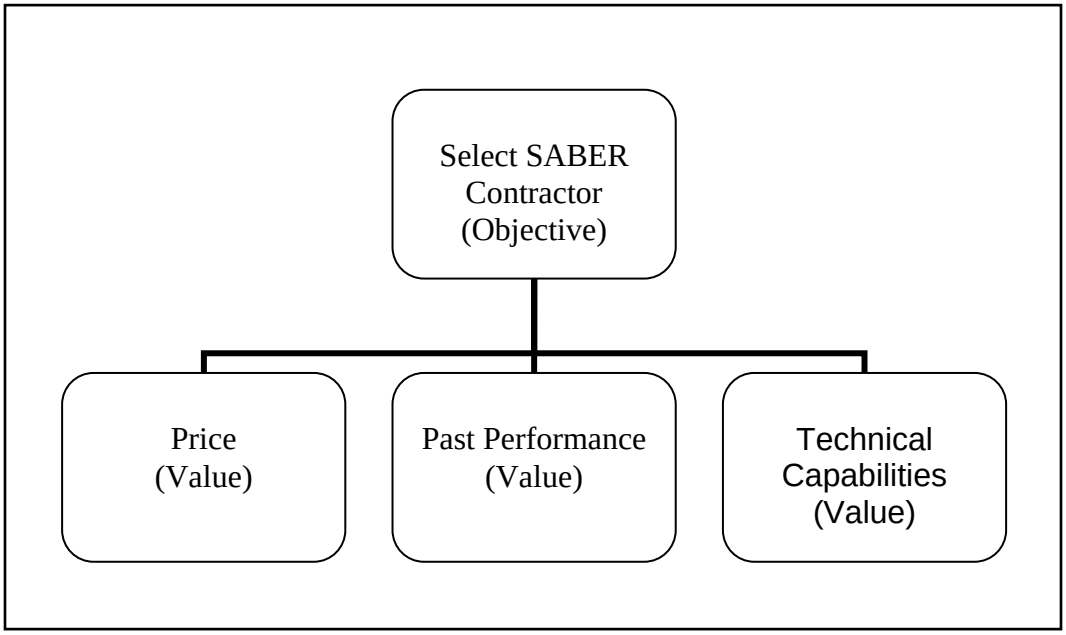


Figure 7. Initial Tier of Value Hierarchy

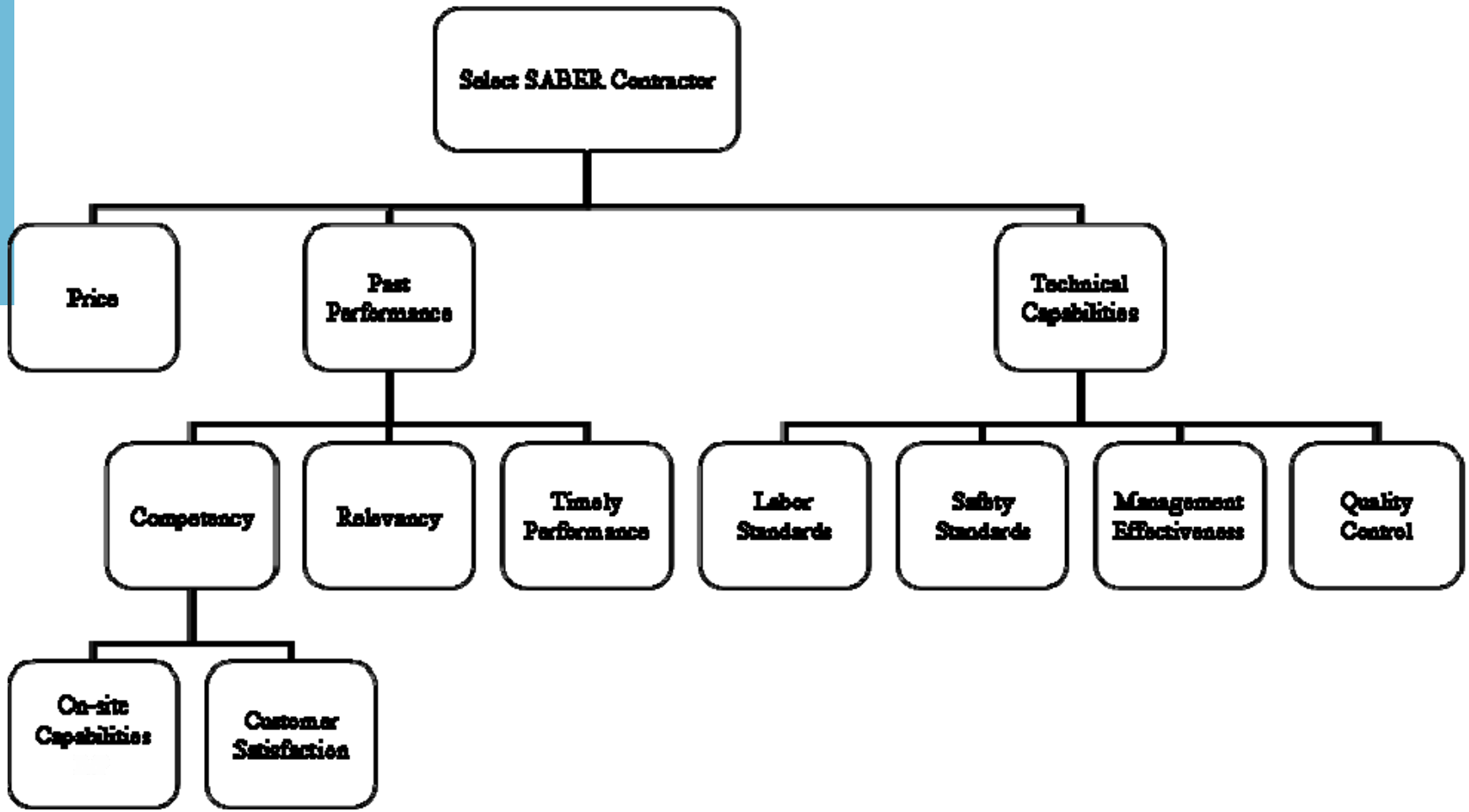


Figure 8. Final Value Hierarchy

As stated earlier, the first tier values of price, past performance, and technical capabilities were determined to be the most important values for the Air Force in selecting a SABER contractor. This configuration closely mirrors the values of the current source selection process; however, the current process includes technical capabilities under past performance, with price and past performance evaluated by separate entities. The VFT hierarchy clearly separates the three values and includes each one within the model so they can be individually recognized and evaluated.

Price is an important value for this model because it is not normally viewed by the members of the subject organization comprising the source selection committee. The price is determined by the coefficient value, and the government does not want a contractor with a coefficient that is too high. However, the government does not want a contractor with a coefficient that is too low either. The coefficient is how the contractor recoups their overhead costs and makes their profit. If the contractor submits an extremely low coefficient to win a contract, they may lose money in the long run and not be successful. The government not only wants a best value contractor, but a successful SABER program.

Past performance is necessary for the government to evaluate and accurately gauge how well the contractor will conduct their overall business activities. The amount of confidence instilled in the contractor is determined through this value. Additionally, technical capabilities will help the Government determine applicable management and quality control characteristics. By considering past performance and technical capabilities as two separate values, the government can evaluate contractors in a more concise manner. Each value in turn has lower tier values to specify further what the Air

Force determines important in evaluating the contractors, leading into the mutually exclusive, collectively exhaustive measures. A definition of each value is presented in Appendix D.

3.3 Step 3: Develop Evaluation Measures

After finalizing the value hierarchy, the next step was to develop the evaluation measures. The measures provide the VFT model the capability to evaluate an alternative in a quantitatively objective manner. Therefore, the measure value functions must be clearly defined to eliminate subjectivity as much as possible throughout the evaluation process. Again, the members of the subject organization were utilized in the development of the measures. These measures were determined to best represent how to achieve the values in the hierarchy while maintaining the integrity of independence and nonredundancy. Measures that were determined important but not incorporated into the hierarchy were: proximity, 8(a) (small business), work done within past three years, and projects worked concurrently. These measures were left out of the model because they are mandatory considerations required of all contractors submitting a proposal. The complete value hierarchy with measures is shown in Figure 9.

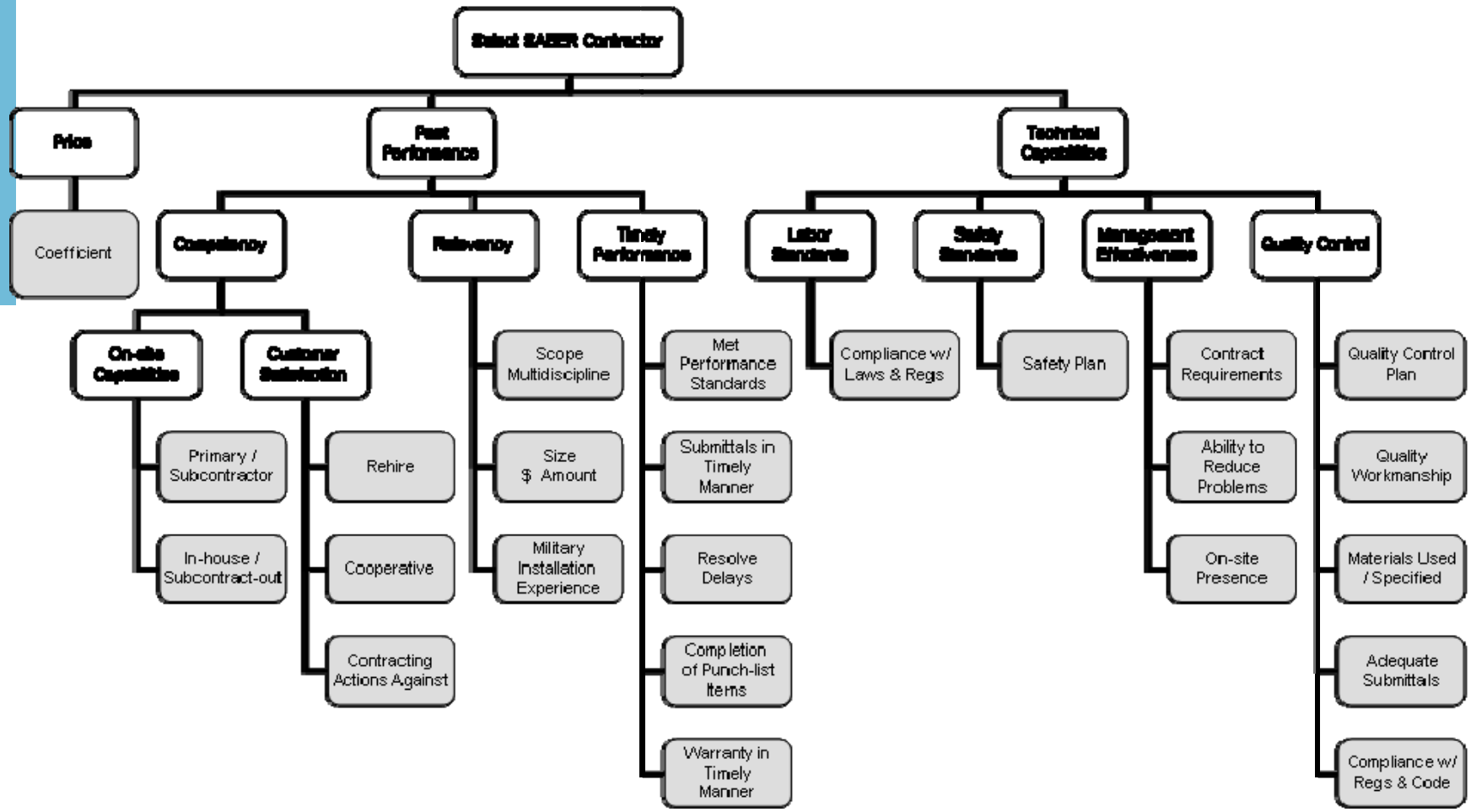


Figure 9. Final Value Hierarchy with Measures (shaded)

The intent in creating the measures was to achieve as many natural, direct scales as possible and as few constructed, proxy scales as possible for ease of use and understanding. However, the natural, direct characteristics could not be met due to the SABER-specific nature of the measures. After careful consideration, all measures were determined to be categorical in nature. Therefore, 6 of the measures were constructed, direct and 18 were constructed, proxy. All measures are summarized in Table 6. The decision maker determined the types of scales to be used (categorical) along with upper and lower bounds. Examples of categories and category definitions for the "In-house / Subcontract-out" measure and "Cooperative" measure are presented in Tables 7 and 8. The definitions for each of the measures are explained in Appendix E.

Table 6. Evaluation Measures Summary

First Tier Value	Second Tier Value	Third Tier Value	Measure	Lower Bound	Upper Bound
Price			Coefficient	< 1.15 or 1.35 <	1.15
Past Performance	Competency	On-Site Capabilities	Primary / Subcontractor	Neither	Prime Only
			In-house / Subcontract-out	Neither	Both
		Customer Satisfaction	Rehire	No	Yes
			Cooperative	Not Cooperative	Exceptional
			Contracting Actions Against	More than 6	0
	Relevancy		Scope Multidiscipline	< 3	5 <
			Size $ Amount	< 100 K	500 K <
			Military Installation Experience	No	Yes
	Timely Performance		Met Performance Standards	Not Met	Exceptional
			Submittals in Timely Manner	14 Days Late <	On Time
			Resolve Delays	None	Exceptional
			Completion of Punch-list Items	None	Exceptional
			Warranty in Timely Manner	14 Days Late <	On Time
Technical Capabilities	Labor Standards		Compliance w/ Laws and Regs	None	Exceptional
	Safety Standards		Safety Plan	None	Exceptional
	Management Effectiveness		Contract Requirements	None	Exceptional
			Ability to Reduce Problems	None	Exceptional
			On-site Presence	None	Exceptional
	Quality Control		Quality Control Plan	None	Exceptional
			Quality Workmanship	None	Exceptional
			Materials Used / Specified	None	Exceptional
			Adequate Submittals	None	Exceptional
			Compliance w/ Regs and Code	None	Exceptional

Table 7. Category Definitions for In-house / Subcontract-out Measure

Category	Category Definition
Neither	Proposal does not demonstrate the capacity of contractor to effectively conduct construction work within their corporation nor the ability to effectively acquire and manage subcontractor(s) to perform construction work.
Subout only	Proposal only demonstrates capacity of contractor to effectively acquire and manage subcontractor(s) to perform construction work.
In-house only	Proposal only demonstrates capacity of contractor to effectively conduct construction work within the means of their corporation.
Both	Proposal demonstrates the capacity of contractor to effectively perform construction work either by the means of their own corporation or through the use of subcontractor(s).

Table 8. Category Definitions for Cooperative Measure

Category	Category Definition
Not Cooperative	Proposal demonstrates negative business conduct or does not address cooperative capabilities at all.
Satisfactory	Proposal addresses cooperative capabilities but demonstrates inconsistencies of both negative and positive conduct.
Good	Proposal addresses cooperative capabilities in strictly positive manner.
Exceptional	Proposal addresses outstanding positive cooperative capabilities to include incentives exercised to maintain or improve capabilities.

3.4 Step 4: Create Value Functions

The next step, and the most difficult in this research effort, was to create the value functions. The purpose of creating the value functions is to be able to convert the actual scores assigned to the measures to a corresponding value which represents the preference of the decision maker. This is determined by developing single dimensional value functions (SDVFs) for each measure. The *x*-axis of the SDVFs were determined in the previous step; this step will determine the corresponding *y*-axis values for each category element within their respective measure. The *y*-axis will always range from a value of 0 (least preferred) to a value of 1 (most preferred) to represent the full range of the decision maker's value spectrum. The upper and lower bounds of the measures shown in Table 6 are the equivalent zero (lower) and one (upper) values on the SDVFs. Completing this step is necessary to convert the subjective nature of the evaluation process into qualitative data. This allows the objective analyses to be conducted later on in the modeling process.

Since all of the measures for this model are categorical in nature, the decision maker directly assigned values to the discrete functions. This process was difficult and took several iterations due to its subjective nature. The decision maker tended to rate different categories within the same measure as the same value. After an explanation that an exact value rating for two different categories within the same measure is essentially equating those categories, the decision maker quickly changed the preference values to ensure a differentiation between the categories. Figure 10 shows the discrete, monotonically increasing SDVF for the "Cooperative" measure as an example. The SDVFs for the remaining measures are included as Appendix E.

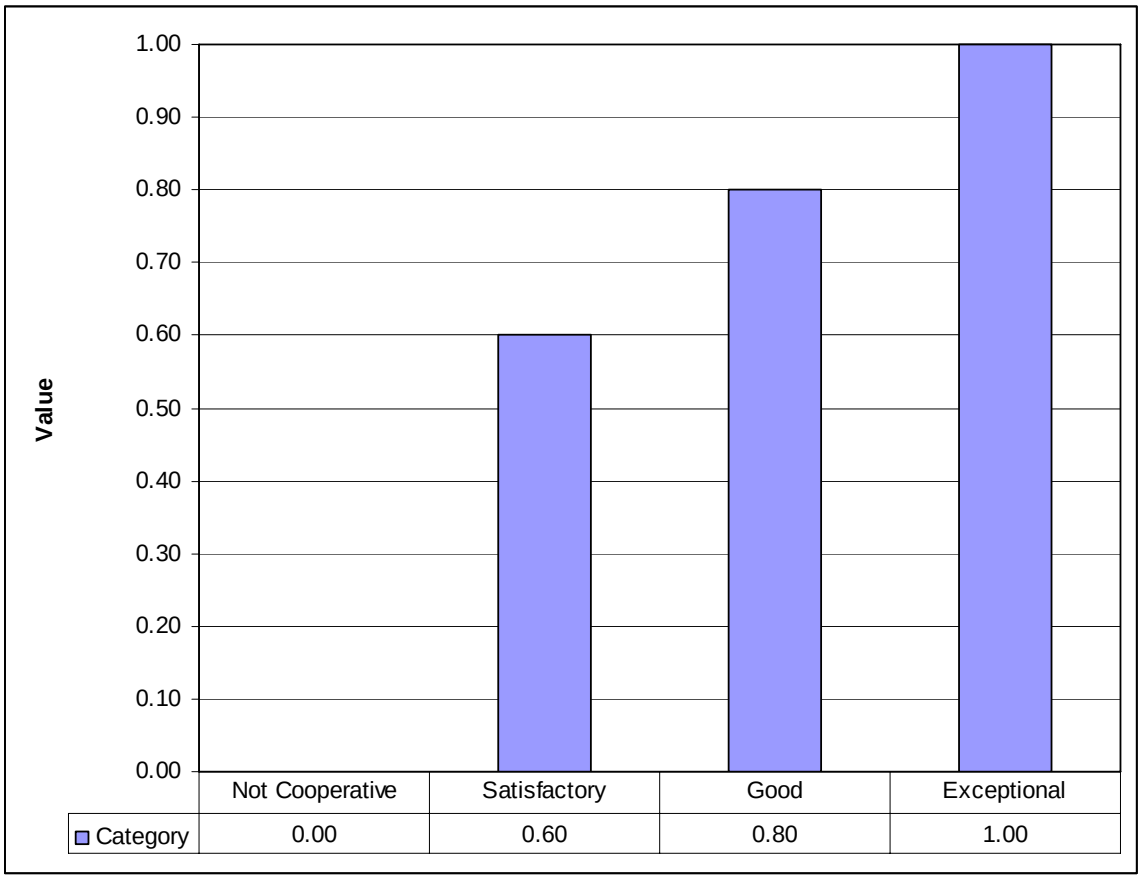


Figure 10. SDVF for Cooperative Measure

3.5 Step 5: Weight the Value Hierarchy

Once the SDVFs have been created, the next step is to weight the values and measures within the hierarchy. Global weighting ultimately determines the level of importance assigned to each value and measure in relation to the entire hierarchy. For the purpose of this research, the SABER Chief and one other CE representative (who also was part of a recent SABER source selection committee) determined the weights of the values and measures using a top-down approach with the 100-marble method. Once they agreed upon the weight values, the local weights were used to calculate the global weights. Figure 11 shows the local and global weights applied to the value hierarchy in its entirety.

Table 9 provides the local and global weights for each measure (sorted in descending order) along with the cumulative global weights. The measure "Coefficient" holds a significant amount of weight (0.330). This is to be expected since price is always going to be a significant factor in selecting a contractor. This also meets the standards set forth in the RFP which ensures that non-pricing factors will significantly outweigh the pricing factor. "Past Performance" and "Technical Capabilities" cumulatively hold a weight of (0.670) which significantly outweighs "Price" at a weight of (0.330).

The next set of fairly significant measures are "Compliance w/ Laws & Regs," "Compliance w/ Regs and Code," "Safety Plan," and "Contract Requirement." These measures, when combined with the "Coefficient" measure, make up 54.9% of the total value of the model. Therefore, these are the measures that the decision maker considers the most important in the selection of a SABER contractor. Furthermore the top 13 measures represent approximate 80% of the model's total value. Therefore, in

accordance with common VFT practices, these 13 measures can be considered the significant attributes. Every competing contractor is expected to have high scores within these measures as they represent a large portion of what the decision maker values. If the competition is strong, it would not be unusual for several alternatives to be rated evenly based on these measures. The bottom 11 measures do not hold significantly high global weights; however, their importance is still significant. These measures are still considered necessary by the decision maker; they just happen to not be rated as important as the top measures. What makes the bottom measures significant is that they can help to differentiate between highly competitive alternatives. If two or three alternatives score evenly throughout the top 13 measures, the bottom 11 measures will be able to weed out the top alternative.

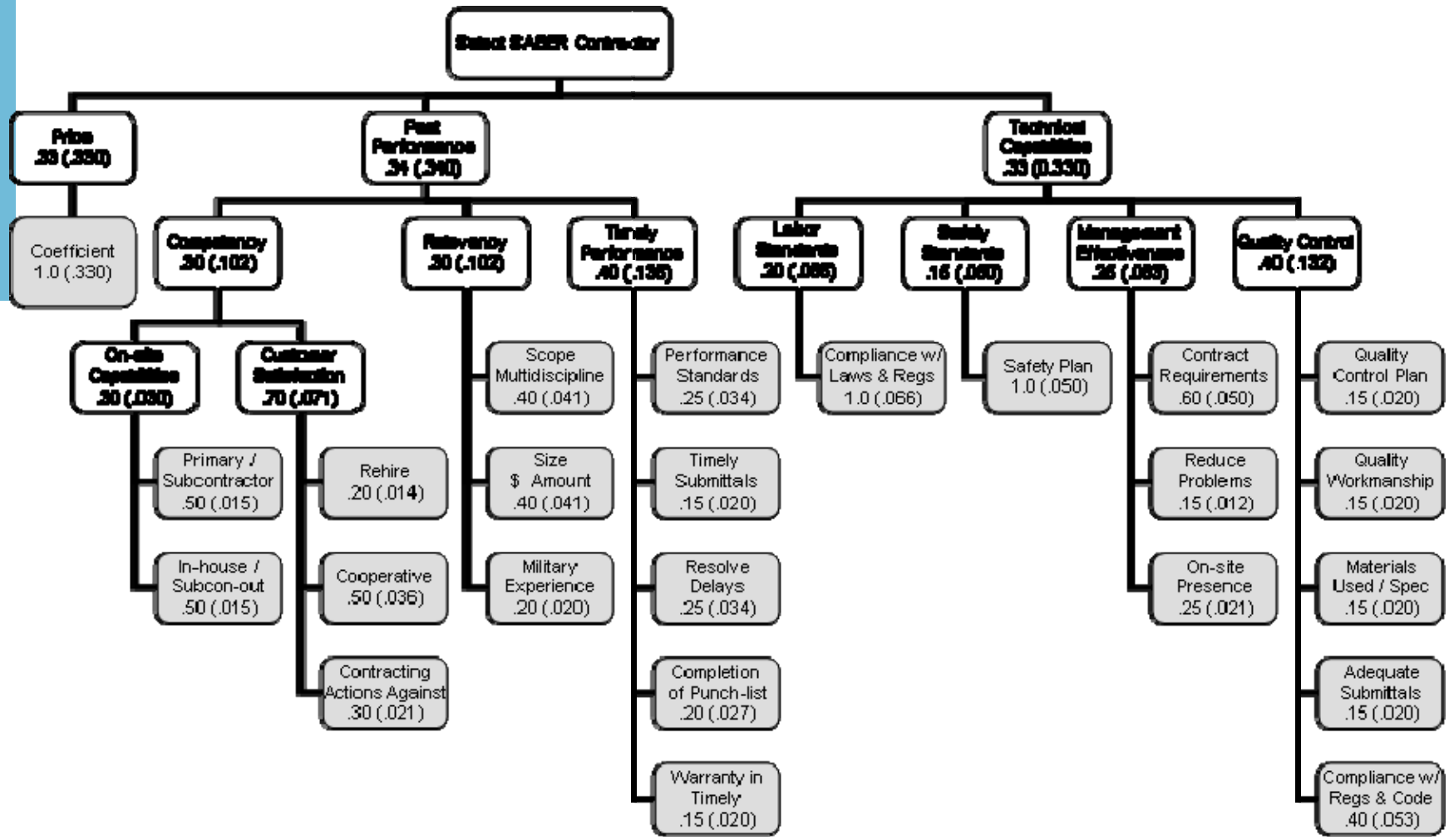


Figure 11. Value Hierarchy with Local and Global Weights (Global in Parentheses)

Table 9. Cumulative Chart of Measure Global Weights

Measure	Local Weights	Global Weights	Cumulative Global Weight
Coefficient	1.000	0.330	0.330
Compliance w/ Laws & Regs	1.000	0.066	0.396
Compliance w/ Regs & Code	0.040	0.053	0.449
Safety Plan	1.000	0.050	0.499
Contract Requirements	0.600	0.050	0.549
Scope Multidiscipline	0.400	0.041	0.590
Size $ Amount	0.400	0.041	0.631
Cooperative	0.500	0.036	0.667
Met Performance Standards	0.250	0.034	0.701
Resolve Delays	0.250	0.034	0.735
Completion of Punch-list Items	0.200	0.027	0.762
On-site Presence	0.250	0.021	0.783
Contracting Actions Against	0.300	0.021	0.804
Quality Control Plan	0.150	0.020	0.824
Submittals in Timely Manner	0.150	0.020	0.844
Quality Workmanship	0.150	0.020	0.864
Military Installation Experience	0.200	0.020	0.884
Materials Used / Specified	0.150	0.020	0.904
Adequate Submittals	0.150	0.020	0.924
Warranty in Timely Manner	0.150	0.020	0.944
Primary / Subcontractor	0.500	0.015	0.959
In-house / Subcontract out	0.500	0.015	0.974
Rehire	0.200	0.014	0.988
Ability to Reduce Problems	0.150	0.012	1.000

3.6 Step 6: Alternative Generation

Once the weighting of the value hierarchy was complete, the next step was to generate the alternatives. However, there were seven contractors that competed for the SABER contract at the subject organization. Therefore, the alternatives were already provided and this step was not necessary. The recent source selection conducted at the subject organization provided a current source of contractor alternatives along with their corresponding past performance and technical information. The seven contractors were identified as Contractor A through G to ensure anonymity.

3.7 Step 7: Alternative Scoring

The final step before conducting analysis is to score the alternatives. As stated in the previous step, empirical data was obtained through 7 contractors who competed for the recent award of a SABER contract. This data was used to score each contractor against the value functions created for each measure within the model. Since access to coefficient data is restricted, notional data was randomly generated for each contractor alternative utilizing a random number generator. A list of all the scores generated for each alternative contractor is included in Appendix F.

Chapter IV. Results and Analysis

This chapter provides the results of the deterministic and sensitivity analyses conducted in Steps 8 and 9 of the value focused thinking (VFT) process. Step 8, deterministic analysis, provided the results of the model by generating a rank ordered list of the alternatives. From these results, the amount of impact that the values and measures have on the alternative can also be observed. Step 9, sensitively analysis, provides insight into how an alternative's ranking can vary if weighting values were to change. This analysis gives the decision maker insight into which values or measures may be sensitive to weighting value changes, along with the variation in weighting values that would cause changes.

4.1 Step 8: Deterministic Analysis

The deterministic analysis is calculated utilizing the "values" that are scored against the SDVFs of the measures and the corresponding global weighting values, which are then incorporated together into the additive value function. The end result is a rank ordering of the alternatives in which each total value will range between 0 and 1. The resulting deterministic analysis of the 7 contractors used in this research is shown in Figure 12. The overall values for the competing contractors range from 0.578 to 0.874. It is important to note that these values only represent the ordinal relationship between the alternatives; there is no ratio relevance to be gained from the values. For example, the value of Contractor D is 0.818 and the value of Contractor B is 0.778. This does not mean that Contractor D is 0.04 value point or 5.1% better than Contractor B; the values simply signify that Contractor D appears to be the better of the two alternatives.

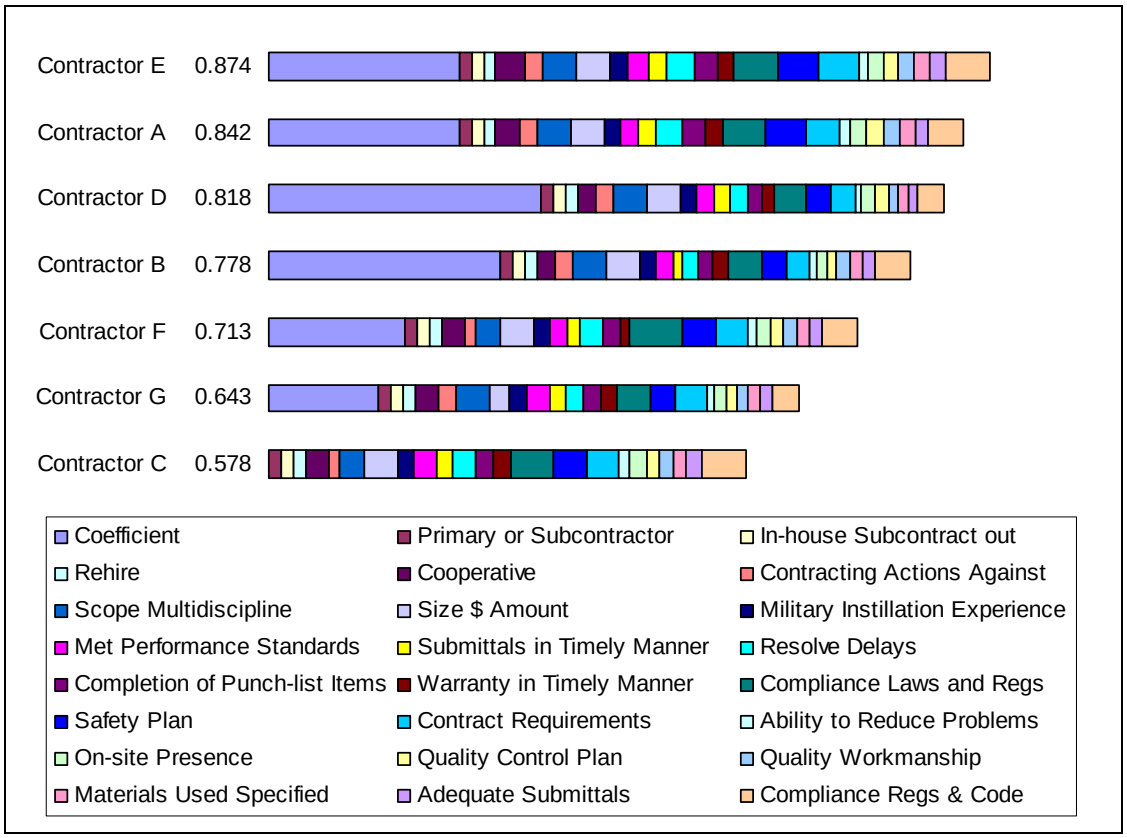


Figure 12. Overall Ranking for Competing Contractors

There is a tremendous amount of insight and information that can be gathered from deterministic analysis. For example, Figure 12 shows that Contractor E represents the best alternative. However, if the Lowest Price Technically Acceptable (LPTA) method of the current SABER source selection process were used, the contractors would be evaluated in rank order of their pricing score as shown in Figure 13. The first contractor that would be evaluated under the LPTA system would be Contractor D. When all values are considered though, Contractor E represents the best choice; yet under the LPTA source selection process, Contractor E is in third place and may not even get evaluated.

Not only is Contractor E a strong competitor, but Contractor A is also considered a more desirable alternative than either Contractor D or B. Additionally, Contractor C received no value for price in this model because of an extremely high coefficient value. However, an alternative could also receive no value for price due to an extremely low coefficient value, yet would be moved to the top of the evaluation order using LPTA.

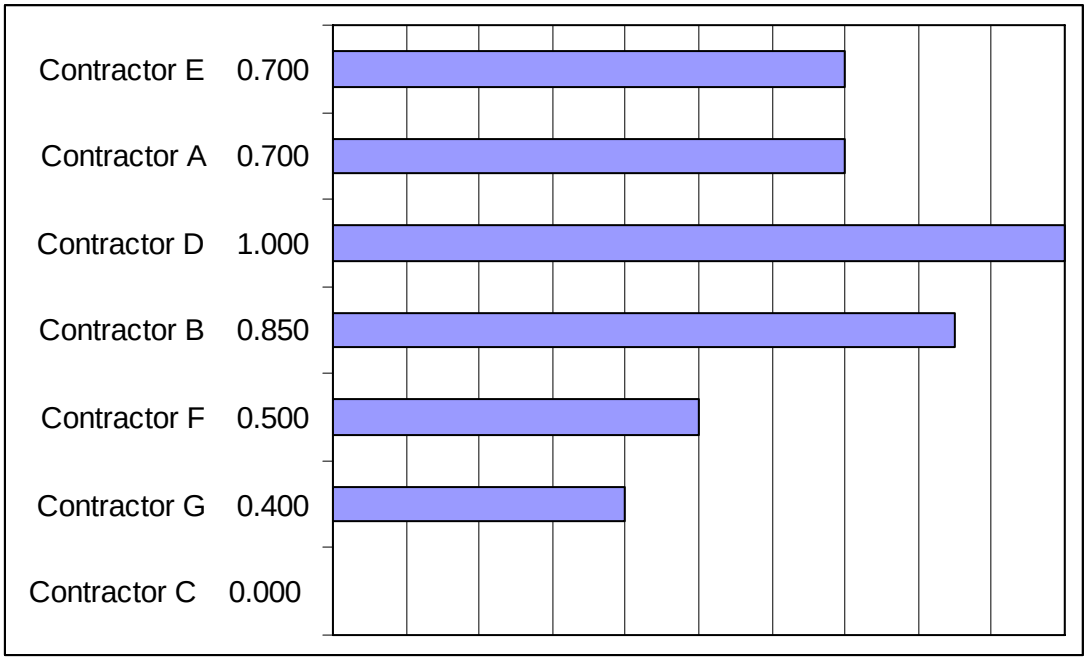


Figure 13. Contractor Rankings against Price (Coefficient)

Deterministic analysis can also be used to compare the contractors across all values of a particular tier, for a set of values or measures within a given branch, or for a value or measure individually. For example, the first tier of Price, Past Performance, and Technical Capabilities can be presented as Figure 14 to better illustrate how each contractor is represented in each of to the top three values. The contractors were already

broken down by price in Figure 13, so Figure 15 illustrates the contractors scores represented by non-pricing values only. From this analysis, insight can be gained into the particular strengths and weaknesses of the contractors. For example, based on non-pricing values, Contractor C would now be ranked third and Contractor F would be in fourth place.

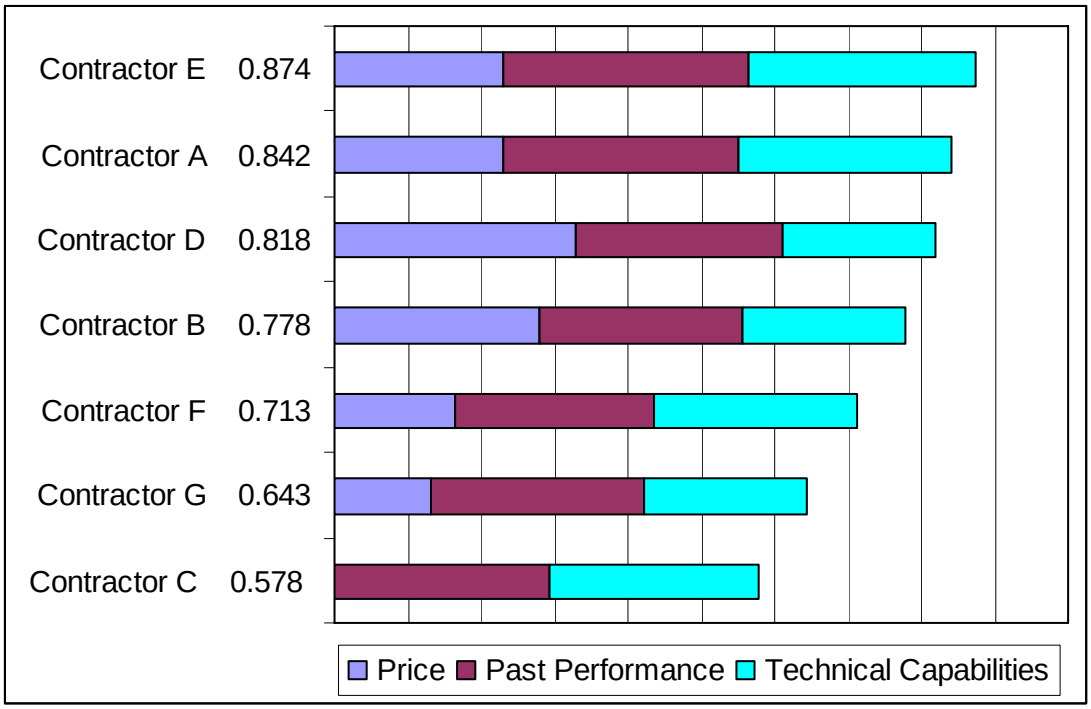


Figure 14. Overall Ranking for Competing Contractors (First Tier Values)

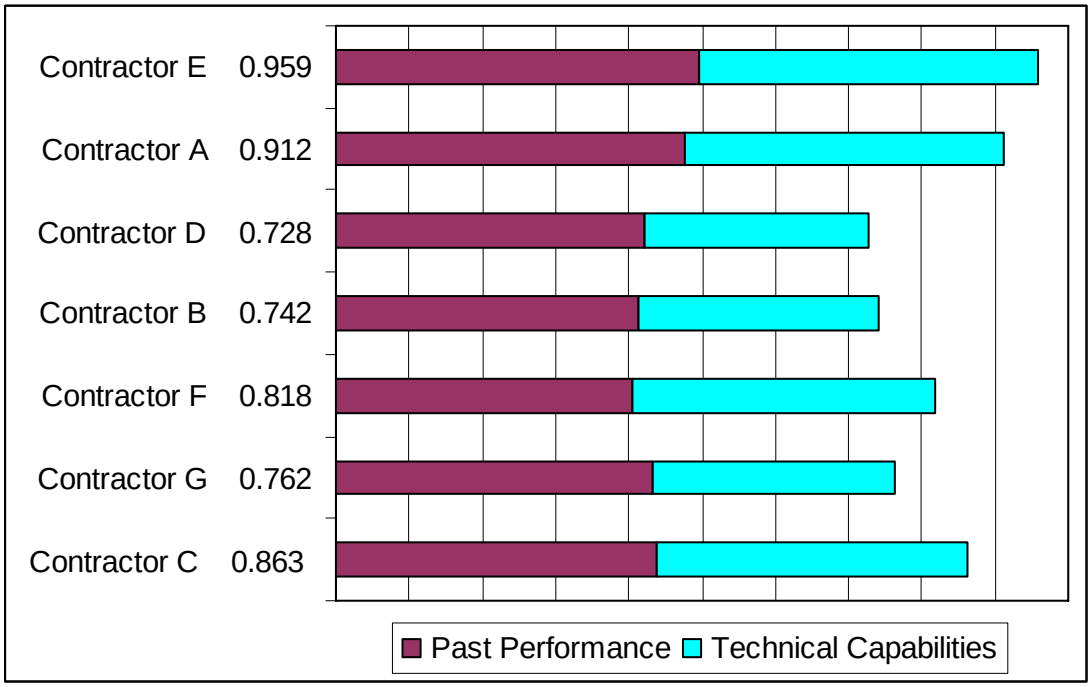


Figure 15. Contractor Rankings against Past Performance and Technical Capabilities

The application of deterministic analysis can continue down the tier levels and branches to show as much or as little detail as the decision makers desire. If the breakout of how the second tier values under Technical Capabilities is desired, then Figure 16 is generated. Immediately it can be noted that Quality Control contributes a significant portion to the value and that Labor Standards has a large variation between the contractors. Conducting this type of analysis can help pinpoint how contractors may be differing from one another or which contractor lacks significance in a highly weighted value. Contractor B and Contractor C have essentially the same score for Technical Capabilities, but looking at analysis output, it is easily noted that Contractor B is better at "Quality Control" and Contractor C is better in "Management Effectiveness."

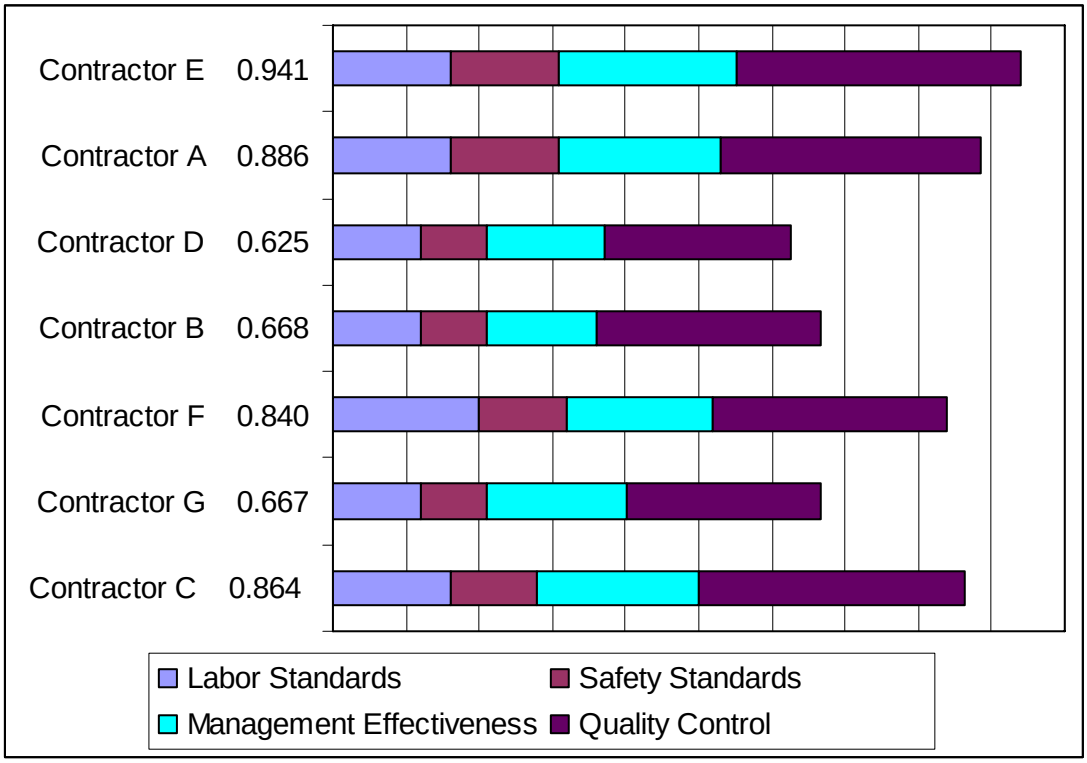


Figure 16. Second Tier Values under Technical Capabilities

Often, decision makers are concerned with an alternative's score for highly weighted measures. The non-pricing measures with the highest global weights for the SABER contractors are: "Compliance Laws and Regs," "Compliance Regs and Code," "Safety Plan," and "Contract Requirement;" these are shown in Figure 17. This analysis shows that Contractor A, F, and C are relatively close for a second place overall rating based on these measures. Additionally, Contractors G, D, and B all score poorly, which makes it difficult for them to be competitive overall.

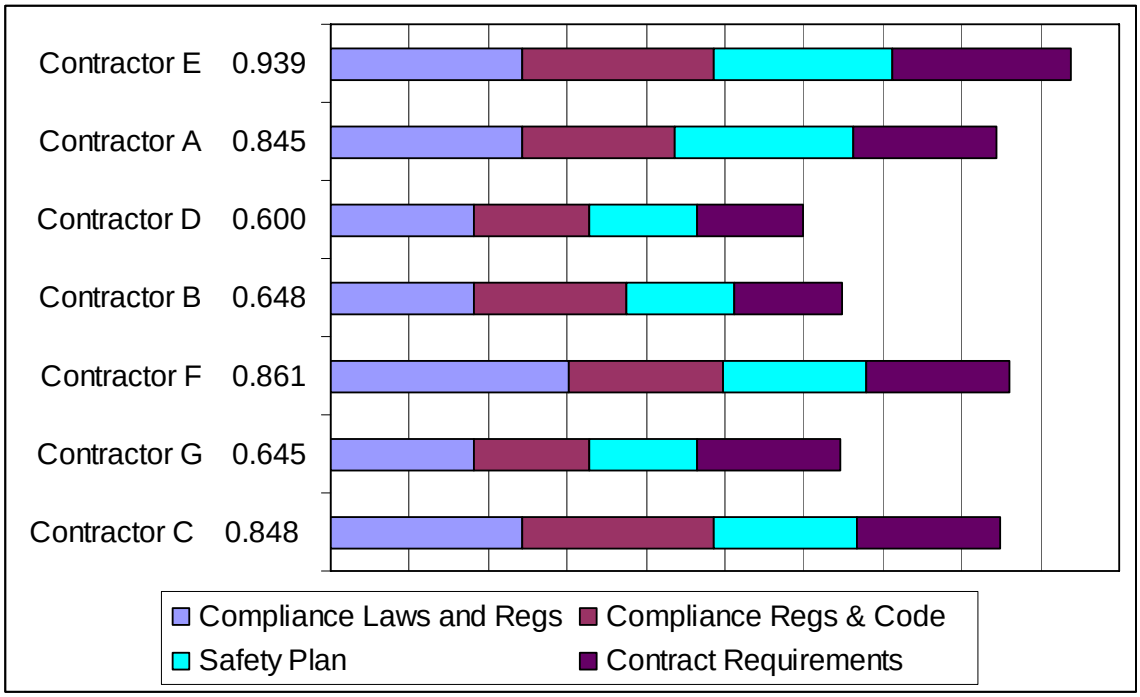


Figure 17. Contractor Rankings for Highly Weighted Measures

The deterministic analyses allows the decision makers to easily decipher how the measures influence the alternatives and helps to sort through and organize a normally very subjective process. This insight can be extremely useful for documentation purposes as well. If a contractor has questions about how they are ranked or where their strength and weaknesses are, insight can be quickly and easily attained from a deterministic analysis as shown in the previous examples.

Several different iterations of deterministic analyses can be executed to provide as much insight as a decision maker deems necessary. For instance, a common use of the deterministic analysis is to create hypothetical alternatives by varying the values of one or two measures within an existing alternative. For example, Contractor C did not

receive any value for price due to a poor coefficient value. What if Contractor C had a highly desirable coefficient value? How would it have ranked against the other contractors if all other measures were held constant? A hypothetical alternative can be created to answer such questions, as shown by Contractor C(1) in Figure 18. Therefore, if Contractor C had submitted a desirable coefficient value, it would have been ranked first.

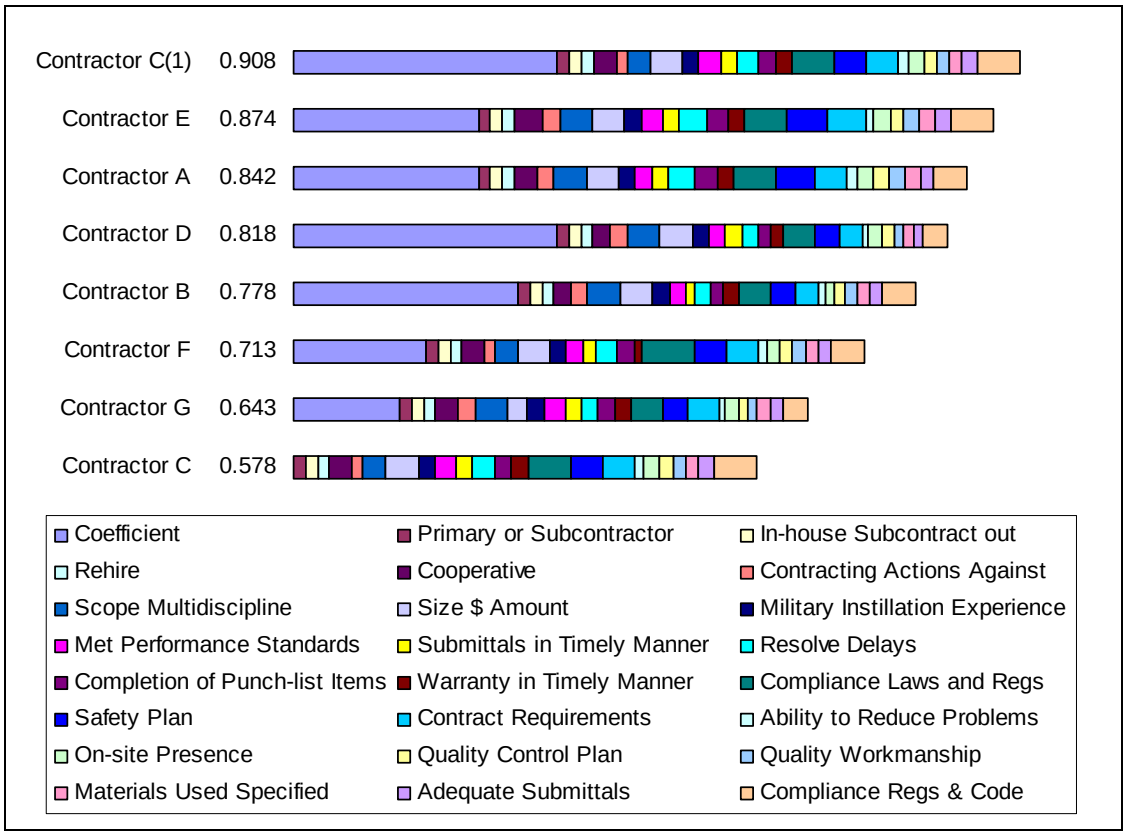


Figure 18. Contractor Rankings Including Hypothetical Contractor C(1)

4.2 Step 9: Sensitivity Analysis

The sensitivity analysis is a unique and extremely insightful aspect of the VFT methodology. The purpose of the sensitivity analysis is to determine how changes in the model will impact the overall decision. Often, changes within the weights assigned to values and measures are explored to pinpoint which values are sensitive to changes, and which ones are not sensitive to changes. By exploring these variations, the decision maker can gain insight into how the alternatives may be influenced by changing certain values, as well as which values may not be necessary or may be extremely influential.

Since price is an area of high concern in the selection of a SABER contractor, and because it possesses such a large global weight, the first sensitivity analysis was applied to the "Price" value. This analysis will provide a graphical representation of how the contractors will vary in rank when the weight assigned to the "Price" value is allowed to range from 0 to 1 while holding the weights of the other values on the same tier, "Past Performance" and "Technical Capabilities," proportionally constant. As shown in Figure 19, this value is slightly sensitive to the weight change due to no change in the top alternative until a moderate increase in the weight from 0.330 to 0.470 is reached. This is also an example of a value that is not sensitive to decreasing weighting values, but is slightly sensitive to increasing weighing values.

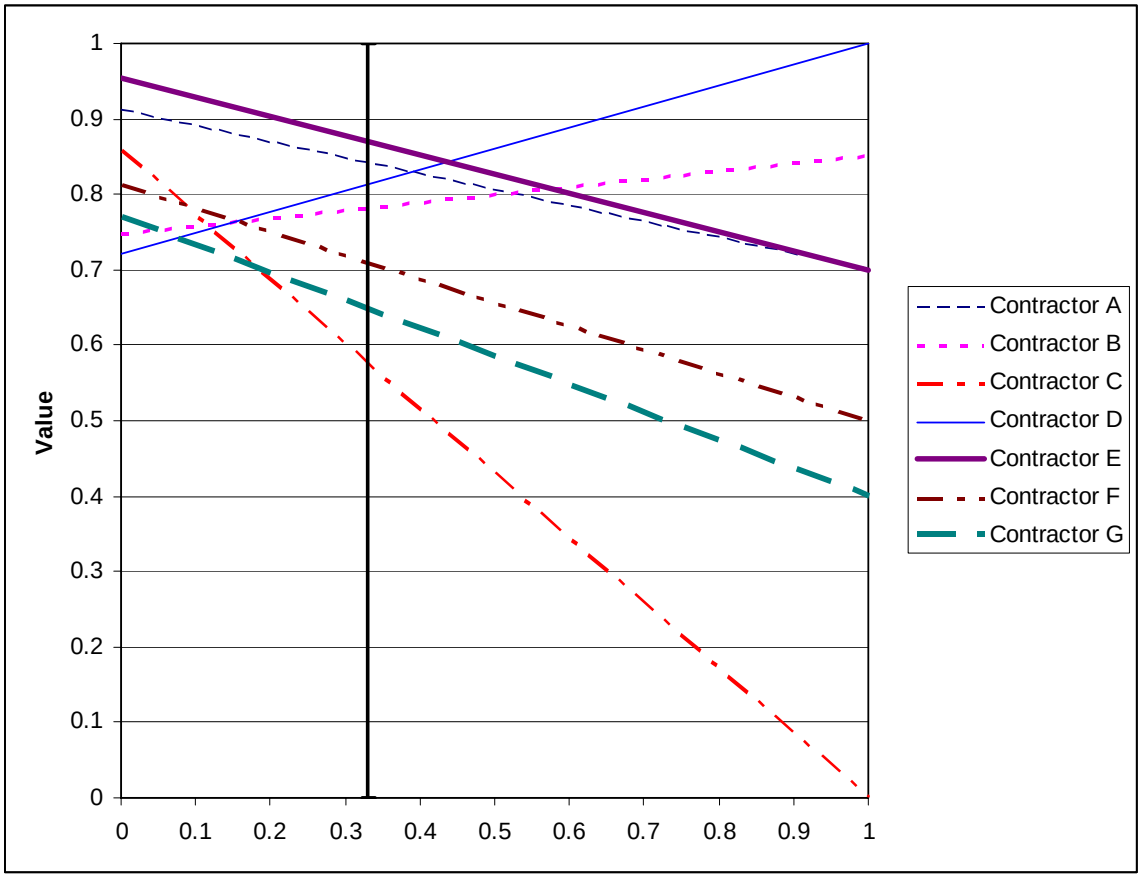


Figure 19. Sensitivity Graph for Price

This is a very useful tool for a SABER source selection. By looking at the weight value determined in the model (0.330), it is apparent that Contractor E is the top alternative. However, an increase in weighted value of "Price" will cause Contractor D to slope upward and Contractor E to slope downward due to the lower price of Contractor D. At approximately 0.470 it can be seen that Contractors E and D crisscross; for that weight value and above, Contractor D is the top alternative.

Figure 19 shows Contractor D as the top value only after the weight is increased to 0.470 and above. The SABER RFP (2004) states: "For those proposals determined to be acceptable, a tradeoff between price and past performance will be conducted with past performance being significantly more important than price." Since past performance (non-pricing factors) should be weighted significantly more than price, it does not make sense to consider what will happen in the weighted range of 0.47 and above on price. The LPTA process elects to evaluate the low priced contractor as a first priority, which is the same as moving to the far right (weighting value of 1.0) on the sensitivity graph.

Other indicators of sensitivity are shallow or steeply sloping lines of alternatives. The more sensitive an alternative is to a given value or measure, the steeper its sloping line will appear due to a greater value change through very little change in weighting. Contractor C from Figure 19 is an example of an alternative showing extreme sensitivity to a given value. This coincides with the deterministic analysis, as Contractor C did not receive any value from its score for the measure of "Price." This analysis can help pinpoint areas that may need further examination or explanation.

Past Performance is another value with a large influence on the SABER contractor decision and has a sensitivity analysis shown in Figure 20. This is an example of an insensitive value because there is no change in the top alterative across the entire range of weighting values. Another indicator that this value is insensitive is the shallow sloping lines of several alternatives.

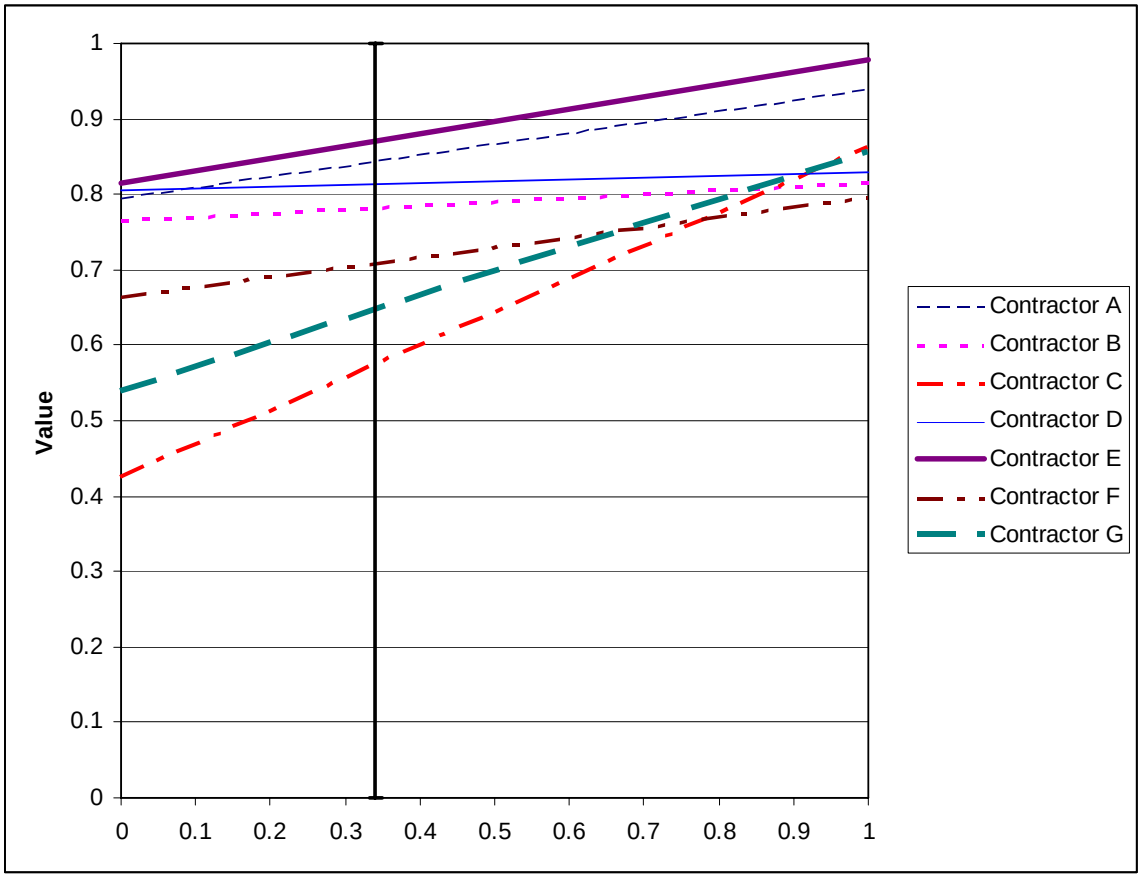


Figure 20. Sensitivity Graph for Past Performance

Figure 21 shows a sensitivity analysis for that last highly (0.300 or above global weight) weighted value within the model. This analysis shows an example of a value that is insensitive to increasing weighting values, but is slightly sensitive to decreasing weighting values. The top alternative would change if the weighting value were decreased to approximately 0.185 or lower.

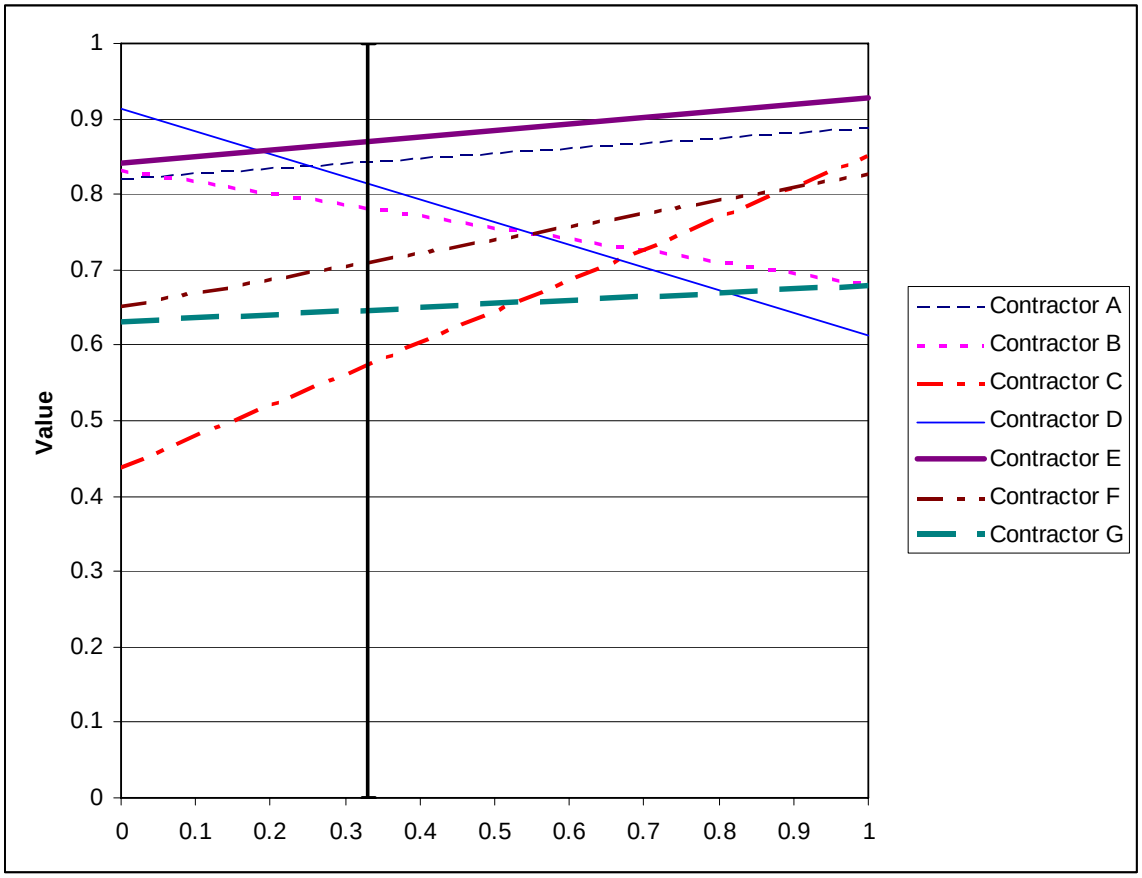


Figure 21. Sensitivity Graph for Technical Capabilities

Sensitivity analysis can provide insight into measures that may not have an overall large global weight, but still may play a significant role in differentiating between two highly competitive contractors. If such an instance were to arise, the sensitivity analysis of that measure could help determine how practical it would be for one contractor to outscore another. Figure 22 shows the sensitivity graph for the measure "Quality Control Plan." If the weighting value increased to approximately 0.100 or greater, Contractor A would overtake Contractor E as the better alternative. However,

with a closer look at the model, the measure "Quality Control Plan" along with four other measures fall under the value "Quality Control." The global weight of "Quality Control" is only 0.132; therefore, the chance of weighting the "Quality Control Plan" measure 0.100 or higher and assigning the remaining weighting (0.032 or less) to the other four measures is small. The impracticality of such a scenario is even more evident knowing the original weighting value of "Quality Control Plan" is 0.020. A 500% increase in assigned weighting for the measure would have to take place.

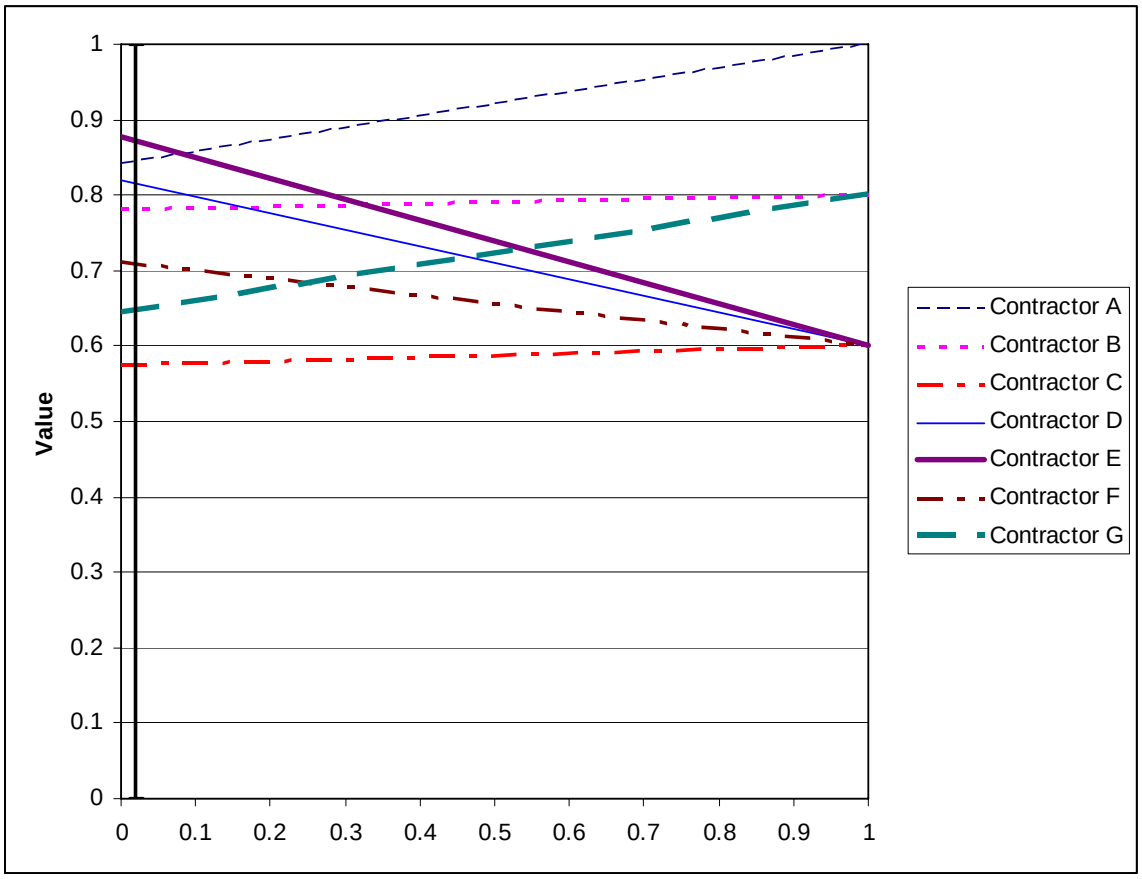


Figure 22. Sensitivity for Quality Control Plan Measure

Chapter V. Conclusions and Recommendations

This chapter provides the closing answers to the research and investigative questions from Chapter 1, a summary of the final questionnaire answers, and a summary of the results and potential future efforts relating to this research. The results presented in this chapter correspond to Step 10 of the Value Focused Thinking (VFT) process. Closing comments will be presented on the potential incorporation of a VFT model in Simplified Acquisition of Base Engineer Requirements (SABER) source selections along with strengths and weakness observed in this research effort. Lastly, recommendations for future research relating to this topic will be synopsized.

5.1 Process Overview

The motivation for this research was to apply an objective analysis tool to the subjective analysis process of a SABER source selection. In doing so, decision makers and subject matter experts with recent exposure to a SABER source selection were consulted. The VFT model was constructed to illustrate the possible benefits and insights that can be gained by incorporating a decision making tool within the evaluation process. The model was developed using the VFT 10-step method (Shoviak, 2001); pre- and post-questionnaires were used to gain further insight into answering the research question posed in Chapter 1: What are all the criteria, values, and measures determined essential by the decision makers to effectively select the best contractor and why is it essential to evaluate all the alternatives? To help fully answer the research question, the following investigative questions were developed and answered during the course of this research:

1) How well does the current selection process work?

2) What are the criteria, to include price and past performance, that are deemed necessary to evaluate competing contractors and what are the underlying measures for these criteria?

3) How are the measures weighted by the decision makers?

4) How well does the VFT model convey the true felling of the decision makers?

5) How does the VFT model compare to the current selection process?

The first investigative question was answered with the literature research discussed in Chapter 2 and the initial questionnaire discussed within Chapter 3. The second and third questions were answered in steps one through five of the VFT process. The hierarchy was comprised of first tier values of Price, Past Performance, and Technical Capabilities. These values were further broken down into 7 second-tier values, 2 third-tier values, and 24 measures. Value functions were developed and defined for the measures to objectively determine the level of attainment each contractor represented, and local and global weightings were applied to the values and measures throughout the hierarchy.

The weighting of the value hierarchy shows that Price is a significant factor in the selection of a contractor which is to be expected. The "Coefficient" measure has the biggest influence in the evaluation process (33%) and can make or break the contractor's competitive probability. The Past Performance and Technical Capabilities values along with encompassing measures make up the other 67% of the decision influence, which holds to the intent of having non-price related factors significantly outweighing price factors as stated in the RFP. More importantly, these assigned weightings hold constant

through the evaluation process, which cannot conclusively be defended by the current SABER source selection process.

The fourth and fifth questions were answered by completing steps six through nine of the VFT process. This was accomplished by utilized the past performance information of seven competing contractors to generate the alternatives to be evaluated. The alternatives were then scored accordingly against the value functions and deterministic and sensitivity analysis was conducted.

5.2 VFT Model – Current SABER Source Selection Comparison

Additional insight into the fourth and fifth investigative questions as well as the overall research question was obtained through a final questionnaire (Appendix G) completed by the research subjects. The following are the collective concluding thoughts gained from the questionnaire:

- VFT process makes it easier to see how values/measures influence the evaluation process and provides a clear understanding of all evaluation criteria.
- Explaining the rational of a decision under the current process is extremely difficult without quantifying numbers – VFT provides quantifying results and clearly defines not only the best choice contractor, but how contractors compare to one another.
- VFT process can potentially reduce need for re-evaluations. One evaluation deemed realistic possibility due to details provided in deterministic and sensitivity analysis.
- VFT process is a great technique for providing accurate and complete documentation of the evaluation process.
- VFT is viewed as a necessary tool for SABER source selections and is recommended for implementation.

From these comments and discussions with the research subjects, the VFT process was viewed as a great tool to help alleviate the problems that arise in the current subjective analysis process. The subjects liked being able to evaluate all competing contractors, being involved in all evaluation criteria (especially price), and the objective qualities and visual graphs provided by the deterministic and sensitivity analysis. These attributes are not available under the current SABER source selection process.

5.3 Conclusions

The main conclusion provided by this thesis is concise: VFT is a viable and essential tool for the SABER source selection process. There are several problems with the current source selection process, to include: there is no way to hold intended weighting constant (i.e., non-pricing factors significantly more important than pricing factors) throughout the evaluations, all competing contractors are not evaluated, lowest priced contractor is evaluated first which introduces immediate evaluator bias, there is no way to objectively differentiate between contractors, and all source selection committee members are not allowed to provide input on all evaluation factors (i.e., price).

VFT can remedy these problems through the objective analysis process described within this thesis. More importantly, realistic data was utilized to evaluate seven competing contractors and showed the importance of evaluating all contractors, holding weighting constant, having an ability to evaluate all criteria (measures), and having an ability to compare and contrast competing contractors through implementation of the model with the use of deterministic and sensitivity analysis. The value hierarchy and value functions could also be utilized to help specify the evaluation factors more clearly within the SABER Request for Proposal (RFP). The final decision is still the

responsibility of the Source Selection Authority (SSA), but a VFT tool which can aid in the probability of selecting the best value SABER contractors for the Air Force can also aid and increase the success and potential of SABER programs.

5.4 Model Strengths

This model provides an objective and systematic development in which all evaluation criteria and all competing contractors can be synthesized into a coherent evaluation process. The data gathered for evaluation purposes is easily transformed into quantifiable data which makes it easier to differentiate and analyze the alternatives. Additionally, the model enables all alternatives considered to be evaluated in a systematic fashion to eliminate bias influences. Instead of relying on subjective judgmental comments, this model requires complete and objective input which is documented and defendable. Analysis can be conducted on any value, measure, or weighting situation within the model, making it extremely versatile and insightful to decision makers and competing contractors alike.

The VFT methodology caters to the values and preferential weightings of the decision makers who utilize the model. These values are what the Air Force is concerned with when selecting a SABER contractor, and a VFT model ensures that all values are incorporated and evident throughout the evaluation process. The model is also adaptable to the values and weightings derived. This enables pertinent addition or deletion of values and measures; changes in weighting to reflect the views of different decision makers are also possible.

5.5 Model Limitations

The main limitation of this model stems from the development of data obtained at a sole location. In utilizing one Air Force base, data was obtained exclusively from one source of subject matter experts. Additional information and data input for value hierarchy construction and weighting values could have been enhanced by incorporating input from several Air Force bases. Therefore, the current model may have some inherent bias geared to the needs of the location investigated. The intent of this research, however, was an initial attempt to illustrate the usefulness of a VFT model in a SABER source selection process; therefore, a sole location with real-world data and the necessary availability of research subjects provided the best scenario.

Another limitation to this model is the incorporation of price within the value hierarchy. The source selection committee collectively wants to evaluate price; however, including price in the model was extremely difficult for two reasons. First, there is only one measure to evaluate price for a SABER contractor and that is through the "Coefficient" measure, which represented 33% of the global weight of the model. Second, the coefficient value range is extremely influential and difficult to pinpoint. The decision makers do not want too low of a coefficient, which will potentially cause a contractor to be unsuccessful throughout the course of the contract. However, they also do not want a coefficient that is too high, potentially gouging the resources of the Government. The value range determined acceptable for this model is notional and was obtained from the subject matter experts. The construction of the value function for this measure is in need of refinement, but served to illustrate the application and usefulness of the model as a whole.

5.6 Future Research

This research was an initial attempt to gain insight into the problem areas associated with the SABER source selection process and provide an avenue to help alleviate those problem areas; therefore, there are several areas for future research work. One main area is to broaden the participation from one Air Force base to several bases. This would enable a wider variety of input from subject matter experts which could possibly result in changes to the value hierarchy constructed in this thesis or provide added validity to the values and measures within the model. Additionally, a universal value hierarchy and weightings may be developed by researching several bases.

Another area for research is to incorporate members from the contracting squadrons on a larger scale and incorporate their thoughts and ideas within the model. Doing so will help validate the model as a source selection tool. Additionally, contracting personnel can help solve the problems that were discussed with the "Coefficient" measure.

Lastly, additional research could be conducted by incorporating the VFT model within an actual SABER source selection to analyze how effective and efficient it would be to the source selection committee in a real-time situation. Additional insight into the model, the source selection process, and the source selection committee along with areas for improvement would be gained from this process.

Appendix A. Past Performance Grading Sheets

F22608-04-R-0002
Attachment 9

PAST AND PRESENT PERFORMANCE QUESTIONNAIRE.
WHEN FILLED IN THIS DOCUMENT IS SOURCE SELECTION SENSITIVE INFORMATION IN ACCORDANCE WITH FAR 3.104

PART I: OFFEROR COMPLETE BELOW:

1. Contractor (Name, Address, and Zip code):

   _____

   _____

   _____

2. Contract Number: _____
3. Program/Project Title: _____
4. Type of Contract: Fixed Price ___ Cost Reimbursement ____ Other ____ (Explain)

   _____

5. Description, location, and relevancy of work.

   _____

   _____

   _____

6. Performance Period: _____
7. Date of Award: _____
8. Original Contract Dollar Value: _____
9. Current/Completed Contract Dollar Value: _____
10. If amounts for 8 and 9 above are different, provide a brief explanation for the reason.

    _____

    _____

    _____

11. Contract Completion Date (including extension): _____
12. Point of Contact Information:

    Procuring/Administrative Contracting Officer:

    Name:_____Phone:_____

    Address:_____Fax:_____

    _____e-mail_____

    _____

Page 1 of 6

PART II. RESPONDENT/GOVERNMENT OFFICIAL'S INFORMATION AND PERFORMANCE EVALUATION

You have been provided as a reference in response to the solicitation for a contract to provide for basewide paving IDIQ. In order for the government to evaluate the past performance of the firm providing you as a reference, please complete this questionnaire and forward to the 14th Contracting Squadron in accordance with the instructions listed below.

The individual knowledgeable of the contractor's day-to-day operations and overall performance should complete this questionnaire. However, that individual is encouraged to supplement their own knowledge of the contractor's performance with the judgement of others within their organization, as applicable.

Offer Due Date and Time: _____

FAX to: (662) 434-3049 or DSN 742-3049

E-MAIL to: Ramona.allen@columbus.af.mil

Mail to: 14th Contracting Squadron/LGCA
Attn: Ramona Allen
555 Seventh Street, Suite 113
Columbus AFB, MS 39710-1006

POC: Ramona Allen, Contract Specialist, 662-434-7785 or DSN 742-7785
Or Waimon Hendrix, Contracting Officer, 662-434-7796, DSN 742-7796

1. Respondent/Government Official's Information

Name: _____

Position/Title: _____

Address: _____

_____

_____

Telephone Number: _____ Fax: _____

E-mail: _____

2. Relationship and time involved with Contractor:

_____

3. Date questionnaire was completed: _____

The following chart depicts the **RATINGS** that are to be used to evaluate the contractor's performance:

U	M	N	S	G	E
Unsatisfactory/No Confidence	Marginal/Little Confidence	Neutral/Unknown/ Confidence	Satisfactory/ Confidence	Very Good/Significant Confidence	Exceptional/High Confidence
Based on the offeror's performance record, extreme doubt exists that the successful offeror will perform the required effort.	Based on the offeror's performance record, substantial doubt exists that the successful offeror will perform the required effort.	No performance record identifiable.	Based on the offeror's performance record, some doubt exists that the successful offeror will perform the required effort.	Based on the offeror's performance record, little doubt exists that the successful offeror will perform the required effort.	Based on the offeror's performance record, essentially no doubt exists that the successful offeror will successfully perform the required effort.

For any neutral, marginal, or unsatisfactory rating, please provide explanatory narratives in the remarks block. These narratives need not be lengthy, just detailed. If a question is not applicable, mark **N/A.** If more space is needed, use the back of the questionnaire or attach additional pages. Be sure to identify your continued narration with the respective line number.

CONTRACT WRITTEN BY: _____

CONTRACT NUMBER: _____

POINT OF CONTACT: _____

NAME OF PRIME CONTRACTOR: _____

1. QUALITY CONTROL: **CIRCLE ONE**

a. Provided quality of workmanship	U	M	N	S	G	E
b. Provided and followed effective Quality Control, (QC) Plan	U	M	N	S	G	E
c. Provided effective inspection procedures to meet contract requirements	U	M	N	S	G	E
d. Stored materials properly	U	M	N	S	G	E
e. Used materials specified	U	M	N	S	G	E
f. Ordered and used adequate materials	U	M	N	S	G	E
g. Provided adequate submittals	U	M	N	S	G	E
h. Provided adequate as-built drawings	U	M	N	S	G	E
i. Identified/corrected deficient work in a timely manner	U	M	N	S	G	E
j. Suggested solutions and displayed initiative to implement solutions	U	M	N	S	G	E

ADDITIONAL COMMENTS: _____

_____

2. TIMELY PERFORMANCE:

	CIRCLE ONE					
a. Provided submittals in a timely manner	U	M	N	S	G	E
b. Researched submittals well and clearly identified the proposed item	U	M	N	S	G	E
c. Matched submittals accurately to contract requirement	U	M	N	S	G	E
d. Met established allotted work schedule	U	M	N	S	G	E
e. Resolved delays	U	M	N	S	G	E
f. Completed punchlist items timely	U	M	N	S	G	E
g. Completed punchlist items adequately	U	M	N	S	G	E
h. Completed work within performance period	U	M	N	S	G	E
i. Developed realistic progress schedules	U	M	N	S	G	E

ADDITIONAL COMMENTS: _____

_____

_____

_____

3. MANAGEMENT EFFECTIVENESS:

a. General Business Practices:	CIRCLE ONE					
1. Provided experienced managers, and supervisors with the technical and administrative abilities needed to meet contract requirements	U	M	N	S	G	E
2a. Hired experienced subcontractors	U	M	N	S	G	E
2b. Paid subcontractors/suppliers in a timely manner	U	M	N	S	G	E
3. Provided well substantiated pricing data for modifications	U	M	N	S	G	E
4. Completed all contract work prior to requesting final inspection. Left no major discrepancies	U	M	N	S	G	E
5. Provided timely and satisfactory response to warranty issues after completion of project	U	M	N	S	G	E
6. Cooperated to resolve problems, attending meetings, (as applicable) and maintained communication to assure satisfactory resolution	U	M	N	S	G	E
7. Provided timely resolution of contract discrepancies	U	M	N	S	G	E
8. Obtained consent of surety for increases in bonding as work in progress increased	U	M	N	S	G	E

b. Pricing:

1. Submitted proposals that accurately represent the work required	U	M	N	S	G	E
2. Provided supporting price/cost information for modifications that were accurate, complete and reasonable, (not over inflated or under estimated)	U	M	N	S	G	E
3. The contractor's overall pricing performance	U	M	N	S	G	E

c. Site Management/Superintendent:

1. Site Manager ensured compliance with contract requirements and safety	U	M	N	S	G	E
2. Site manager acted promptly to resolve problems and ensure work quality	U	M	N	S	G	E
3. Delegated sufficient authority to Site Manager to make decisions or take actions during project performance	U	M	N	S	G	E
4. Site manager consistently present on site when work was performed	U	M	N	S	G	E
d. Contractor's overall Management Effectiveness	U	M	N	S	G	E

ADDITIONAL COMMENTS: _____

_____

_____

4. COMPLIANCE WITH LABOR STANDARDS: **CIRCLE ONE**

a. Submitted payrolls in a timely manner	U	M	N	S	G	E
b. Completed payrolls correctly	U	M	N	S	G	E
c. Complied with labor laws and regulations with specific attention to the Davis-Bacon Act	U	M	N	S	G	E

ADDITIONAL COMMENTS: _____

_____

_____

5. COMPLIANCE WITH SAFETY STANDARDS: **CIRCLE ONE**

a. Provided adequate safety plan	U	M	N	S	G	E
b. Implemented safety plan	U	M	N	S	G	E

6. OTHER PAST PERFORMANCE CONSIDERATIONS: **CIRCLE ONE**

a. Assessment of liquidated damages (frequency, circumstances, severity of problem etc.) (Yes No)

b. Based on the contractor's overall performance, would this contractor be re-hired? If not, explain in "Additional Comments" (Yes No)

c. Was the contractor cooperative in negotiating modifications so that they would result in fair and reasonable cost adjustments to the contract? (Yes No)

d. The contractor provided all deliverables (including documentation) in a timely and accurate manner (Yes No)

e. Have there been any labor disputes or violations of public law? (Yes No)

f. Have there been any indications that the contractor has had any financial difficulties? (Yes No)

g. Contractor submitted modifications and other required proposals in a timely manner. (Yes No)

h. Was the contractor ever issued a Cure or Show Cause Notice under the referenced contract? If yes, explain outcome in "Additional Comments" (Yes No)

ADDITIONAL COMMENTS: _____

_____

_____

_____

7. Overall Rating

a. How would you rate the contractors performance on an overall basis U M N S G E

ADDITIONAL COMMENTS: _____

_____

_____

_____

Completed questionnaires must be received in 14th Contracting Office, Columbus AFB MS NLT Offer Due Date.

If you have any questions, please contact _____, phone _____.

THANK YOU FOR YOUR TIME AND QUICK RESPONSE.

Date: 18 Jun 03

Appendix B. Evaluation Sheet

SOURCE SELECTION INFORMATION – SEE FAR 3.104
FOR OFFICIAL USE ONLY

EVALUATOR WORKSHEET

EVALUATOR: _____

CONTRACTOR: _____

RATING:

( ) Exceptional ( ) Very Good ( ) Satisfactory ( ) None ( ) Marginal ( ) Unsatisfactory

STRENGTHS:_____

WEAKNESSES:_____

SUMMARY:_____

_____ _____
SIGNATURE (EVALUATOR) **DATE**

SOURCE SELECTION INFORMATION – SEE FAR 3.104
FOR OFFICIAL USE ONLY

Appendix C. Initial Questionnaire

Question 1. How is the current evaluation process of SABER Source Selection conducted?

Answers:

Subject A:

1.) Given first candidate and they are rated based on capabilities, historical projects, evaluations from other military units and evaluation from outside agencies.
2.) Rate each candidate until you either give the highest rating or you go through all candidates. If you hit the highest rating, you stop.

Subject B:

Past performance, capability, management, firm breadth of talent. The process of SABER Source Selection is based on a number of factors to include statements from base contracting officials and engineering and contract management personnel.

Subject C:

Contracting receives bid packages to include past performance. Contracting establishes Tech Eval Committee. Committee ranks all proposals. Contracting ranks all proposals based upon cost factors. Rank proposals based upon tech eval and cost.

Subject D:

CE selects team members, normally two or more. Each member is provided background and performance criteria for each proposal. These are graded with strengths and weaknesses and ranked in priority order. Cost is not factor evaluated by CE team.

Question 2: What are the evaluation criteria utilized in the current SABER Source Selection?

Answers:

Subject A:

Capabilities listing, project completed, evaluations from contracting & CE at other units, evaluations from outside agencies.

Subject B:

Past performance, price, and written evaluations from base officials.

Subject C:

Experience involved in execution of work. Experience in performance of like work. Dollar amount of like work and period work was performed. Technical capabilities of company and production capabilities.

Subject D:

Past performance, experience or expertise, subcontracting, costs.

Question 3: Is there a clear understanding of all evaluation criteria utilized in the current SABER Source Selection?

Answers:

Subject A:

No. Depending on the evaluator, one may place higher marks on certain areas than another evaluator. This can have a dramatic affect if, per say, one person rates paper work over quality of work.

Subject B:

Yes. However, if the information is skewed or unreliable the outcome of selecting a SABER entity would be flawed.

Subject C:

I feel that there is not a clear understanding of the criteria or the value of each element in the selection process. I feel too much justification on cost vs. past performance trade-off is required. [Per clarification with subject – currently too much emphasis on cost rather than past performance.]

Subject D:

Yes.

Question 4: How many times are competing contractors evaluated or re-evaluated?

Answers:

Subject A:

Maybe once but it could go as far as three or four times to break dead-locks.

Subject B:

Usually, once. There should be no need for re-evaluation unless two or more contractors are very close in capability and technical expertise.

Subject C:

Twice, if there is not a clear ranking of the competing contractors.

Subject D:

Most are intended to evaluate once, but clarifications or changes prompt a re-evaluation and/or proposal change.

Question 5: If evaluations are done more than once, what type of information becomes more evident by conducting re-evaluations?

Answers:

Subject A:

Comparisons to past history. If there were completion issues or problems.

Subject B:

Ability to execute – multi-discipline, multi-task jobs / subcontractors affiliated with the prime contractor.

Subject C:

Relevance of experience of past work and customer satisfaction.

Subject D:

Knowledge of the contract requirements may be lacking. Probably a contractor to avoid.

Question 6: If an evaluation of a contractor was done only once with the current evaluation process, would there be enough information to conduct proper documentation?

Answers:

Subject A:

No. Case in point, we rated a contractor high but we were not shown his coefficient. It turned out to be too low and therefore we have had to battle the contractor on trying to increase his margin on contracts trying to make up the difference.

Subject B:

Yes. Provided all data presented is accurate and provides an honest look at the contractor.

Subject C:

Not 100% of the time.

Subject D:

Yes. Most all solicitations provide a clause or paragraph to say award may be made with no discussion.

Question 7: Is there a need for improvement in the evaluation process of SABER Source Selections?

Answers:

Subject A:

Yes, see answer for #6. Need to have data file on evaluations of each delivery order done by a contractor for the military. Utilize ACES (mandatory). In areas where subcontractors are hard to find, eliminate firms who are 90% contracted out to subs.

Subject B:

Yes. Too many times the process of source selection is not conducted by person with the necessary technical capability. People also have a tendency to allow their personal views to get involved in the process. There should be a hard look at the proposed contractor – an ability to complete work, subs, and in-house capability.

Subject C:

Yes!

Subject D:

Yes. I see a need to have the technical team provide input or direction on the cost. Most contracting officers do not have enough knowledge to make valid decisions.

Appendix D. Value Hierarchy Definitions

Price

The price value is based on the overall factored coefficient value submitted by the contractor. A coefficient that is too low indicates that a contractor may be trying to underbid to get a higher evaluation, but may not be successful throughout the life of the contract. An extremely high coefficient is undesirable because the Air Force does not want to lose money throughout the life of the contract either. The intent is to achieve a reasonable price for the Government while at the same time ensuring the contractor will be successful.

Past Performance

Past performance is an important value because this helps the Air Force determine the amount of confidence we can place in the abilities of a contractor based on work performed in previous (within the past 3 years) contracts. Evaluation of the past performance enables the Air Force to determine the capabilities of a contractor in terms of operations, management, and construction efforts of a SABER contractor. The RFP details example projects that a contractor can expect to encounter, therefore there should be viable example of similar an exceeding efforts submitted by the contractors. Past performance is further broken down into three sub-values: Competency, Relevancy, and Timely Performance.

Competency

The Air Force desires a SABER contractor that has demonstrated the ability and competence of performing and managing similar construction projects to those that will

be encountered throughout the lifespan of a SABER contract. This value is a means to measures the confidence that the Air Force can expect to place on a contractor based off of previous performance evaluations. Competency is further broken down into two sub-sub-values: On-site Capabilities and Customer Satisfaction.

On-site Capabilities

The on-site capabilities of the competing contractors are extremely important for a SABER contract due to the high volume and quick completion of construction projects to be issued. It is essential that the Air Force has the ability to rate the capabilities of the contractors to ensure that the expedition factor entailed in SABER work can be accomplished successfully.

Customer Satisfaction

A rather generic but still extremely important value is customer satisfaction. The Air Force seeks contractors that will not only do the work required, but complete the work in a fashion that meet or exceeds the expectations of their customers. There are numerous Task Orders throughout the years of a SABER contract, therefore the contractor need to demonstrate a fluid and consistent high standard of business practice. The Air Force is an organization which requires a standard of excellent, and will accept nothing less.

Relevancy

The importance and utilization of SABER as means of construction on Air Force bases has increased by leaps and bounds over the years. These construction projects can and will vary greatly in size, scope, and manner of execution. The contractors need to be rated on their abilities to be able to handle large scale, multidiscipline projects. The Air

Force desires a well rounded contractor, and would also prefer a contractor with military installation experience due to the unique requirement and standards that are entailed with projects performed on bases.

Timely Performance

The timeliness of performance which can be expected from a contractor is crucial for a SABER contract. The main purpose of SABER is to plan and perform construction projects in an expedited method. The contractors need to present the ability to meet deadlines and handle unforeseen conditions in a timely and efficient manner. The intent of having a SABER contract is negated by contractors that do not show the ability to perform in a timely fashion.

Technical Capabilities

The value of technical capabilities focuses on how well a contractor adheres to regulations, building codes, and building standards as well as managerial issues. Again, the Air Force is seeking an efficient, ethical, and competent contractor who can demonstrate excellence in their technical capabilities. The value of technical capabilities is further broken down into four sub-values: Labor Standards, Safety Standards, Management Effectiveness, and Quality Control.

Labor Standards

This value is incorporated to ensure that the contractor can comply with applicable laws and regulations governing labor standards. The Air Force will not tolerate non-compliance of such issues and seeks a contractor that will demonstrate full adherence to applicable labor standards.

Safety Standards

Safety is a major concern on Air Force bases, therefore the contractor need to have the ability to construct and implement an appropriate safety standard for their corporation. This value enable the Air Force expressive the confidence level held in the contractor to be able to run operations in an efficient and safe application.

Management Effectiveness

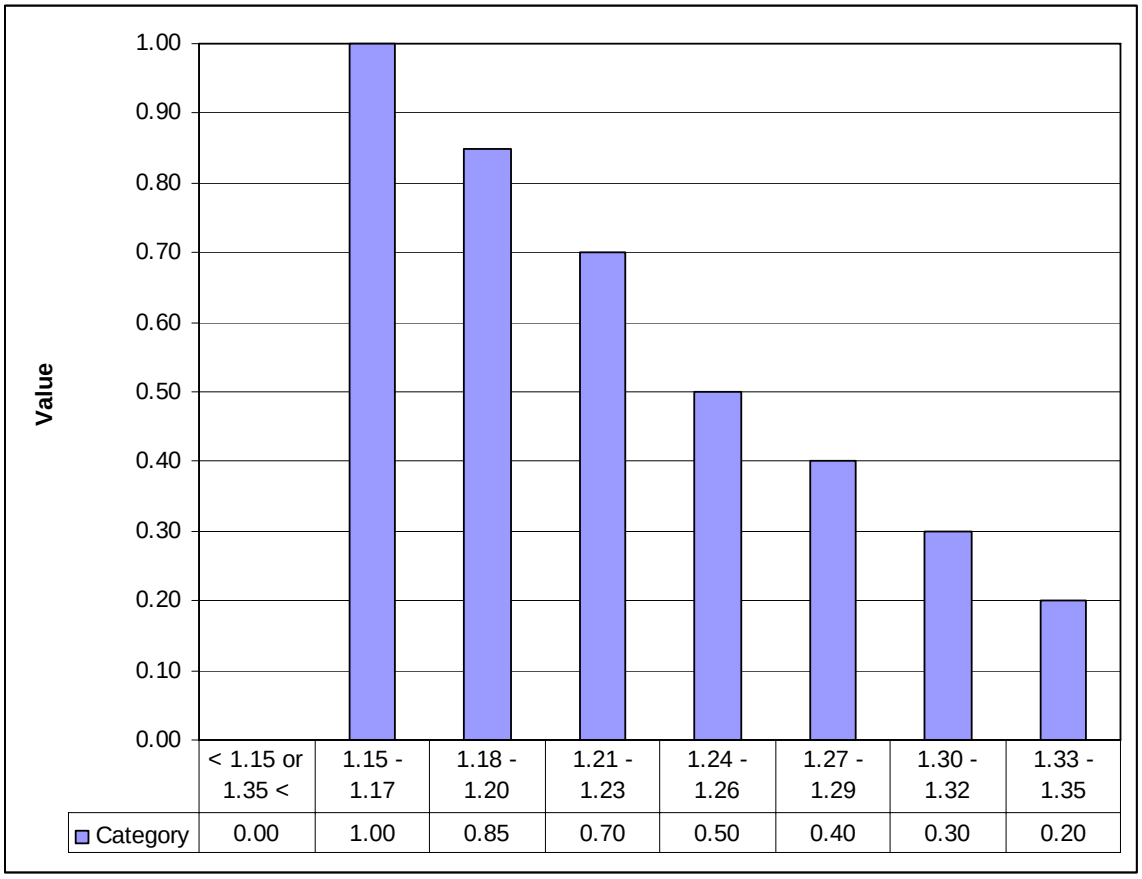
As stated throughout the definitions of previous values, a SABER contract will require a maximum managerial effort from the contractors due to the nature and intent of the SABER program. Several projects will be executed simultaneously, and unforeseen site conditions and change orders will happen, so the contractor needs to demonstrate an ability to handle an array of situations. Additionally, the contractors need to be readily available, or have a representative that is readily available to address issues that arise with ongoing projects and future projects.

Quality Control

The Air Force desires a contractor that can not only provide timely and cost efficient projects, but also provide coherent plans and high quality work. The contractor needs to be able to demonstrate the ability to perform in compliance with applicable regulations and building codes, as well as an ability to properly submit and adhere to submittal requirements.

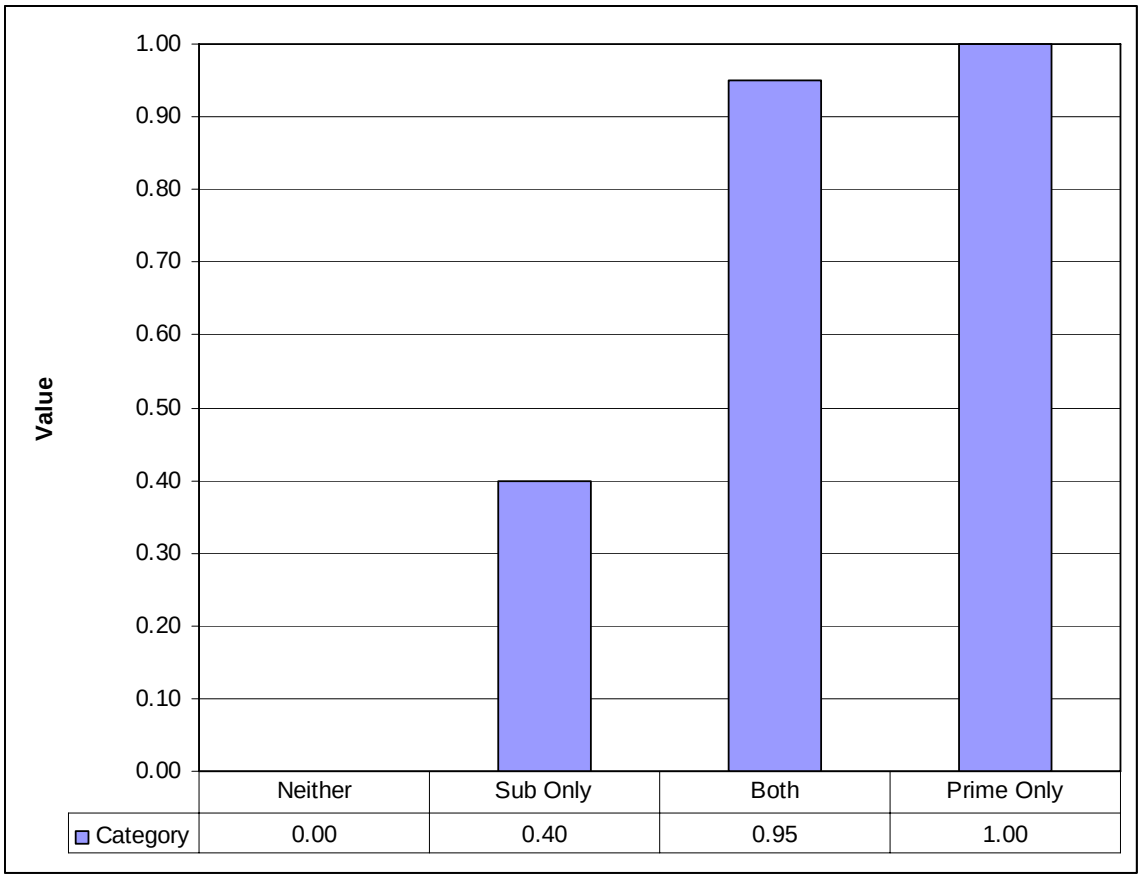
Appendix E. Measure Definitions

M1: Coefficient



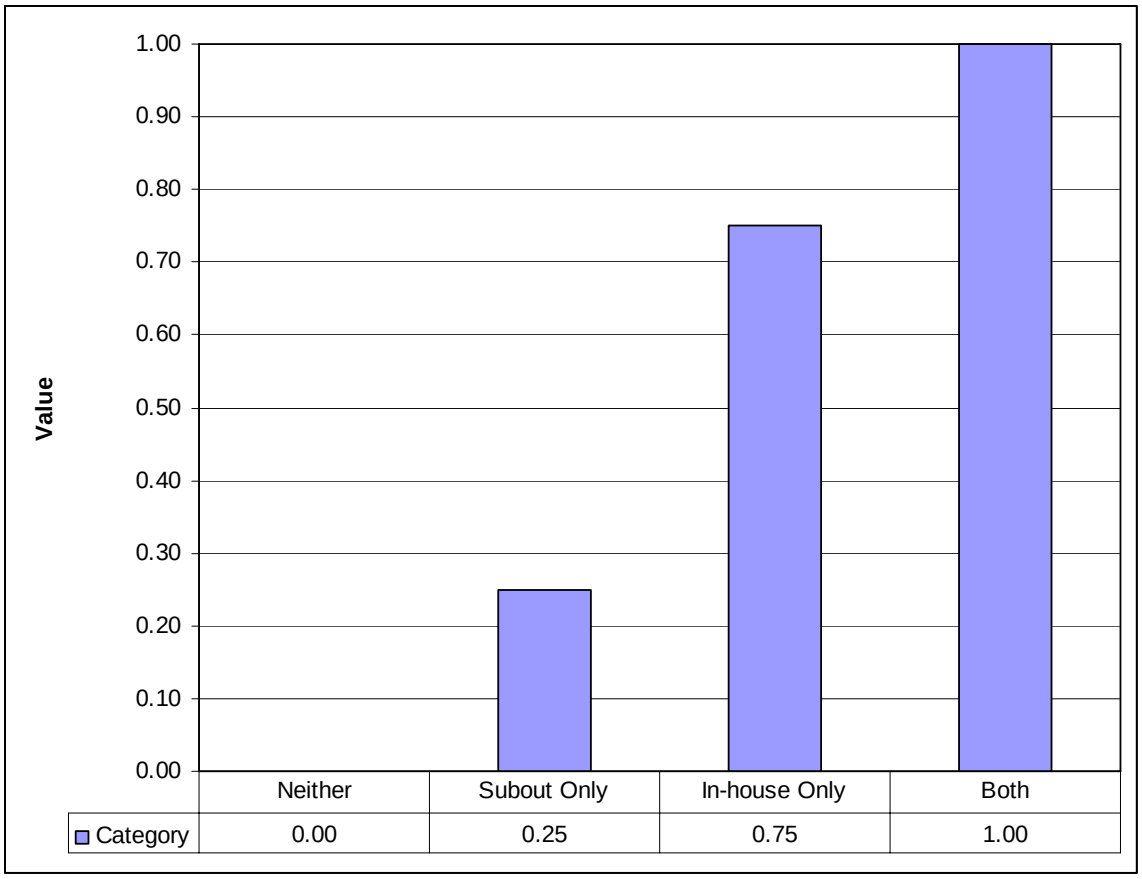
	Category Definition
< 1.15 or 1.35 <	Overall coefficient submitted by contractor is less than 1.15 or greater than 1.35
1.15 – 1.17	Overall coefficient submitted falls in corresponding range
1.18 – 1.20	Overall coefficient submitted falls in corresponding range
1.21 – 1.23	Overall coefficient submitted falls in corresponding range
1.24 – 1.26	Overall coefficient submitted falls in corresponding range
1.27 – 1.29	Overall coefficient submitted falls in corresponding range
1.30 – 1.32	Overall coefficient submitted falls in corresponding range
1.33 – 1.35	Overall coefficient submitted falls in corresponding range

M2: Primary or Subcontractor



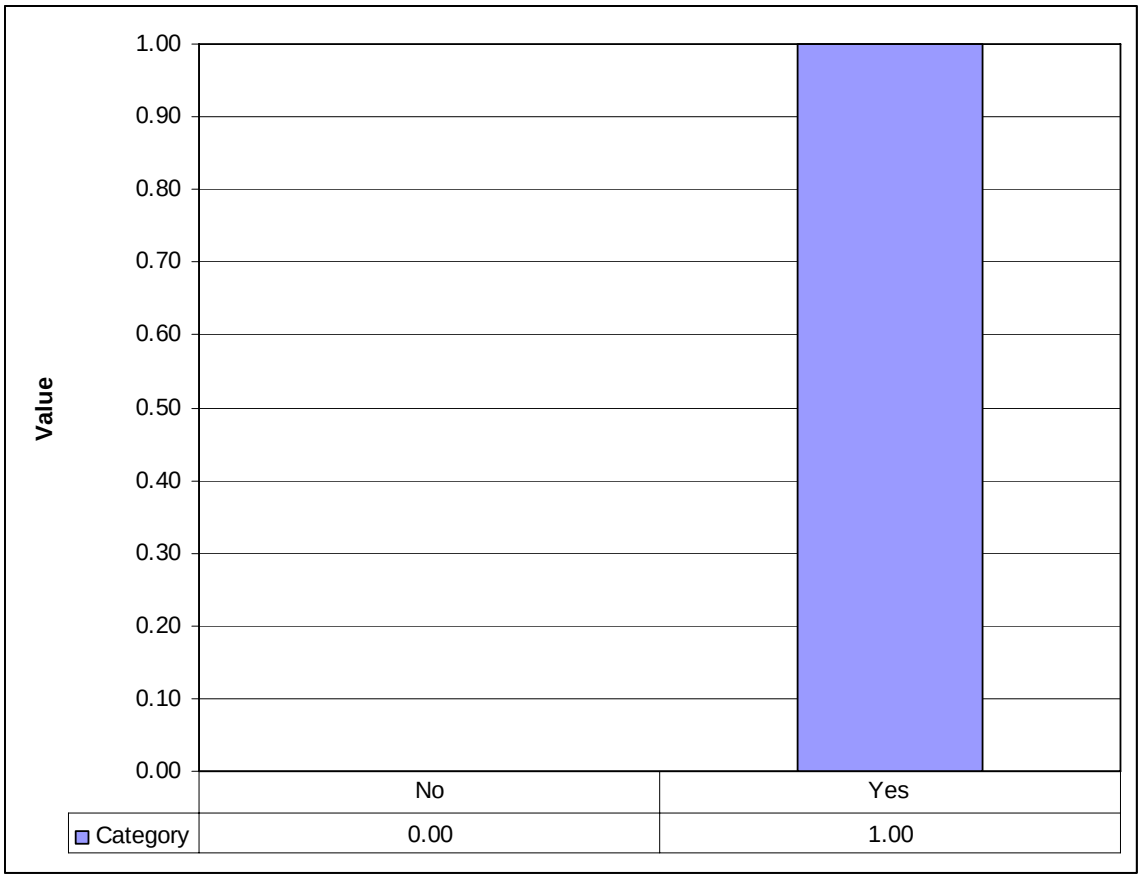
Category	Category Definition
Neither	Proposal does not demonstrate the capacity of contractor to effectively conduct and manage construction work as a subcontractor or a prime contractor.
Sub Only	Proposal demonstrates capacity of contractor to effectively conduct and manage construction work as a subcontractor only.
Both	Proposal demonstrates capacity of contractor to effectively conduct and manage construction work as either a subcontractor or a prime contractor.
Prime Only	Proposal demonstrates the capacity of contractor to effectively conduct and manage construction work as a prime contractor only.

M3: In-house Subcontract out



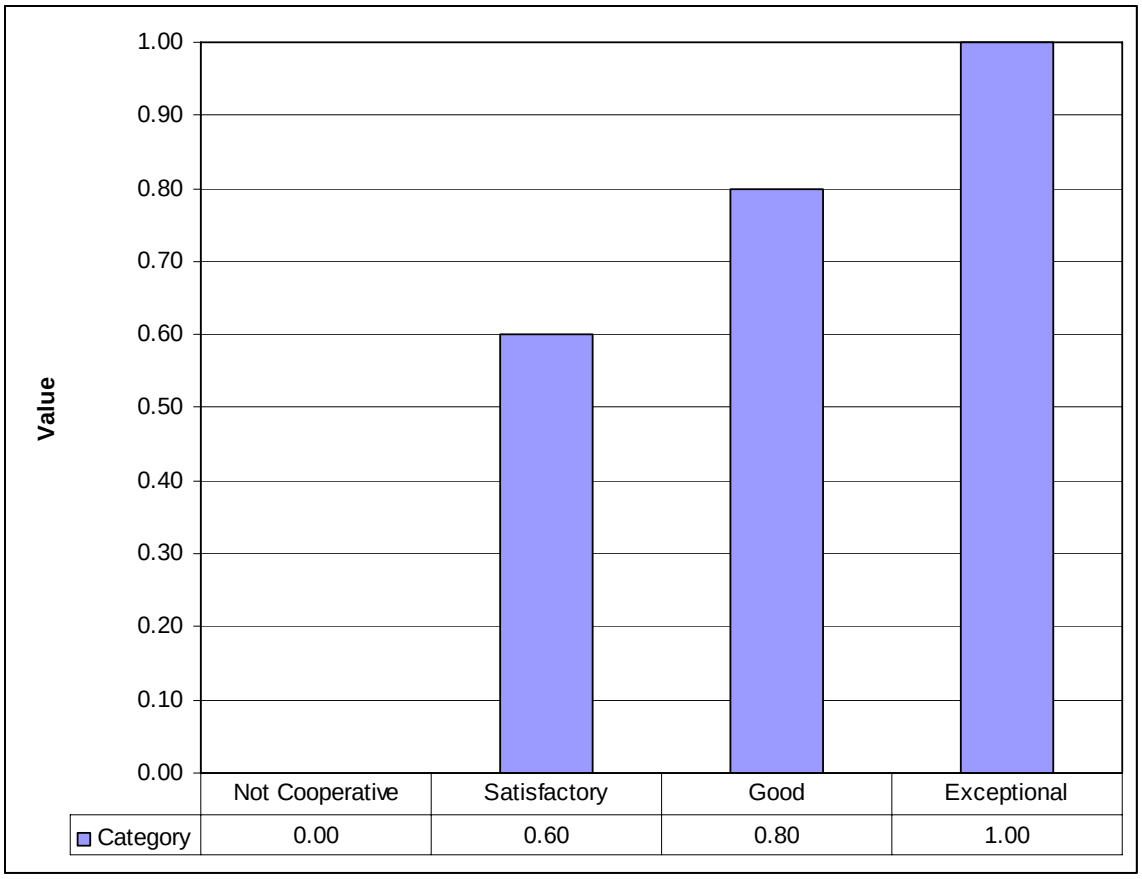
Category	Category Definition
Neither	Proposal does not demonstrate the capacity of contractor to effectively conduct construction work within their corporation nor the ability to effectively acquire and manage subcontractor(s) to perform construction work.
Subout only	Proposal only demonstrates capacity of contractor to effectively acquire and manage subcontractor(s) to perform construction work.
In-house only	Proposal only demonstrates capacity of contractor to effectively conduct construction work within the means of their corporation.
Both	Proposal demonstrates the capacity of contractor to effectively perform construction work either by the means of their own corporation or through the use of subcontractor(s).

M4: Rehire



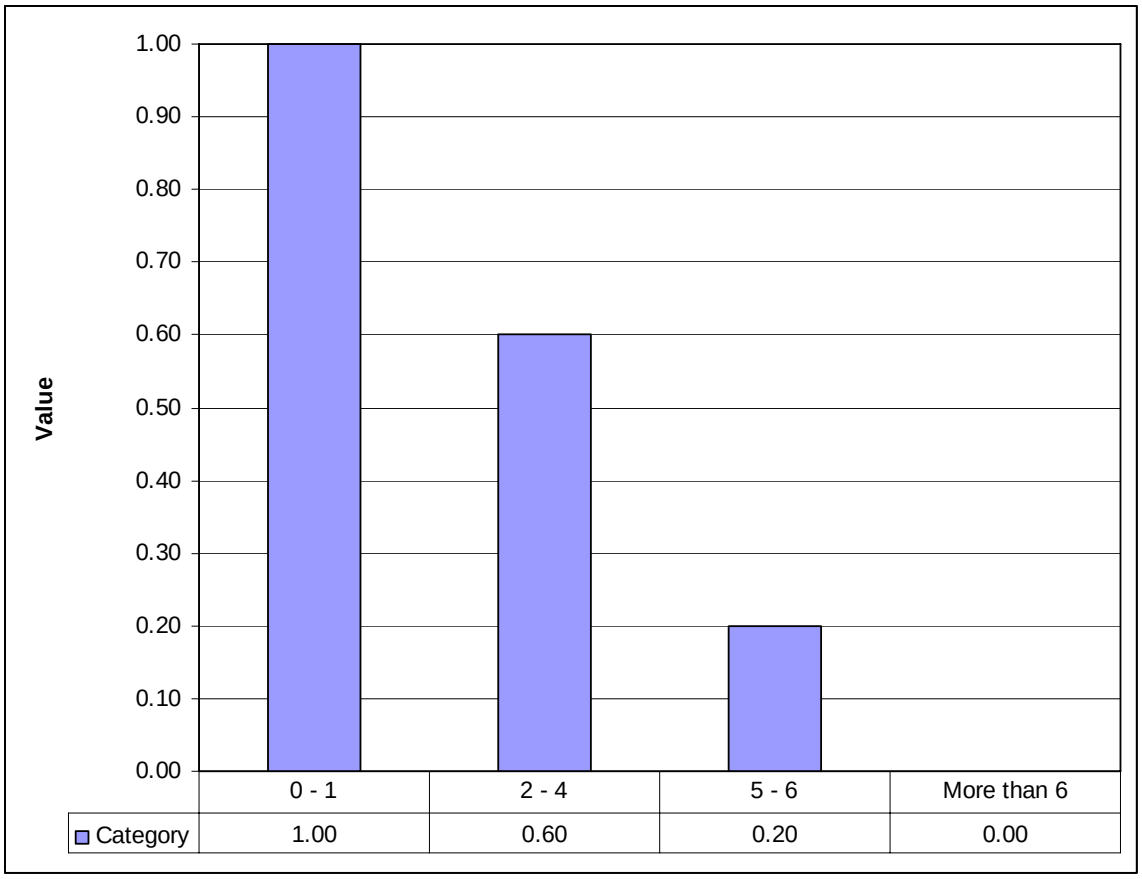
Category	Category Definition
No	Proposal does not demonstrate the desire for the contractor to be rehired for future work.
Yes	Proposal demonstrates the dire for the contractor to be rehired for future work.

M5: Cooperative



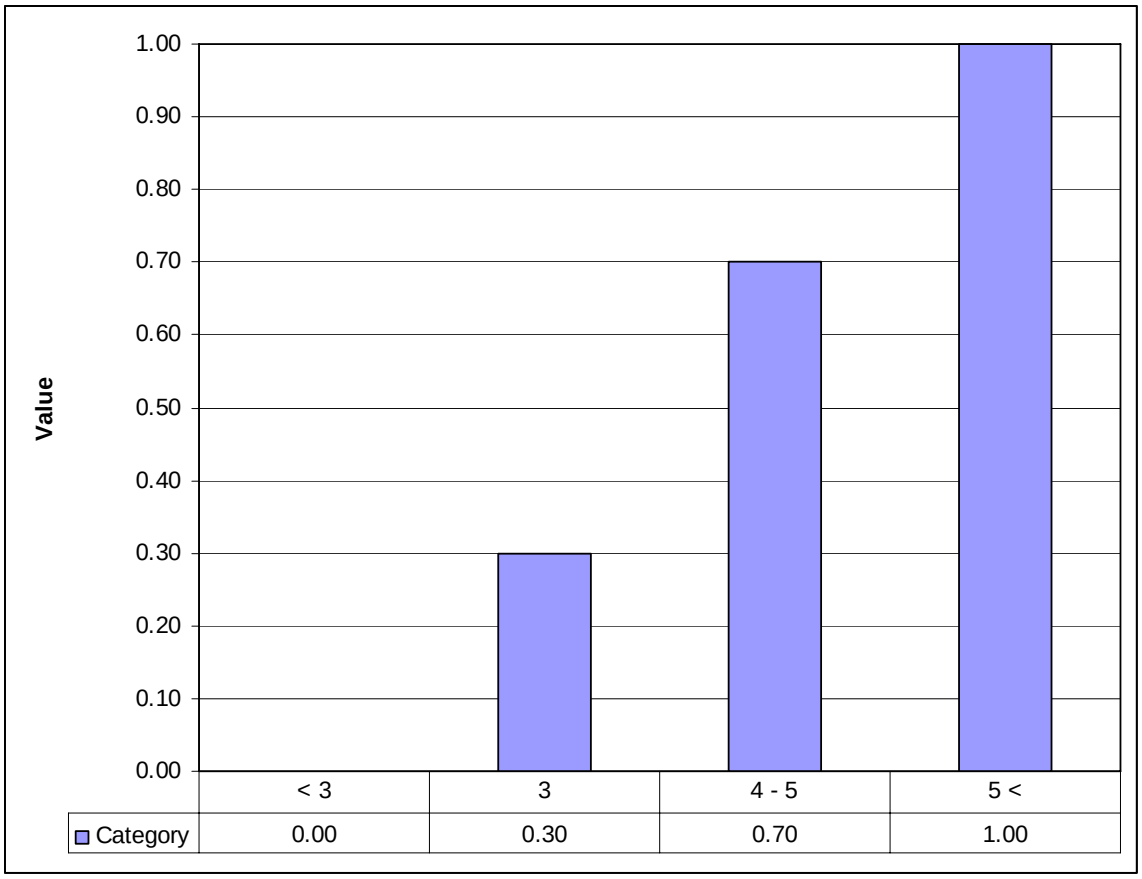
Category	Category Definition
Not Cooperative	Proposal demonstrates negative business conduct or does not address cooperative capabilities at all.
Satisfactory	Proposal addresses cooperative capabilities but demonstrates inconsistencies of both negative and positive conduct.
Good	Proposal addresses cooperative capabilities in strictly positive manner.
Exceptional	Proposal addresses outstanding positive cooperative capabilities to include incentives exercised to maintain or improve capabilities.

M6: Contracting Actions Against



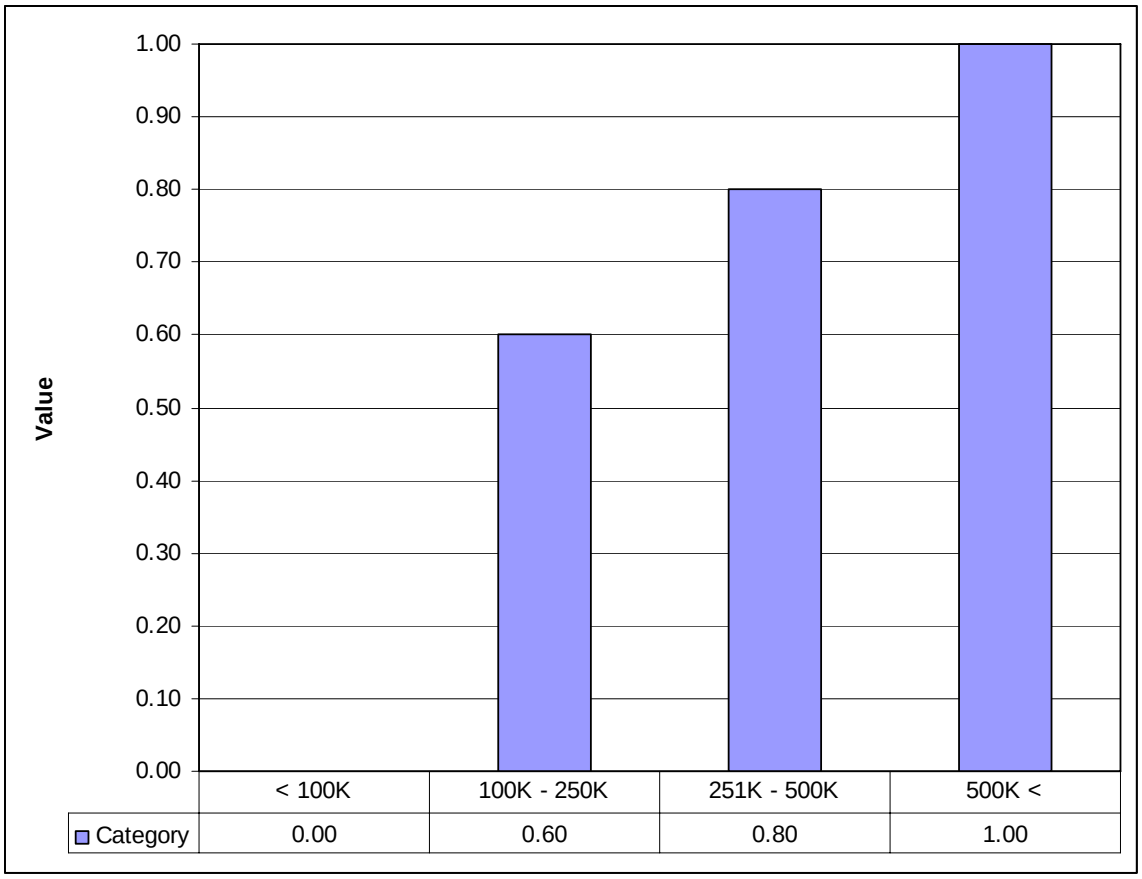
Category	Category Definition
0 - 1	Proposal demonstrates contracting actions against the contractor to number in the corresponding range.
2 - 4	Proposal demonstrates contracting actions against the contractor to number in the corresponding range.
5 - 6	Proposal demonstrates contracting actions against the contractor to number in the corresponding range.
More than 6	Proposal demonstrates contracting actions against the contractor to be greater than 6.

M7: Scope Multidiscipline



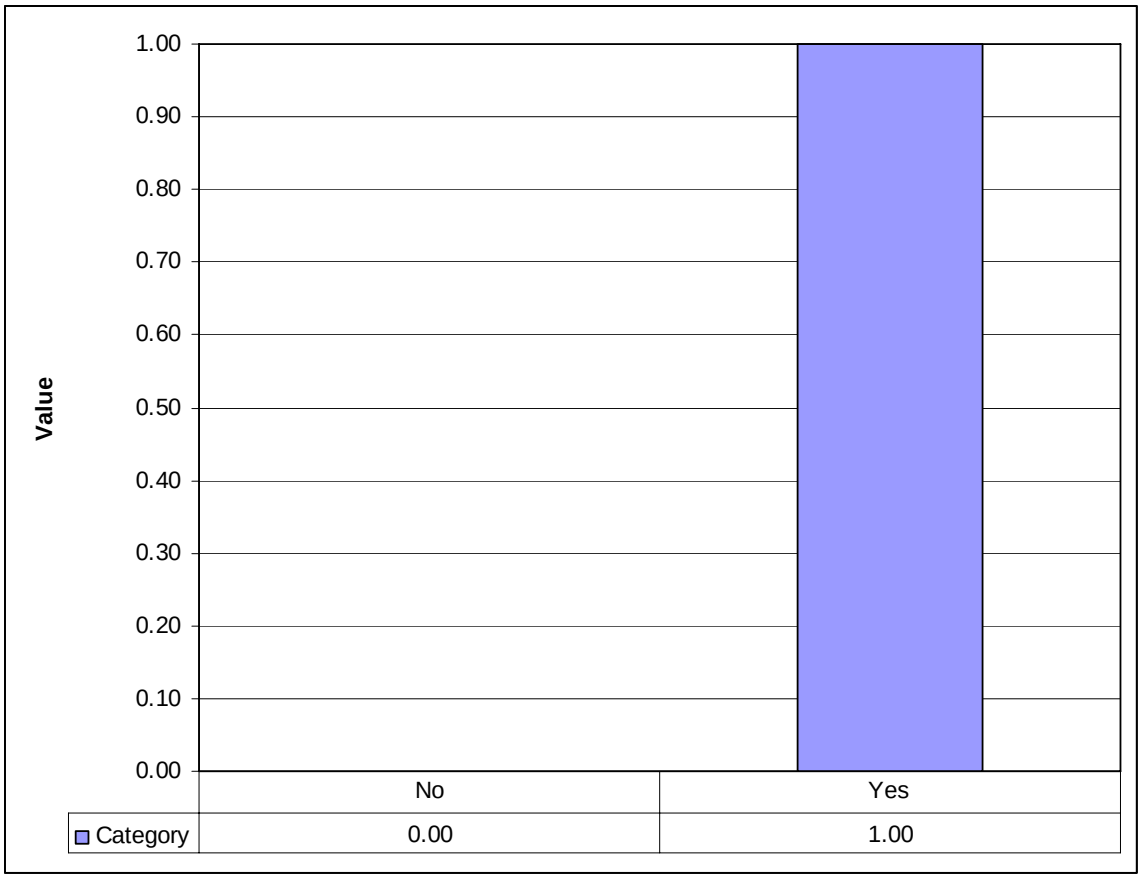
Category	Category Definition
< 3	Proposal demonstrates the contractor's ability to properly execute less than three construction disciplines.
3	Proposal demonstrates the contractor's ability to properly execute three construction disciplines.
4 - 5	Proposal demonstrates the contractor's ability to properly execute four or five construction disciplines.
5 <	Proposal demonstrates the contractor's ability to properly execute five or more construction disciplines.

M8: Size $ Amount



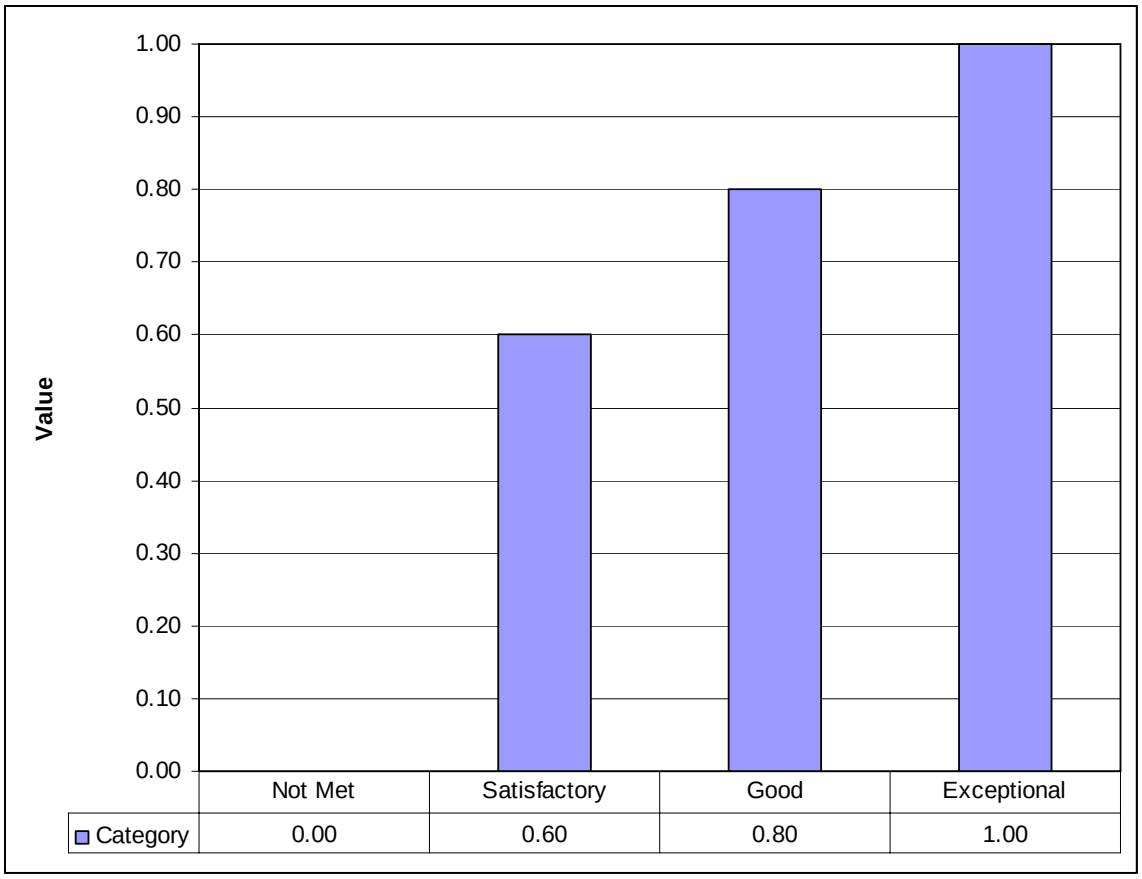
Category	Category Definition
< 100K	Proposal demonstrates the contractor's ability to properly execute construction projects priced at less than $100K only.
100K – 250K	Proposal demonstrates the contractor's ability to properly execute construction projects priced between $100K and $250K.
251K – 500K	Proposal demonstrates the contractor's ability to properly execute construction projects priced between $251K and $500K.
500K <	Proposal demonstrates the contractor's ability to properly execute construction projects priced in excess of $500K.

M9: Military Instillation Experience



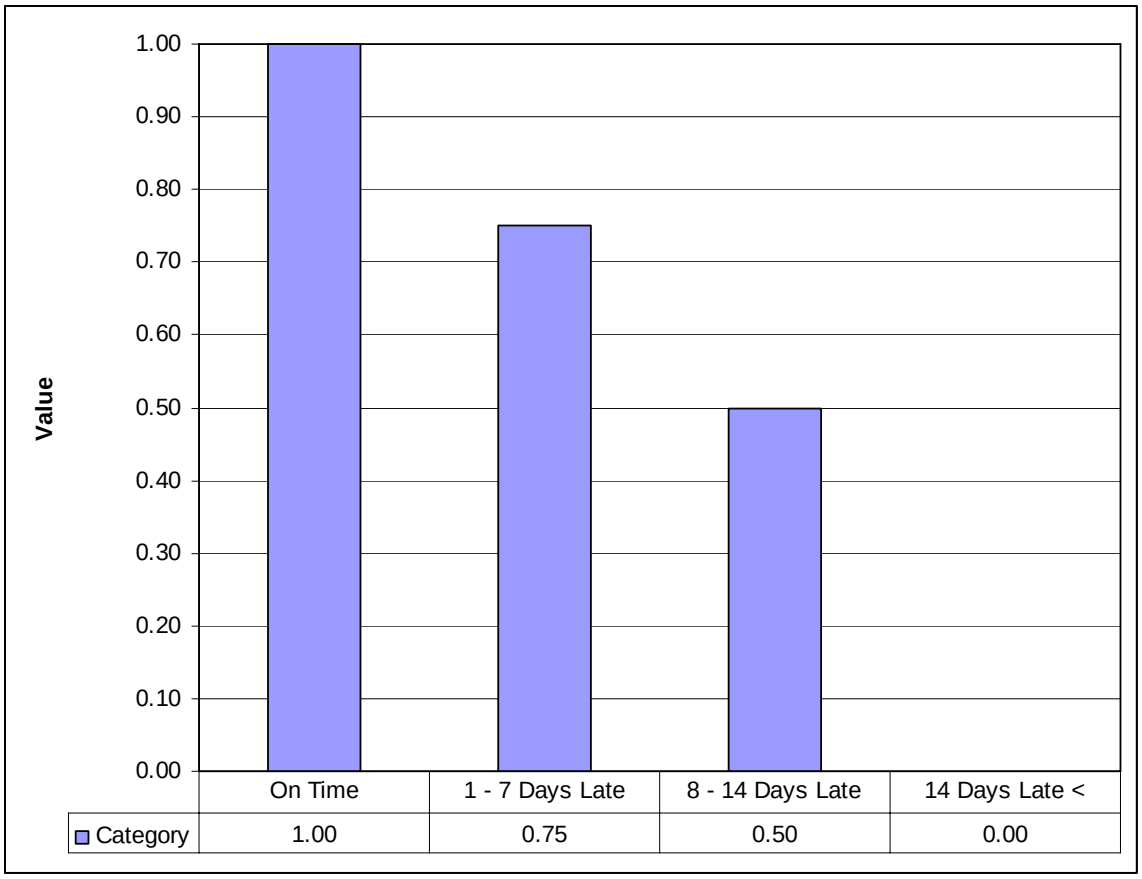
Category	Category Definition
No	Proposal does not demonstrate contractor's familiarity/previous work experience with/on military installations and conditions therein.
Yes	Proposal demonstrates contractor's familiarity/previous work experience with/on military installations and conditions therein.

M10: Met Performance Standards



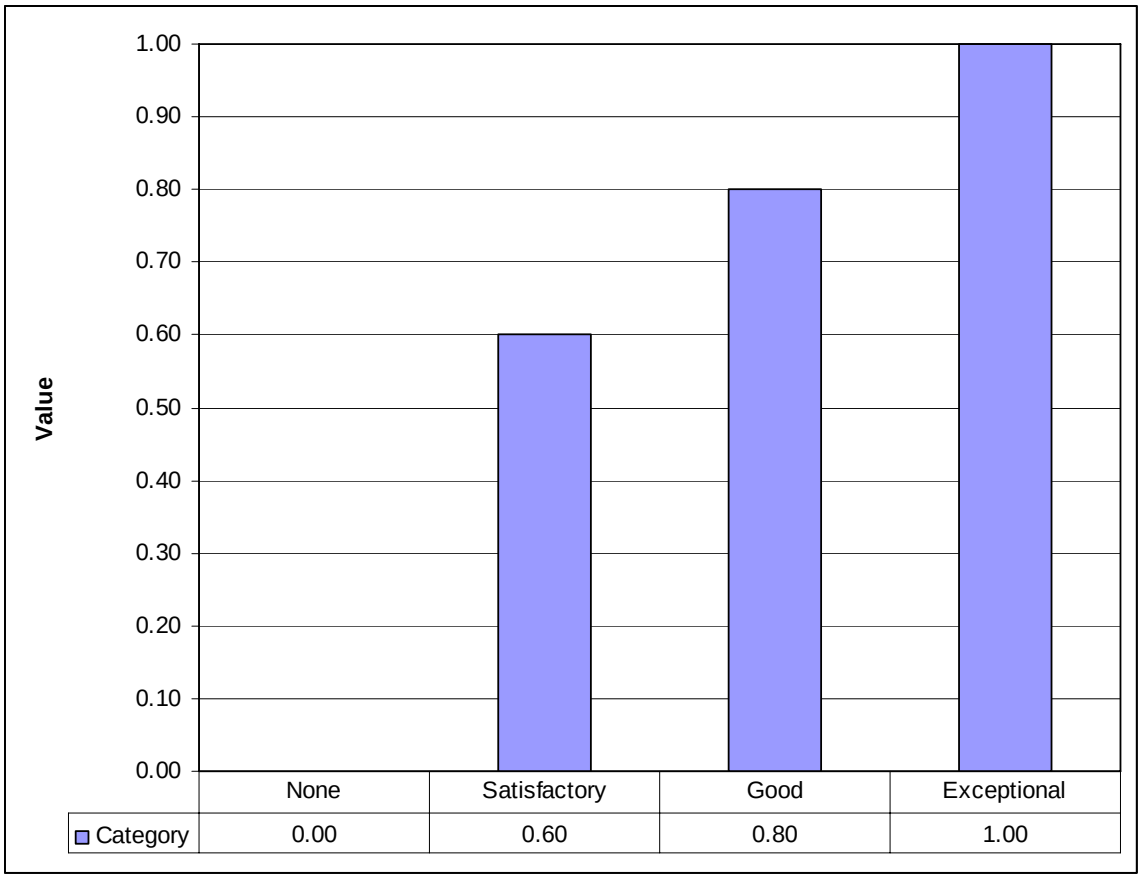
Category	Category Definition
Not Met	Proposal demonstrates negative ability of contractor to meet performance standards or does not address ability to meet performance standards at all.
Satisfactory	Proposal demonstrates inconsistencies in ability of contractor to meet performance standards, but relays overall positive ability of contractor to meet performance standards.
Good	Proposal demonstrates ability of contractor to meet performance standards in a strictly positive manner.
Exceptional	Proposal demonstrates contractor ability to achieve performance standards in a manner which exceeds the expectations of the end users/customers.

M11: Submittals in Timely Manner



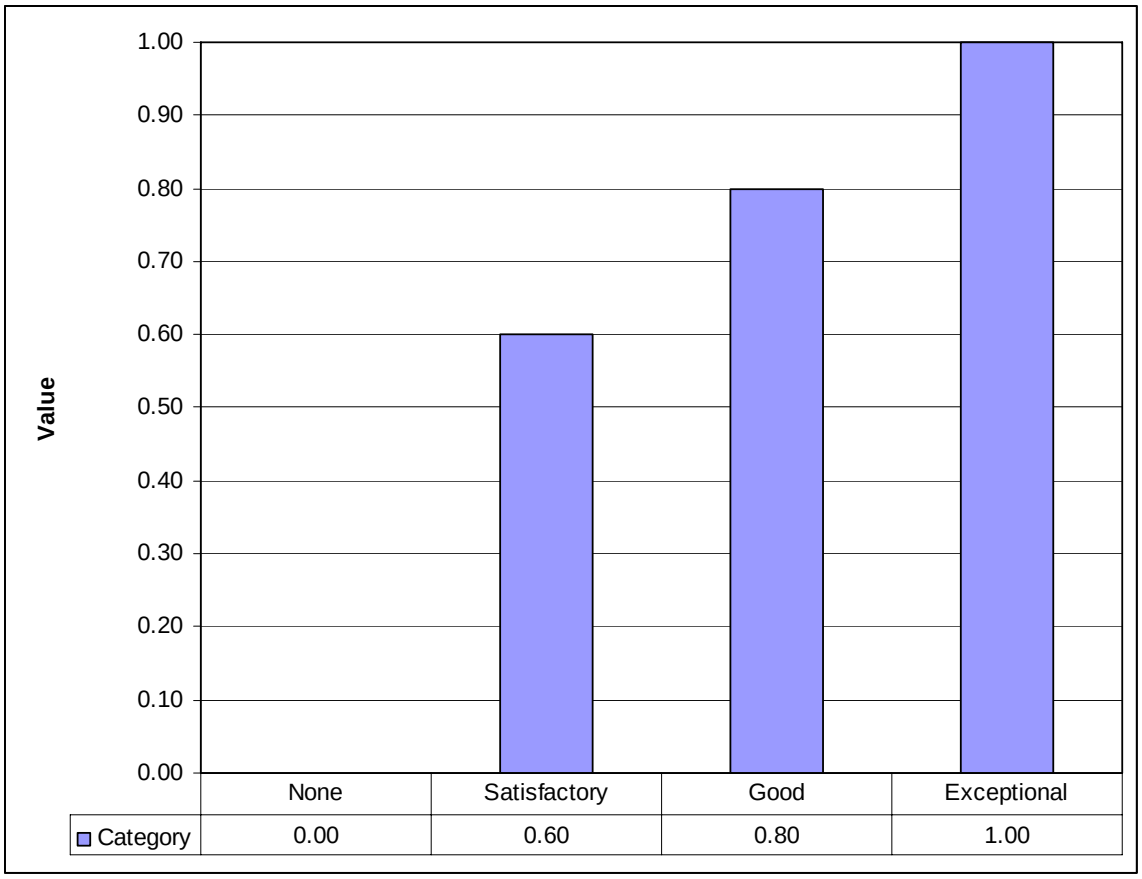
Category	Category Definition
On Time	Proposal demonstrates the ability of the contractor to consistently delivery submittals on time.
1 – 7 Days Late	Proposal demonstrates the contractor to consistently deliver submittals 1 to 7 days after deadline.
8 – 14 Days Late	Proposal demonstrates the contractor to consistently deliver submittals 8 to 14 days after deadline.
14 Days Late <	Proposal demonstrates the contractor to consistently deliver submittals more than 14 days after deadline.

M12: Resolve Delays



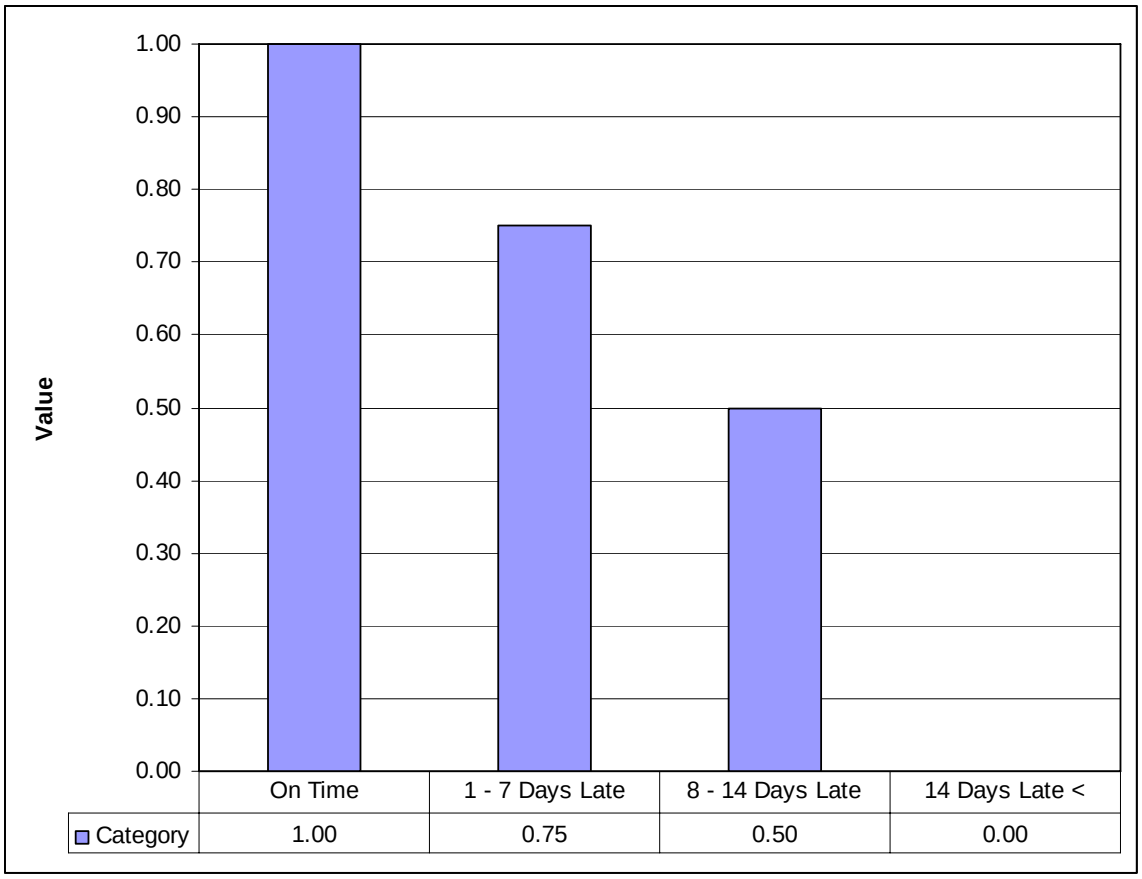
Category	Category Definition
None	No performance record to resolve delays identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will resolve delays to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will resolve delays to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully resolve delays to the required effort.

M13: Completion of Punch-list Items



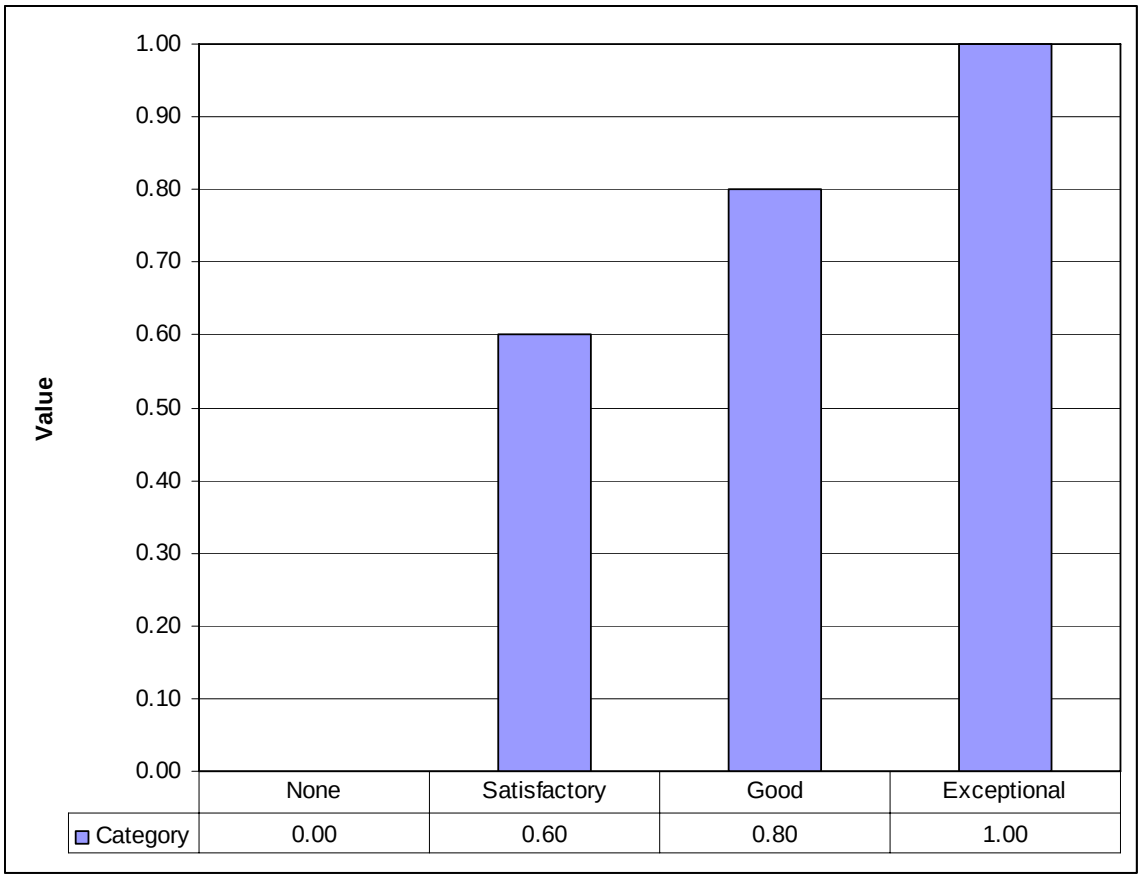
Category	Category Definition
None	No performance record to complete punch-list items identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will complete punch-list items to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will complete punch-list items to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully complete punch-list items to the required effort.

M14: Warranty in Timely Manner



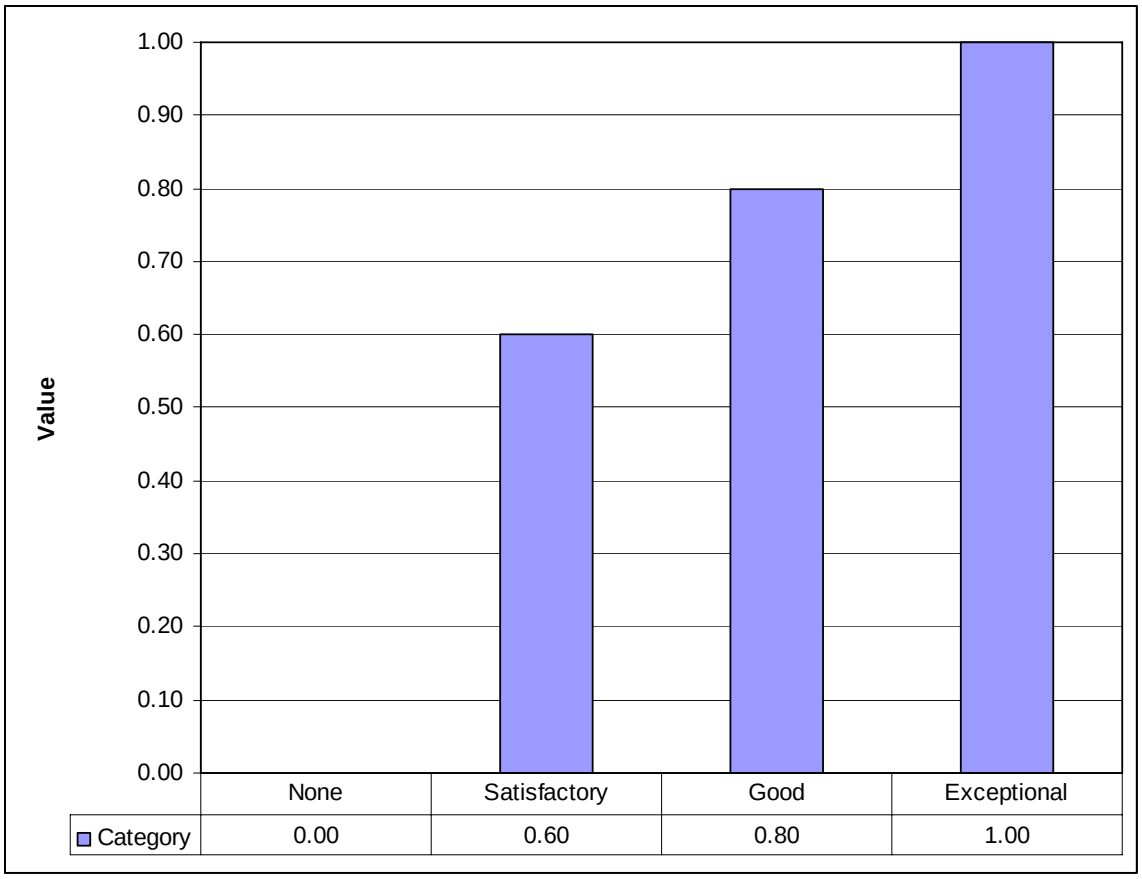
Category	Category Definition
On Time	Proposal demonstrates the ability of the contractor to consistently address warranty issues to the complete satisfaction of customer expectations.
1 – 7 Days Late	Proposal demonstrates the contractor to consistently address warranty issues 1 to 7 days late of customer expectations.
8 – 14 Days Late	Proposal demonstrates the contractor to consistently address warranty issues 8 to 14 days late of customer expectations.
14 Days Late <	Proposal demonstrates the contractor to consistently address warranty issues more than 14 days late of customer expectations.

M15: Compliance Laws & Regs



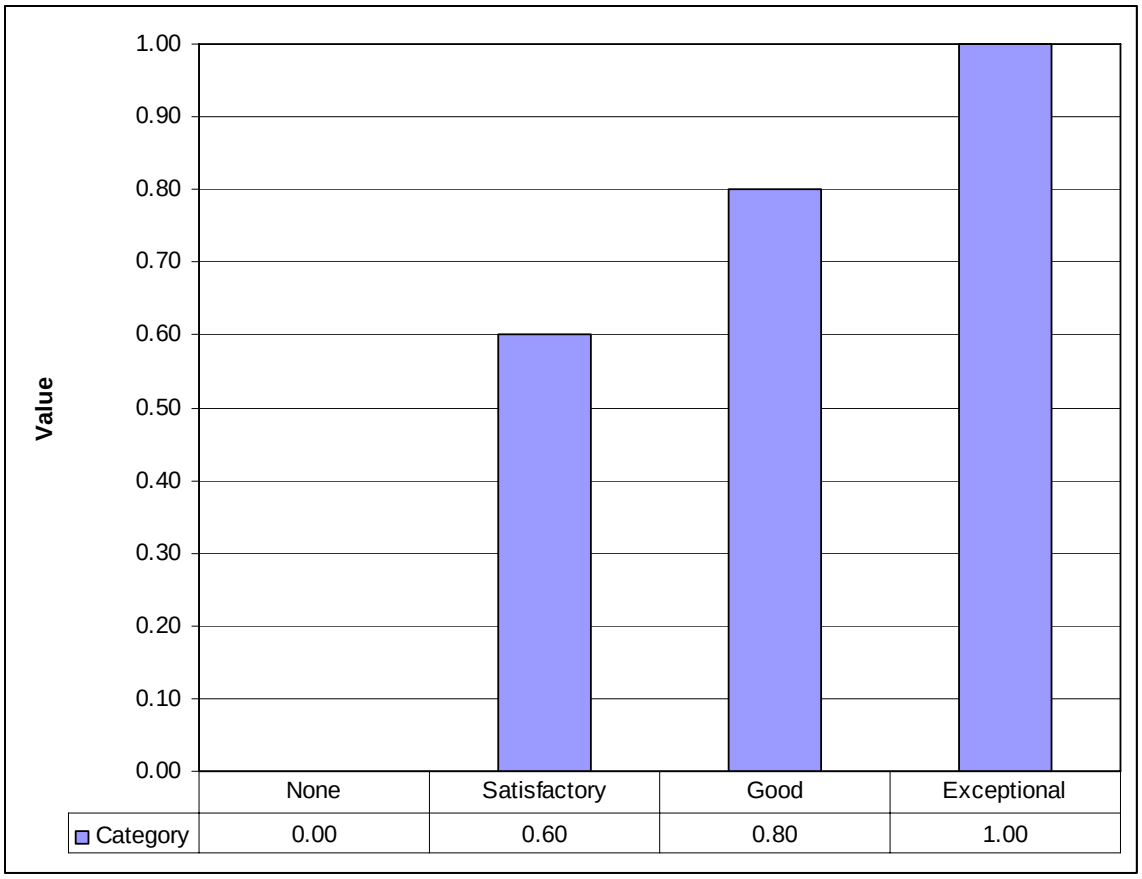
Category	Category Definition
None	No performance record of compliance with applicable labor laws and regulations identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will comply with applicable labor laws and regulations to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will comply with applicable labor laws and regulations to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully comply with applicable labor laws and regulations to the required effort.

M16: Safety Plan



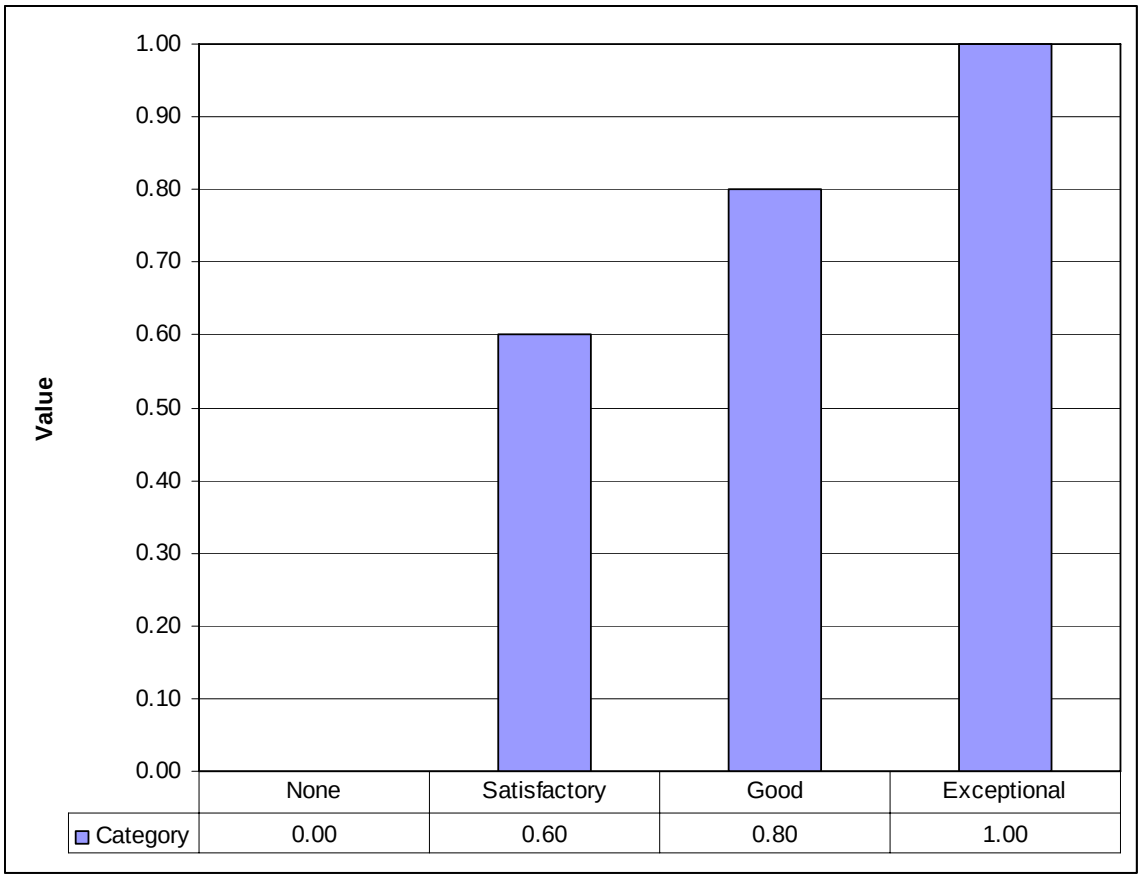
Category	Category Definition
None	No performance record to complete and properly execute a safety plan identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will complete and execute a safety plan to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will complete and execute a safety plan to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully complete and execute a safety plan to the required effort.

M17: Contract Requirements



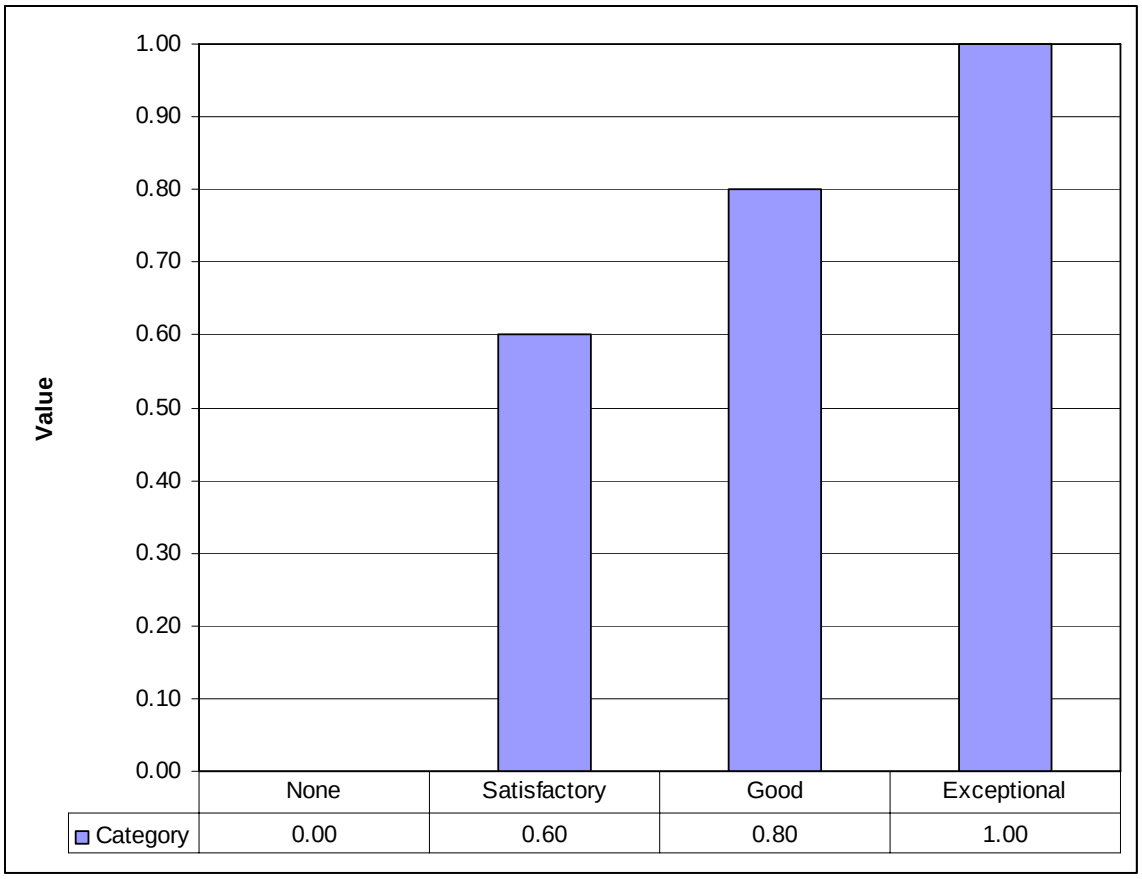
Category	Category Definition
None	No performance record to complete contract requirements identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will complete contract requirements to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will complete contract requirements to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully complete contract requirements to the required effort.

M18: Ability to Reduce Problems



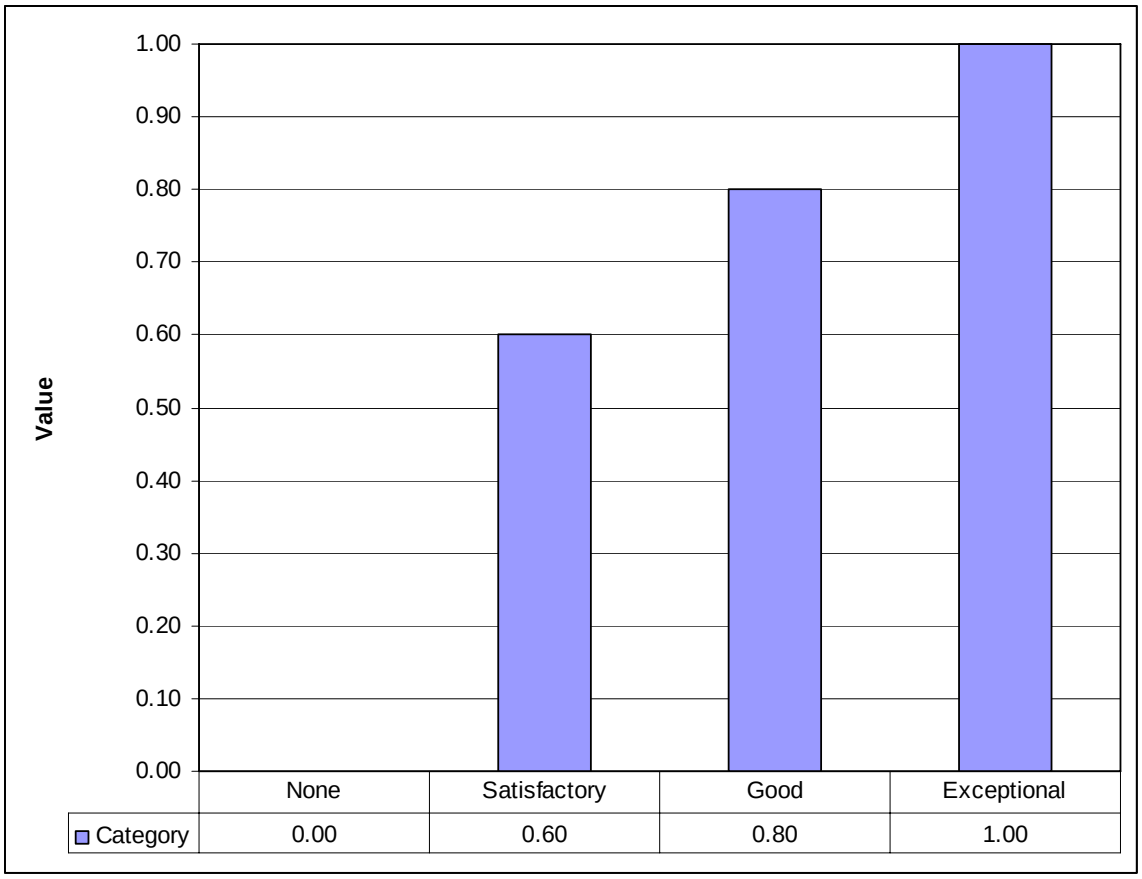
Category	Category Definition
None	No performance record showing ability to reduce and remedy problems identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will reduce and remedy problems to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will reduce and remedy problems to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully reduce and remedy problems to the required effort.

M19: On-site Presence



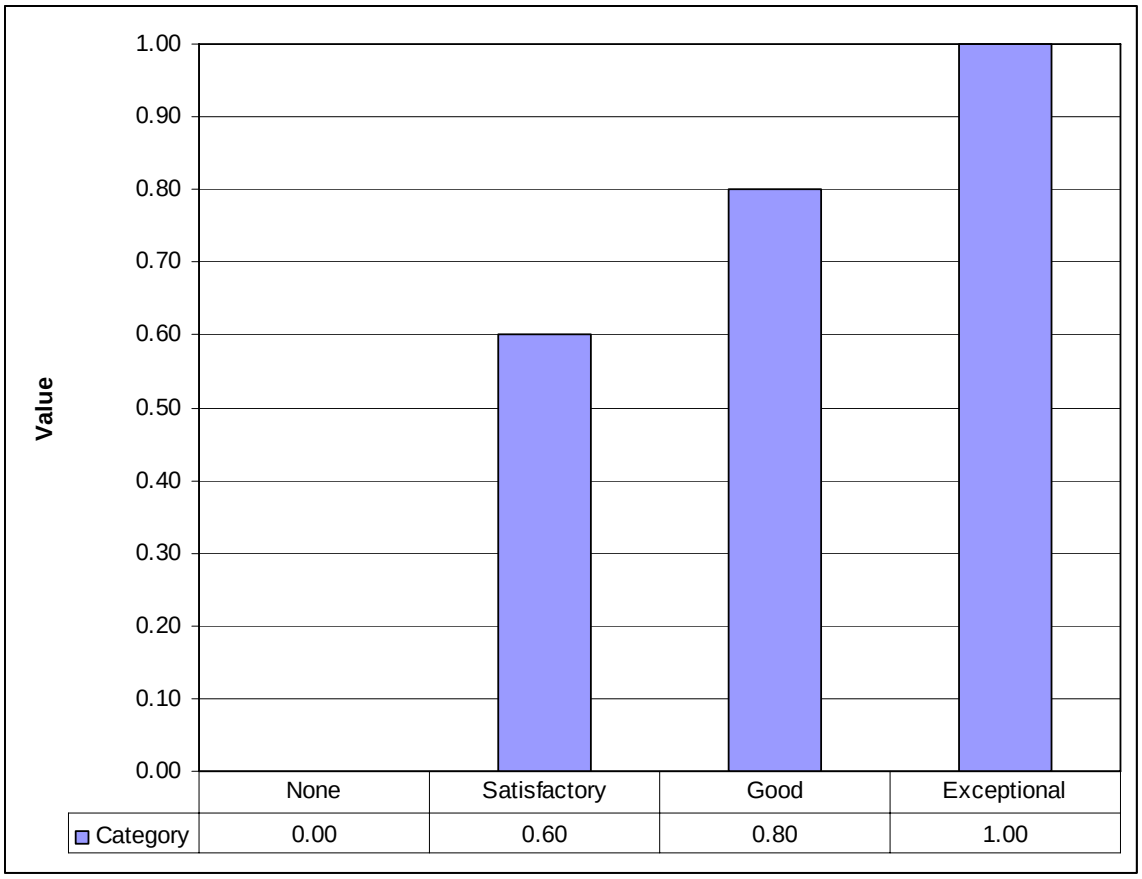
Category	Category Definition
None	No performance record to execute and maintain on-site presence identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will execute and maintain on-site presence to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will execute and maintain on-site presence to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully execute and maintain on-site presence to the required effort.

M20: Quality Control Plan



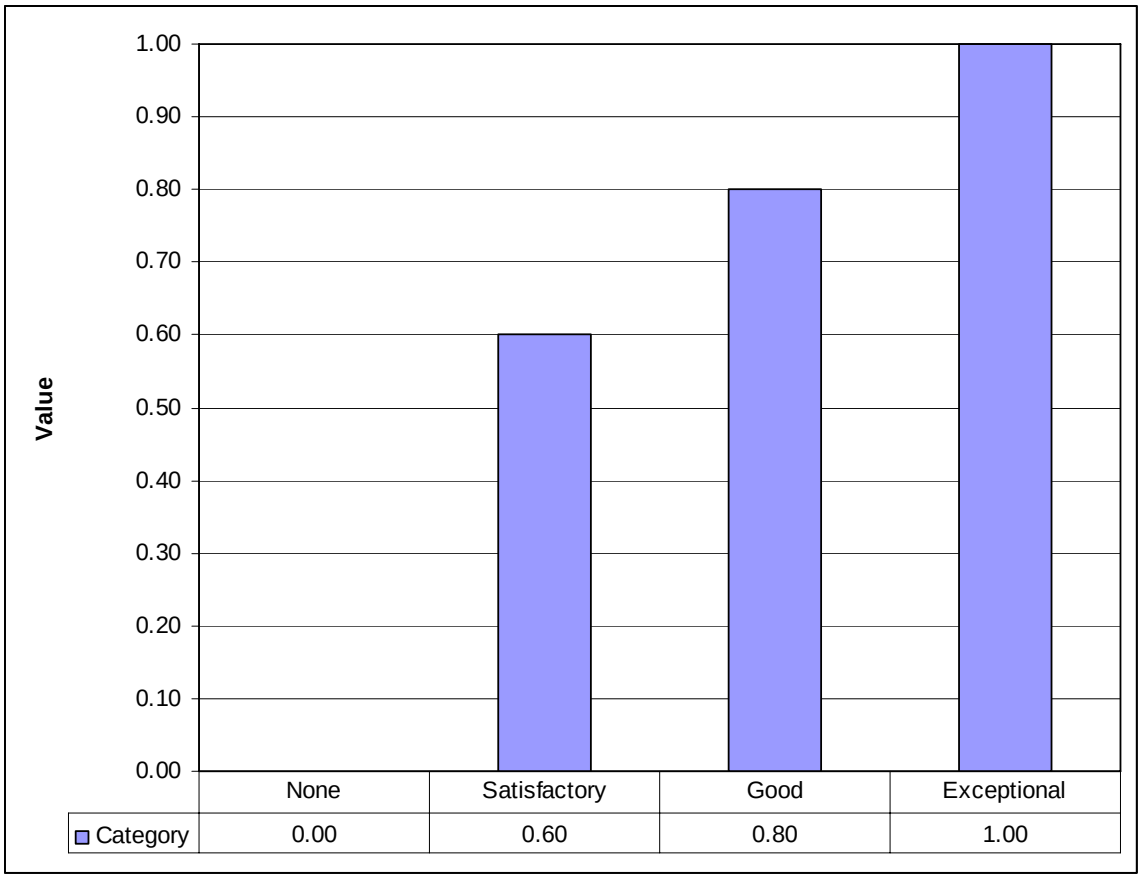
Category	Category Definition
None	No performance record to complete and properly execute a quality control plan identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will complete and execute a quality control plan to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will complete and execute a quality control plan to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully complete and execute a quality control plan to the required effort.

M21: Quality Workmanship



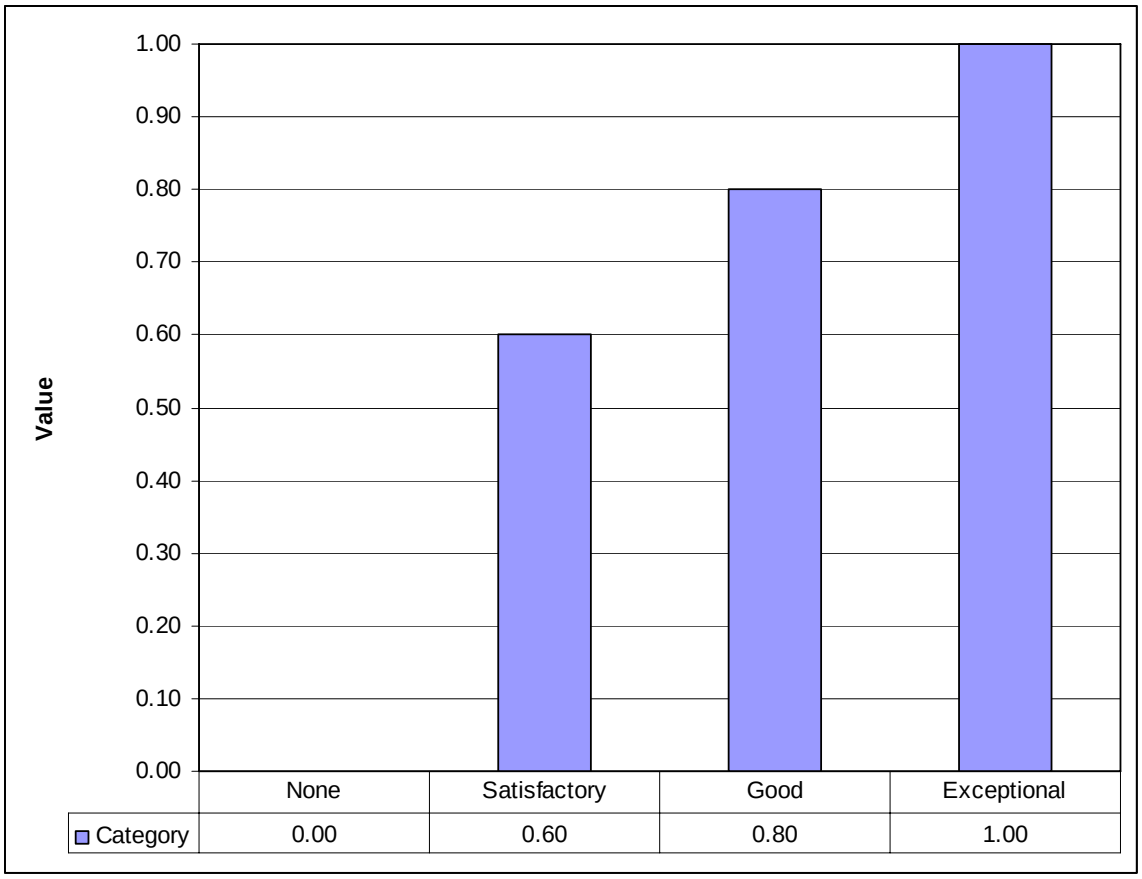
Category	Category Definition
None	No performance record demonstrating the ability of contractor to perform quality workmanship identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will perform quality workmanship to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will perform quality workmanship to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully perform quality workmanship to the required effort.

M22: Materials Listed Specified



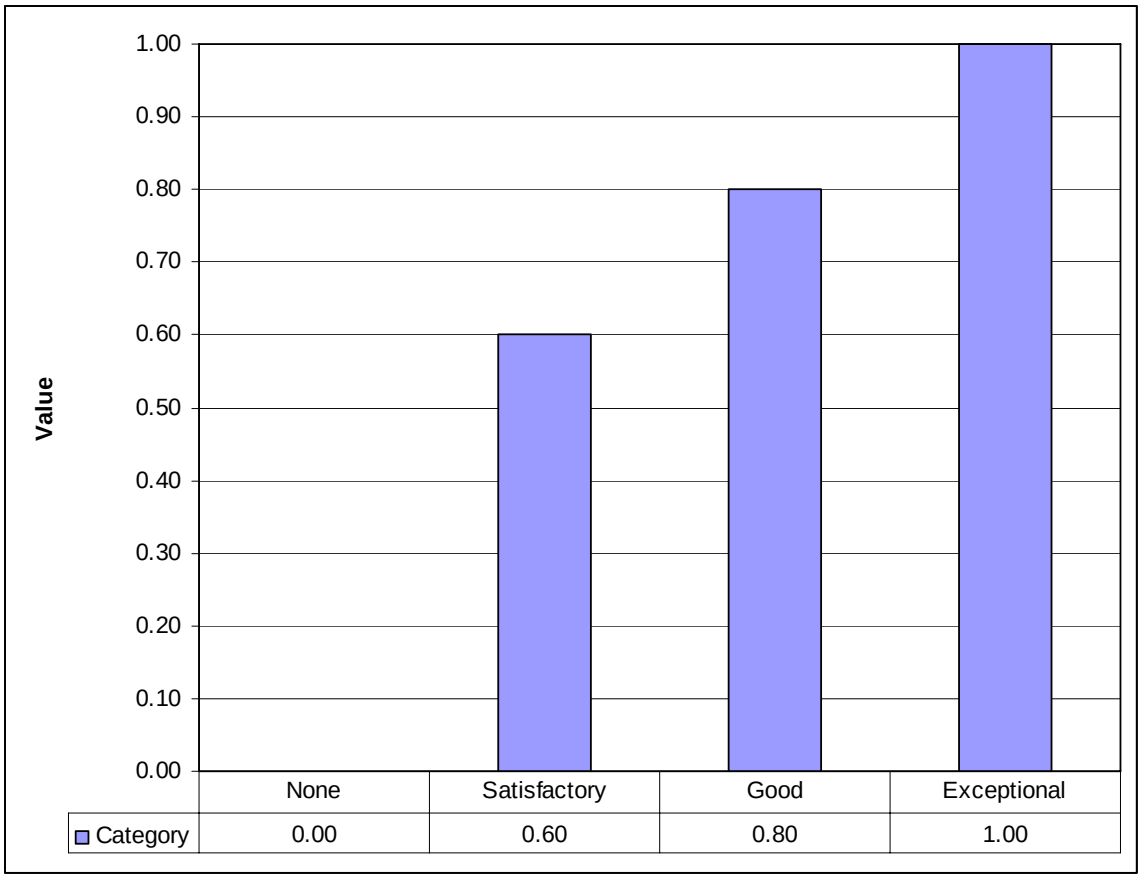
Category	Category Definition
None	No performance record of adherence to listed/specified materials identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will adhere to listed/specified materials to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will adhere to listed/specified materials to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully adhere to listed/specified materials to the required effort.

M23: Adequate Submittals



Category	Category Definition
None	No performance record of providing adequate submittals identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will provide adequate submittals to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will provide adequate submittals to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully provide adequate submittals to the required effort.

M24: Compliance Regs and Code



Category	Category Definition
None	No performance record of compliance with applicable building regulations and code identifiable.
Satisfactory	Proposal demonstrates that some doubt exists that the contractor will comply with applicable building regulations and code to the required effort.
Good	Proposal demonstrates that little doubt exists that the contractor will comply with applicable building regulations and code to the required effort.
Exceptional	Proposal demonstrates that essentially no doubt exists that the contractor will successfully comply with applicable building regulations and code to the required effort.

Appendix F. Alternative Scores

Alternative	M1	M2	M3	M4	M5
Contractor A	1.21 - 1.23	Both	Both	Yes	Good
Contractor B	1.18 - 1.20	Both	Both	Yes	Satisfactory
Contractor C	< 1.15 or 1.35 <	Prime Only	Both	Yes	Good
Contractor D	1.15 - 1.17	Both	Both	Yes	Satisfactory
Contractor E	1.21 - 1.23	Both	Both	Yes	Exceptional
Contractor F	1.24 - 1.26	Prime Only	Both	Yes	Good
Contractor G	1.27 - 1.29	Prime Only	Both	Yes	Good

Alternative	M6	M7	M8	M9	M10
Contractor A	0 - 1	5 <	500K <	Yes	Satisfactory
Contractor B	0 - 1	5 <	500K <	Yes	Satisfactory
Contractor C	2 - 4	4 - 5	500K <	Yes	Good
Contractor D	0 - 1	5 <	500K <	Yes	Satisfactory
Contractor E	0 - 1	5 <	500K <	Yes	Good
Contractor F	2 - 4	4 - 5	500K <	Yes	Satisfactory
Contractor G	0 - 1	5 <	100K - 250K	Yes	Good

Alternative	M11	M12	M13	M14
Contractor A	On Time	Exceptional	Exceptional	On Time
Contractor B	8 - 14 Days Late	Satisfactory	Satisfactory	On Time
Contractor C	On Time	Good	Good	On Time
Contractor D	On Time	Satisfactory	Satisfactory	1 - 7 Days Late
Contractor E	On Time	Exceptional	Exceptional	On Time
Contractor F	1 - 7 Days Late	Good	Good	8 - 14 Days Late
Contractor G	On Time	Satisfactory	Good	On Time

Alternative	M15	M16	M17	M18	M19
Contractor A	Good	Exceptional	Good	Exceptional	Exceptional
Contractor B	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Contractor C	Good	Good	Good	Exceptional	Exceptional
Contractor D	Satisfactory	Satisfactory	Satisfactory	Satisfactory	Good
Contractor E	Good	Exceptional	Exceptional	Good	Exceptional
Contractor F	Exceptional	Good	Good	Good	Good
Contractor G	Satisfactory	Satisfactory	Good	Satisfactory	Good

Alternative	M20	M21	M22	M23	M24
Contractor A	Exceptional	Exceptional	Exceptional	Good	Good
Contractor B	Satisfactory	Good	Good	Good	Good
Contractor C	Good	Good	Good	Exceptional	Exceptional
Contractor D	Good	Satisfactory	Satisfactory	Satisfactory	Satisfactory
Contractor E	Good	Exceptional	Exceptional	Exceptional	Exceptional
Contractor F	Good	Good	Good	Good	Good
Contractor G	Satisfactory	Satisfactory	Good	Good	Satisfactory

Appendix G. Final Questionnaire

Question 1. How does the current evaluation process of SABER Source Selection compare to the VFT model?

Answers:

Subject A:

[Current evaluation process] Much more subjective, tends to lock you into low price offerors and puts tremendous pressure on the selection team to definitively prove that the low price guy isn't the best or else you're stuck with him. The VFT model helps make a strong case for why the selected offeror is best choice and this will also help if there is ever a protest.

Subject B:

The current process focuses on price and performance. There is no regard for staff size or professional expertise.

Subject C:

The VFT model makes it much easier to select factor to be used in the selection process and to understand their value as related to the total value. The entire process is much easier to evaluate contractors.

Subject D:

The current evaluation process is very subjective and does not provide a very user friendly result. Explaining the rational of your decisions is very difficult without some type of quantifying number. VFT is very detailed and does provide the desired quantifying result.

Question 2: Is there a clear understanding of all evaluation criteria utilized in the VFT model?

Answers:

Subject A:

Yes.

Subject B:

Yes. The criteria and evaluation can be used through empirical data.

Subject C:

It is easier to understand the values of the factors. The bar graph makes it very clear to understand the values and their relationships.

Subject D:

Yes. It provides very descriptive breakouts of each factor and generates thought.

Question 3: How many times would competing contractors need to be evaluated or re-evaluated utilizing the VFT model?

Answers:

Subject A:

Unsure.

Subject B:

(1) One time.

Subject C:

One time! Very good.

Subject D:

I do not see much need to do this if the results are so descriptive. No more than once.

Question 4: Is there enough information provided by the VFT model to conduct proper documentation?

Answers:

Subject A:

Yes… much better than current process.

Subject B:

Yes.

Subject C:

The ability to select additional factors and assign value to these and how each relates to the total value and to the other proposals is very good documentation.

Subject D:

Yes.

Question 5: What information, if any, needs to be more evident when utilizing the VFT model?

Answers:

Subject A:

Nothing that I can think of.

Subject B:

1. Capability of Contractors
2. Expertise of Contractors
3. Disciplines involved

Subject C:

I was not able to identify further information needs at this time.

Subject D:

None.

Question 6: Is a VFT model a viable tool for the evaluation process of SABER Source Selection?

Answers:

Subject A:

Yes.

Subject B:

Yes. Much better than our current evaluation system.

Subject C:

This would be a very useful tool to use in SABER Source Selections. I feel this model would greatly improve the selection process and documentation needs to support contractor selection.

Subject D:

Yes, I would utilize this tool now if it was made available.

Bibliography

AFFARS Informational Guidance. IG5315.305, Past Performance Evaluation Guide (PPEG), July 2005.

AFFARS Information Guidance. IG5336.9201, Air Force Contracting Construction Guide, Chapter 2: Simplified Acquisition of Base Engineer Requirements (SABER), December 2005.

AFFARS Mandatory Procedure. MP5315.3, Source Selection, (10 August 2005).

AFPAM 32-105, Working in the Engineering Flight, Chapter 3: SABER Element Role and Responsibilities, October 1999.

Burman, Allan V. "Putting Past Performance First," *Government Executive*, October 1997.

Duncan, J. Heath. *The Application of Value Focused Thinking to Utilities Privatization Source Selection.* MS Thesis, AFIT/GEM/ENV/04M-10. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, (March 2004).

Federal Acquisition Regulation. Subpart 15.3 – Source Selection, 15.305 Proposal evaluation.

Federal Acquisition Regulation. Subpart 15.101-2 Lowest Price Technically Acceptable Source Selection Process.

Furr, J. W. "Government business – smart business." *Report to Army Management Staff College,* Fort Belvoir, VA, (1996).

Gransberg, Douglas D. "Evaluating Best Value Contract Proposals," *AACE International Transactions*, C&C.04, (1997).

Gransberg, Douglas D. and Ellicott, Michael A. "Best Value Contracting: Breaking the Low-Bid Paradigm," Transaction of AACE International, VE&C.5, (1996).

Hatush, Zedan. and Skitmore, Martin. "Criteria for Contractor Selection," *Construction Management and Economics*, 15: 19-38, 1997.

Heaps, Brian J. *An Analysis of the Acquisition Process for Simplified Acquisition of Base Engineering Requirement (SABER) Contracts and its Potential Impact on Contractor Performance.* MS Thesis, AFIT/GAQ/ENV/01M-08. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 2001.

Henry, Elwood and Brothers, Heidi S. "Cost analysis between SABER and Design Bid Build Contracting Methods," *Journal of Construction Engineering and Management*, 127: 359-366 (September/October 2001).

Kashiwagi, Dean T. and Savicky, John. "Analysis of Best-Value Pricing," *AACE International Transactions*, PM.18, 2002.

Keeney, Ralph L. Value-Focused Thinking: A Path to Creative Decisionmaking. Cambridge, Massachusetts: Harvard University Press, 1992.

Keeney, Ralph L. "Value-Focused Thinking: Identifying Decision Opportunities and Creating Alternatives," *European Journal of Operational Research*, 92: 537-549, 1996.

Kelman, Steve. "Past Performance Revisited," *Federal Computer Week*, August 2005.

Kennedy, Patrick D. and Cannon, Maeve E. "Government Procurement Basics," *The CPA Journal*, 74, 5: 60-63 (May 2004).

Kirkwood, Craig W. *Strategic Decision Making: Multiobjective Decision Analysis with Spreadsheets.* Belmont CA: Wadsworth Publishing Company, 1997.

Nash, Ralph C. Jr. John Cibinic Jr., and Karen R. O'Brien. *Competitive Negotiation: The Source Selection Process*. Washington D.C.: The George Washington University, 1999.

Nash, Ralph C. Jr. Steven L. Schooner, and Karen R. O'Brien. *The Government Contracts Reference Book: A Comprehensive Guide to the Language of Procurement*. Arlington, Virginia: The George Washington University, 1998.

Ragsdale, Cliff T. *Spreadsheets Modeling and Decision Analysis*, 4e. South-Western Publishing, 2004.

Request for Proposal. *Template for Simplified Acquisition of Base Engineer Requirements (SABER) Request for Proposal (RFP)*. United States Air Force, 2003.

Sambur, Marvin R. Department of the Air Force Memoradum, Subject: Justification and Documentation of Best Value Source Selection Decisions, June 2003.

Shoviak, Mark J. *Decision Analysis Methodology to Evaluate Integrated Solid Waste Management Alternatives for a Remote Alaskan Air Station.* MS Thesis, AFIT/GEE/ENV/01M-20. Graduate School of Engineering and Management, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 2001.

Smith, Jennifer M. "RFP Evaluations: How can they be Objective & Defendable?," 87th Annual Conference of the California Association of Public Purchasing Officers, January 2004.

Templin, Carl R. and Noffsinger, Ken R. "An Assessment of the Role of Technical and Risk Evaluation Factors in Defense Source Selection Decisions," *International Journal of Purchasing and Materials Management*, 30: 37-43 (Fall 1994).

Weir, Jeffrey. Class Lecture, OPER 743, Advanced Decision Analysis. Graduate School of Engineering and Management, Air Force Institute of Technology, Wright-Patterson AFB OH, Fall 2005.

Vita

Captain John R. Trumm was born in Marinette, Wisconsin. In 1995 he graduated from Potosi High School in Potosi, Wisconsin, and entered Wentworth Military Academy Lexington, Missouri in August of the same year. He attended the United States Air Force Academy in June of 1996 where he earned a Bachelor of Science in Civil Engineering and was commissioned in May 2000.

Captain Trumm's first assignment was to Pope AFB, North Carolina where he served as the executive officer for the 2nd Airlift Squadron until March 2001. His next assignment was at Columbus AFB, Mississippi as a student in Undergraduate Pilot Training. In August 2001, Captain Trumm entered the Civil Engineering career field and was assigned to the 14th Civil Engineer Squadron, Columbus AFB. While stationed at Columbus, he served in the Engineering Flight as the SABER Chief, Base Pavements Engineer, and Chief of Design. He then entered the Graduate School of Engineering and Management, Air Force Institute of Technology in August of 2004. Upon graduation, he will be assigned to the 607th Combat Operations Squadron, Osan AB, Korea.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
23-03-2006	Master's Thesis	Jun 2005 – Mar 2006

4. TITLE AND SUBTITLE

A Decision Analysis Tool for the Source Selection Process

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)

Trumm, John R., Captain, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)

Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way
WPAFB OH 45433-7765

8. PERFORMING ORGANIZATION REPORT NUMBER

AFIT/GEM/ENV/06M-16

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

N/A

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT

APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The source selection process for choosing a contractor does not incorporate a standardized objective decision analysis tool; therefore, the process is extremely subjective and provides little guidance to distinguish between highly competitive contractors. The Air Force Simplified Acquisition of Base Engineer Requirements (SABER) program selects contractors through a Low Price Technically Acceptable (LPTA) source selection process and encounters the same problem of not being able to objectively distinguish between the competing contractors. The LPTA process rank orders the contractors based on price and evaluates the bidders in order until an "exceptional" contractor is discovered. However, the SABER source selection committee members wish to evaluate all contractors using all decision criteria with the ability to objectively compare all contractors to one another.

Since there are several factors and guidelines to consider when awarding a SABER contract, a value focused thinking approach was used to create a structured decision making model that takes into account all values along with their desired weighting as specified by members of a SABER source selection team. The model was then used to evaluate seven contractors who recently competed for a SABER contract and perform deterministic and sensitivity analysis on the recommended decision outcome. The results of this research illustrate the valuable insight and practicality of applying a quantitative, objective, consistent, and defendable tool for SABER source selections. The value gained from this model will potentially aid the SABER source selection process, as well as other government and private/public source selections.

15. SUBJECT TERMS

Source Selection, Decision Analysis, Simplified Acquisition of Base Engineer Requirements (SABER), Value Focused Thinking (VFT)

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Alfred E. Thal, Jr., Ph.D., ENV
U	U	U	UU	139	**19b. TELEPHONE NUMBER** *(Include area code)* (937) 255-3636, ext 7401/alfred.thal@afit.edu

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std. Z39-18

Form Approved
OMB No. 074-0188