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Exploring Beliefs about Using Systems Engineering to Capture Contracts

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Abstract

When contracts require that complex systems be engineered, systems engineering often leads the technical activities on proposals. Decision makers in organizations have beliefs gained from trial-and-error experiences about how to use systems engineering on proposals to capture contracts. This paper explores a set of these beliefs. Each belief is formalized into a hypothesis so it can be empirically evaluated. Analysis results from a survey designed to identify critical success factors on proposals are analyzed to evaluate each hypothesis. The survey research is discussed, including the survey content, how the survey was created and administered, the process for analyzing survey results and threats to validity related to the survey. The survey data is used to draw conclusions about each hypothesis and belief.

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1. Introduction

When organizations engineer complex systems, systems engineering often leads the technical activities on proposals. Decision makers in organizations generally have beliefs about how to use systems engineering in proposal management to capture contracts. Beliefs are defined as “a conviction of the truth of some statement”¹. In this paper, the beliefs define decision makers’ opinions about certain actions that an organization may take to potentially improve their chances of being awarded contracts.

Within organizations, beliefs about how to use systems engineering to capture contracts evolve over time. Many times this evolution occurs through trial-and-error as decision makers adapt their strategies for using systems engineering on proposals and observe how the outcome appears to be affected. It is possible that such a sequential trial-and-error approach could lead to erroneous conclusions and possibly poor policy decisions because decision makers may emphasize only a limited subset of the relevant considerations. A more methodical approach is needed.

This paper applies a scientific approach to examining these proposal-related beliefs about using systems engineering on proposals to capture contracts. This paper presents a set of beliefs related to how to use systems engineering on proposals. Each of these beliefs is formulated into one or more hypotheses. Each of the hypotheses is evaluated by analyzing the results of a factor relationship study of actual proposal efforts. The data used for this study was collected in a survey to identify critical success factors on proposals. This paper discusses the survey content, how the survey was created and administered, the process of analyzing the survey results, the demographics of the respondents, and other important contextual information. The study also discusses threats to validity and study limitations. The conclusions related to the hypotheses are used to identify a subset of the beliefs that are supported by the study data.

2. Beliefs and Reasons for Beliefs

The beliefs about how to use systems engineering to capture contracts are synthesized from several sources. The primary source of information that contributed to these beliefs is the industry experience and knowledge of the authors. Each of the authors has used systems engineering on numerous proposals designed to capture contracts to engineer complex systems. The authors have also reviewed many examples of consultancy-based proposal management literature aimed at preparing managers to develop winning proposals^{2,3,4,5,6}. The literature reviewed primarily focuses on the programmatic aspects of preparing the proposal document. None of the literature reviewed particularly focuses on using systems engineering to capture contracts. Nonetheless, some consistent themes emerge in the literature that are consistent with the authors’ experience, such as developing a relationship with the customer prior to submitting the proposal, investing adequate resources on the proposal, and keeping in touch with the customer. Another major source of information that helped to formulate these beliefs was feedback from subject matter experts asked to validate the survey questions, the survey instrument, and a systems engineering optimization modeling framework as part of the research design of a dissertation related to the use of systems engineering on proposals⁷. A number of beliefs were formulated, and four beliefs were chosen to present in this paper because they address relationships that the authors believe are likely valid based upon their experience and knowledge.

Each belief that is explored in this paper is presented in Table 1. The first column of Table 1 presents the beliefs and the second column explains the reasons for each belief.

3. Defining Hypotheses from Beliefs

This section formalizes the beliefs presented in Table 1 into formal hypotheses. A hypothesis is defined as “a tentative assumption made in order to draw out and test its logical or empirical consequences”¹. In this paper, hypotheses differ from beliefs because the hypotheses provide formal statements about the relationship between well-defined variables, and therefore hypotheses are testable. The hypotheses presented in this paper do not imply causation. They simply state that as the value for one variable varies in a particular way, the value for another variable also varies in a particular way. These hypotheses, as well as a detailed definition of each factor mentioned in each hypothesis, appear in Smartt⁷. Table 2 presents these hypotheses. The first column states the beliefs again. The second column presents the related hypotheses.

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