Chapter 19
Selecting Strategies and Approaches in Systems Engineering:
Applying the Descriptive Research Method

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ABSTRACT

This chapter presents a method of applying the principles of the descriptive research method to studies aimed at ascertaining the data needed for making a recommendation in regard to what strategy or approach should be chosen in a certain development stage of future projects. The idea is to use data extracted from already-finished projects to make decisions related to similar projects in their early stages. First, the method is briefly described; next, two case studies that illustrate the method are presented. The method is based on isolating an independent variable, which can be development strategy, integration approach or any other strategy or approach, and deciding which attribute of the independent variable is preferable with respect to the dependent variable, project success, measured by the extent of meeting the requirements, planned budget, planned schedule, and customer satisfaction.

INTRODUCTION

Systems engineers are often required to make decisions about which approach or strategy should be applied at a certain development stage of a new system or product. In other words, the question is: What strategy or implementation approach is preferred over all other available and relevant approaches or strategies? This chapter presents a method for applying the principles of the *descriptive research method* to studies aimed at ascertaining the data needed for making a recommendation in regard to which strategy or approach should be chosen at certain development stages of future projects. The idea is to use data

extracted from already-finished projects to make decisions related to similar projects in their early stages. First, the method is briefly described, after which two case studies illustrating the method are presented.

A *descriptive study* is a statistical study used to identify patterns or trends in a situation, but not the causal linkages among its different elements (Business Dictionary, 2011). Tsang (1997) makes a distinction between the *descriptive* and *prescriptive* approaches. In the former, judgment and evaluation are suspended; in the latter not only are they undertaken, but the best practices are put forward to the reader. It seems that there is currently a growing dichotomy between the two streams of research. The descriptive stream deals with the question: How does an organization learn? Alternatively, the prescriptive stream asks: How should an organization learn?

According to Sekaran (2000), *descriptive studies* are undertaken in order to ascertain, and be able to describe, the characteristics of the variables of interest in a situation or in a given research problem. They describe relevant aspects of the phenomena of interest from an individual, organizational, industry-oriented or other perspective. Quite frequently, descriptive studies are undertaken in organizations to learn about the various aspects of a problem under investigation. The goal of a descriptive study is to provide the researcher with a profile or describe relevant aspects of the phenomena of interest. In many cases, such information may be vital before even considering certain corrective steps. Descriptive studies which present data in a meaningful form might help to (1) understand the characteristics of a group in a given situation; (2) think systematically about aspects in a given situation; (3) offer ideas for further examination and research, and (4) help make certain simple decisions about the issue.

Decision analysis is a method used to identify the best option from a set of alternatives, under uncertainty, using the possible outcomes of each alternative and their probabilities of occurrence to calculate the expected value of the outcome (INCOSE, 2010). Real world decisions often involve a high degree of ambiguity, conflicting goals due to multiple objectives, complex trade-offs, more than one decision maker, or several sequential decisions. It is in these types of situations where decision analysis is most valuable (Skinner, 2001).

At first glance, the method presented in this chapter has a similar purpose to that of a trade study – to select the most cost-effective alternative from a set of alternatives that may solve a given problem. According to the FAA (2006), a *trade study* is the activity of a multidisciplinary team to identify the most balanced technical solutions among a set of proposed viable solutions. According to INCOSE (2010), a trade study describes a process that compares the appropriateness of different technical solutions. However, this chapter does not deal with trade studies. The difference is that the method presented in the next section aims at analyzing systems projects in which the development phase has been completed. The results of this analysis may serve as lessons learned regarding the strategy or approach to be implemented in future projects that will be performed in similar contexts.

THE METHOD

The main goal of the study method presented in this chapter is to cope with questions such as: Given that there are several strategies or approaches, all of which can be implemented at a certain development stage of a given systems project, which is the preferred approach? How should a decision be made regarding the strategy or approach that is most appropriate for a certain decision gate, taking into account the project's unique characteristics, context and circumstances? What are the implications of choosing a specific approach or strategy in relation to meeting the requirements, and the planned budget and time? According to this study method, projects in which

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