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An Empirical Investigation of Build-or-Buy Decisions in Software Development

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Abstract

When an organization seeks to apply a computer-based application to its business processes, the decision of whether to build or buy software must typically be made. Much previous research has bypassed the build-or-buy decision stage. Even the limited studies focusing on the build-or-buy decision have tended to focus on checklists or guidelines for decision criteria and decision procedures. Thus, the build-or-buy decision process has not been explored fully from the behavioral perspective. The present research provides new insights into decision makers' actual behavior when making build-or-buy decisions. Based on the belief processing model of Smith, Benson, and Curley (1991), a model is developed to describe the actual cognitive processes involved in the build-or-buy decision. Two hypotheses based on the theoretical background are proposed and will be investigated in an empirical study. We then describe the research methods for the empirical study in some detail. We conclude with a short discussion.

Keywords: Build-or-Buy Decisions, Software Development, Software Selection, Decision Process Models, Cognitive/Behavioral Decision Making

I. Introduction

When an organization seeks to apply a computer-based application to its business processes, the decision of whether to build or buy software must typically be made. With the rapid development of the IT industry, an organization has an increasing number of choices for its software needs, including off-the-shelf software packages (Bryce and Bryce, 1987), in-house development, and outsourcing to external contractors (Martin and McClure, 1983; Venkatesan, 1992).

The software build-or-buy decision should follow the requirements specification process. However, most research bypasses the build-or-buy decision stage and goes directly from requirements specification to specific buy or build procedures (Byun and Suh, 1996). Even the limited studies focusing on the build-or-buy decision have tended to focus on checklists or guidelines for decision criteria and decision procedures (Bryce and Bryce, 1987; Gershkoff, 1990; Martin and McClure, 1983). Buchowicz (1991) approached the build-or-buy decision from a behavioral approach, but the proposed model was a normative sequence of conditional judgments based on different decision factors. Recent research by Rands (1993) examined the relationship between the build-or-buy decision and vertical integration, and linked capacity and the build-or-buy decision at both strategic and tactical levels. However, the practical operation of the build-or-buy decision process was not discussed.

In sum, the build-or-buy decision process has not been explored fully from the behavioral perspective, so few clues are available for how build-or-buy decisions are actually made. The present research is intended to provide new insights into decision makers' actual behavior when making build-or-buy decisions.

II. Background

General Build-or-Buy Research

Build-or-buy decision research originated in the fields of production and manufacturing. Culliton (1942) first explored the subject by introducing a prescriptive framework for logistics managers. Subsequent research focused on economic aspects of the build-or-buy decision. For example, Williamson (1981) proposed that transaction costs associated with building or buying are the most important factor in the decision. The goal of the decision makers under the transaction costs theory is to minimize transaction costs. Hubler (1966) applied cost/benefit methods and accounting procedures such as overhead cost allocation to the build-or-buy decision. Other literature contributed to the research by developing checklists and guidelines (e.g., Higgins, 1955; Robinson, et. al., 1967)

While some recent research has attempted to extend and develop the transaction costs theory (e.g., Gardiner and Blackstone, 1991; Lyons, 1995; Meijboom, 1986; Poppo and Zenger, 1995), other researchers have advocated incorporating more factors into the decision-making process (e.g., Dale and Cunningham 1984). Some of these factors are related to corporate strategy (Ford and Farmer, 1986; Venkatesan, 1992; Welch and Navak, 1992), marketing relationships (Walker and Weber, 1987), and vertical integration (Venkatesan, 1992). However, none of these research perspectives has focused on behavioral descriptions of the build-or-buy decision. We will propose a model of the process that allows us to investigate the cognitive and behavioral aspect of build-or-buy decisions at a level of detail not previously researched.

A literature review of research on software build-or-buy decision making shows that most researchers have focused on procedures for the selection, acquisition, and evaluation of a specific type of software (e.g., Beiser, 1993; Byun and Suh, 1996; Sawyer, 1995; Subramanian and Gershon, 1991). Other researchers have proposed different decision models and decision methods for the tasks of selection, acquisition, and evaluation (e.g., Anderson, 1990; Blanc and Jelassi, 1989; Davis and Williams, 1994; Lee, 1998; Min, 1992; Shoval and Lugasi, 1987 and 1988). Most of these decision models and methods are based on rational decision-making theory (Savage, 1972). However, the assumptions and characteristics of the rational model have been criticized by empirical research (e.g., Heracleous, 1994). Much previous empirical research has shown that the build-or-buy decision is not a rational process (e.g., Bryce and Bryce, 1987; Buchowicz, 1991; Drummond, 1996; Elam and Sabherwal, 1995; Ford et. al, 1993; Layton, 1985; Rands, 1993; Welch and Navak, 1992; Zahedi, 1985). One goal of the current research is to test whether analysts engaged in build-or-buy decisions apply rational (normative) choice models or instead rely on heuristic choice models.

III. A Model for Build-or-Buy Decisions

To be able to investigate build-or-buy decisions thoroughly, a descriptive model of the processes involved is necessary. Previous models proposed in the literature have failed to capture behavioral aspects of such decisions or have not even attempted to describe actual behavior. We have chosen the belief processing model of Smith, Benson, and Curley (1991) as the basis for our new build-or-buy model. This model describes general information processing capabilities of people reaching conclusions, and has been applied in a range of decision-making tasks (e.g., Browne, Curley, and Benson, 1997; Menon et al., 1999). The essence of the model is that decision makers process information by first screening it for relevance and reliability in the current problem situation. Information that is deemed sufficiently relevant and reliable is used as evidence in a reasoning process in which the decision maker constructs arguments for and against the various alternatives. Following the application of judgments such as strength and completeness of arguments, a conclusion or decision is made.

Using the Smith, Benson, and Curley (1991) model as a starting point, we have developed a model of the build-or-buy decision process. This model appears in Figure 1. The following paragraphs describe the model in some detail.

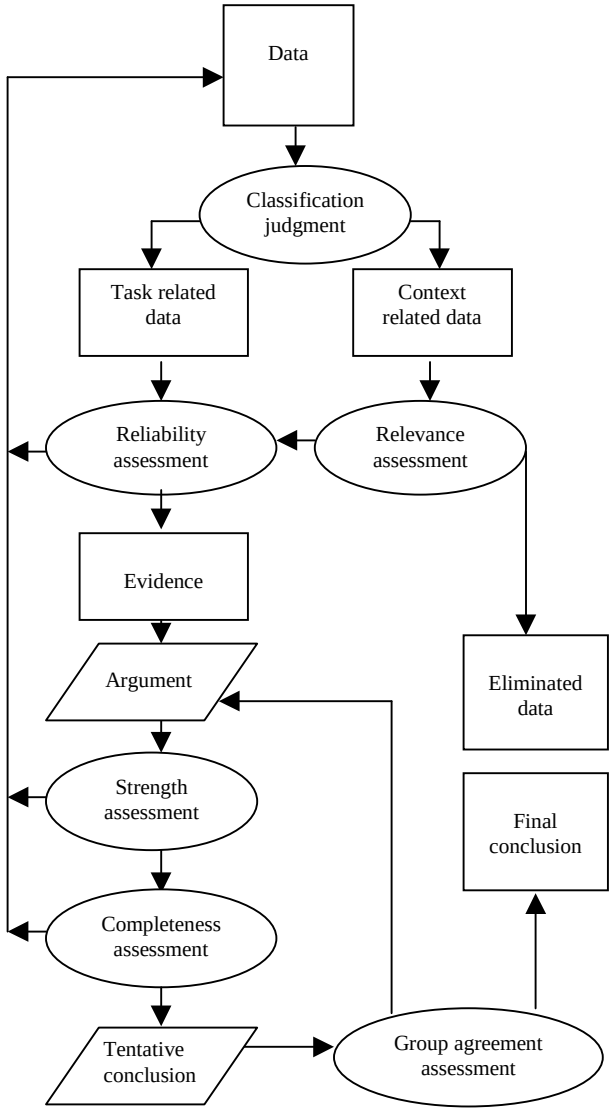

Figure1: Model for Software Build-or-Buy Decision Process
Squares= Input / Output of Process
Rectangles= Intermediate Outputs
Parallelograms= Intermediate Actions
Ellipses= Judgments

model begins with the generation of data, which may come from a variety of sources, including end-users, management, or the analyst himself. The data are the raw materials upon which the ultimate decision is based. After they are activated in the analyst's working memory, the data are classified into task variables and context variables. These two groups of variables have been found to be influential in people's decisions (Payne, 1982; Tversky & Kahneman, 1981). In the present model, task-related data refer to data characterizing the nature or attributes of the business process and application software, and relationships with other processes and software. Context-related data, on the other hand, refer to data specifying the organization, situation, or environment

in which the business process and application software exist.

Data deemed relevant and reliable are used as evidence in an argument construction process. This process of developing arguments that support or fail to support alternative choices (e.g., to build or to buy software) is the central component of the decision-making process (Smith, Benson, and Curley, 1991). Arguments made are assessed for their strength and completeness. Weak arguments are hypothesized to play little or no role in the ultimate decision. If the arguments generated are judged to be incomplete, the decision maker will move back through the process to collect or consider more data.

The arguments are combined according to their judged strengths to help the decision maker to reach a tentative conclusion. For the tentative conclusion to become the final choice, one additional assessment is necessary. In practice, the build-or-buy decision is often made under the direction and supervision of people from different business departments. A decision or evaluation group is usually created, in which an analyst or IS manager works as the project manager or chairs the group or committee (Byun and Suh, 1996; Gershkoff, 1990). The analyst often cannot ignore the degree of agreement from other group members. Research has shown that the final objective may not be achieved if group members persist in holding contrary positions (Innami, 1994). The analyst has to assess the degree of agreement to minimize conflict and reach a consensus. The group agreement judgment will determine whether the tentative conclusion becomes the final conclusion and the decision of whether to build or buy is implemented. If the assessment is not satisfactory, more arguments will be generated from the evidence.

IV. Hypotheses

Based on the theoretical background presented, the following hypotheses will be investigated in our empirical study:

H1: Analysts engaged in software build-or-buy decisions will follow the cognitive/behavioral processes specified in our model.

H2: Analysts will use heuristic choice models when arriving at final conclusions rather than normative models, (i.e., the method for combining arguments to reach conclusions will be heuristic rather than normative).

V. Method

Practicing systems analysts have been recruited to participate in the study. Each analyst will be presented with a scenario in which a decision of whether to build or buy software is required. Analysts will be asked to consider the evidence presented and to make a decision. They will be asked to speak aloud as they consider the evidence, and their responses will be tape recorded. Procedures for assuring the validity of the results in process tracing studies will be followed (Ericsson and Simon, 1993).

The tape recorded sessions will be transcribed for analysis. Independent coders will then model the cognitive processes of the analysts as revealed in the transcriptions of their decision making. The degree of fit of the data to our model and to competing models (e.g., Buchowicz, 1991; Rands, 1993) will be assessed. H1 shall be deemed supported if the data are judged to fit our model more closely than the competing models. To test H2, the choice models apparent in subjects' protocols will be coded and analyzed.

VI. Conclusion

In this paper, a model of the software build-or-buy decision has been proposed. We have also proposed hypotheses based on the model, and have outlined an empirical study to test the usefulness of the model. One result of this research should be an improved theoretical understanding of analyst behavioral during build-or-buy decisions. The research will also contribute to IS practice by providing prescriptions for analysts based on the empirical findings. Because of the growing importance of software selection in IS development (Fichman and Moses, 1999), and the dramatic increases in software use, an improved understanding of decisions concerning software is more important than ever.

We intend that the model developed here be general enough to apply to any build-or-buy decision, not just in the context of software or information systems, because the model is based on a general cognitive model of decision making. The cognitive steps involved in moving through the data—evidence—argument—conclusion process are hypothesized to apply to all decisions, although other components such as task-related data and context-related data have been included for the specific case of software.

However, specific decision outcomes under particular situations cannot be drawn from the model, because that is not its purpose. This model does not prescribe what inputs are appropriate, what data are relevant and reliable, or how to assess and evaluate data, evidence, and arguments. Those issues are dependent on the particular situation, and may be addressed in future empirical research.

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