INTERPRETATION OF ISSUES BY COGNITIVE CATEGORIZATION: LINKS TO INNOVATION ADOPTION DECISIONS

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CHAPTER I

INTRODUCTION

Strategic decisions are specific commitments to action which are "important in terms of actions taken, the resources committed, or the precedents set" (Mintzberg, Raisinghani & Theoret, 1976: 246). In particular, strategic decisions involve the commitment of organizational resources to actions that will fulfill the organizational objectives (Shrivastava & Grant, 1985). Mintzberg et al. (1976) characterized strategic decision making by ill-defined, complex and unstructured issues such as the purchase of new equipment for the organization, the development of a new product, market, or program, and the acquisition (or merger) of another organization. The common factor in each of these examples is the novelty of the issue to the organization. Unstructured issues are characterized by their novelty, and thus, lack of a predetermined set of responses (Mintzberg et al., 1976) as well as their complexity (Mason & Mitroff, 1981). Interpretation of strategic issues by decision makers is essentially reflected in decisions that involve the whole organizational context. Organizations respond differently to the same or similar environmental stimuli because their strategic decision makers may interpret

similar cues in dissimilar ways. Understanding how decision makers interpret strategic issues, and their cognitive processes that underlie these decisions, may be critical to understanding strategic decisions and subsequent organizational outcomes.

The Research Problem

Recently, researchers have explored the effects of feedback from past decisions, perceived organizational slack, decision framing (Bateman & Zeithaml, 1989), and organizational strategy and structure (Thomas & McDaniel, 1990; Thomas, Clark, & Gioia, 1993) on strategic issue interpretation. Meyer (1982) and Smart and Vertinsky (1984) have linked strategic issue interpretation to the different strategic responses of organizations in situations of environmental crises. Gioia and Chittipeddi (1991) and Thomas et al. (1993) have studied strategic issue interpretation within a sense-making framework, defined as environmental scanning and related cognitive processes, interpretation, and responses. In this line of research, however, there is a considerable lack of theory development, and corresponding empirical investigation, addressing the individual level determinants of strategic issue interpretation and decision makers' cognitive representations of strategic issues within a decision making context.

One potentially useful approach in explaining the process of how individual cognitions are related to strategic decision making, particularly to strategic issue interpretation, is cognitive categorization theory developed from cognitive psychology (Rosch, 1975; 1978). Rosch (1975; 1978) and Mervis and Rosch (1981) proposed that individuals employ categories to perceive and interpret natural objects or events. Members of one category (objects, parts, or events) share common perceived attributes which also distinguish them from members of another category. For example, "bird" could be a category, the members of which may share attributes such as wings, beaks or feathers. Beak is an attribute that may differentiate the members of "bird" category from the members of "mammal" category in the eyes of the perceiver.

Categories are important in perception and interpretation of the environmental stimuli because they reduce the ambiguity of the stimuli and the cognitive effort required to process information about these stimuli. Thus, decision makers interpret strategic issues as mainly belonging to a particular category that accommodates interpretive cues, stores relevant information, and helps to facilitate effective communication. Categorization theory has been applied to other areas of social sciences. For example, Kulik (1989) explored job categories, the attributes of these categories, and how the attributes

affect the evaluations of jobs. Her results indicated that job categorizations influence the respondents' evaluations of a job's motivating potential. Dutton and Jackson (1987) developed a model that explained how categorizing an issue as a threat or an opportunity affects the relevant information processing and the subsequent organizational responses. They proposed that once an issue is categorized, congruent information with the category, rather than incongruent information, and information that confirms the category, rather than information that disconfirms it, will be recalled. They also linked the interpretation of issues as threats with internal organizational responses and the interpretation of issues as opportunities with external organizational responses.

This paper examines a specific type of strategic issue that has been studied widely in several disciplines: innovation adoption decisions. Cognitive categorization theory is used to explain how decision makers perceive and interpret potential innovation adoption alternatives. The adoption of innovations consists of creation, development and implementation of new products, services, or processes (Damanpour, 1991). Innovation adoption decisions are representative of strategic issues that are open-ended and unstructured, and can naturally be viewed as a special type of decision making under uncertainty. Several studies have looked at the relationship between innovations and their

organizational determinants. Damanpour (1991), in a meta-analysis of 23 empirical studies, found significant positive relationships between innovation and organizational determinants such as specialization, professionalism, functional differentiation, slack resources, administrative intensity, and communication. Yet there is a notable lack of theory explaining the individual, organizational, and environmental determinants of innovation adoption decisions and their interrelationships within a strategic decision making context. Little, if any, conceptual work to date has attempted to explain why and how innovations and organizational, individual, and environmental characteristics are related.

Dissertation Objectives and Contributions

This paper develops a cross-level model (Rousseau, 1985) of interpretation of innovation adoptions, integrating strategic decision making with cognitive categorization theory. It attempts to determine the cognitive categories that decision makers are likely to use in making innovation adoption decisions. Then, it examines effects of individual, organizational, and environmental contexts on the cognitive representation of innovation alternatives. Individual differences explored are risk propensity, self efficacy, cognitive complexity, education level, age, and past experience. Organizational characteristics explored are organizational strategy, top management team information

processing capacity, structural complexity and resource availability. The environmental context is captured by perceived environmental uncertainty. The purpose of the study is to examine how individual cognitions are associated with decision makers' intentions to adopt organizational innovations, and the contextual determinants of these cognitions through the lens of cognitive categorization theory.

This study offers significant contributions to our knowledge of innovation adoption processes and, in general, of strategic decision making processes. First, it attempts to propose and validate cognitive categories and concepts that can be used to differentiate innovation alternatives within a strategic decision making context. Second, it incorporates individual differences such as cognitive complexity, self efficacy, and risk propensity among decision makers to explain how these particular categories are employed in issue interpretation. Third, this is a research proposal that integrates individual and organizational determinants of issue interpretation, and evaluates the relative importance of each contextual construct set. Fourth, cognitive categorization theory, a well grounded theory from cognitive psychology, is used to provide a theory base for examining decision makers' innovation choices in organizations.

CHAPTER II

LITERATURE REVIEW

There are three main research streams that this paper integrates: strategic issue interpretation, cognitive categorization, and organizational innovation. The logical sequence of the conceptual discussion follows a path from the most broad to the most specific research theme. Thus, the discussion starts with an overview of the general perception process, addressing particularly the fit of strategic issue interpretation into this framework. Second, an overview of the literature of strategic issue interpretation is presented. Third, cognitive categorization theory and organizational innovation adoptions are reviewed, respectively. Cognitive categorization theory is viewed as the means for interpreting strategic issues whereas innovation adoptions are the particular environmental stimuli to be interpreted through categorization. Then, the study proposes innovation attributes and the categories that accommodate these attributes. The last part of the study focuses on individual, organizational and environmental factors that are hypothesized to influence the cognitive categorization of potential innovation adoptions.

The General Perception Process

Perception is a cognitive process by which one provides the self with meaning about the environment. In particular, environmental stimuli affect the interpretation process which eventually results in responses, such as attitudes, behavior, judgments and decisions. Figure 1 presents an overview of the perception process.

Insert Figure 1 about here.

Objective environmental stimuli, such as people, objects, or events, are present in any decision. However, the determinants of stimuli interpretation are affected by factors that are unique to the individual decision maker and to the experience s/he has had with similar stimuli before. Decision makers attribute meanings to incoming stimuli. Sometimes the stimuli are interpreted as belonging to a cognitive category that accommodates members considered to be equivalent by the perceiver. These meanings later motivate decision makers to act or decide in a certain way in responding to a situation, issue, problem, object, or a person.

The general perception process, as in Figure 1, finds considerable support from the attribution theory literature. For example, Weiner (1985) developed a model of attribution in which he explained individual performance as an outcome

of the causal attributions pertaining to previous success or failure feedback. According to Weiner, individuals attribute their performance on a task to either internal (e.g., ability, effort) or external (e.g., task difficulty, luck, help from external parties) factors. In Figure 1, Weiner's success/failure feedback corresponds to environmental stimuli whereas performance is the behavioral outcome. Sweeney, Anderson, and Bailey (1986) conducted a meta-analysis of 104 studies to understand the relationship between psychological depression (outcome in Figure 1) and individual attributions of performance outcomes (stimuli in Figure 1). They found that individuals attributing failure outcomes to lack of ability rather than bad luck, and individuals attributing success outcomes to good luck rather than high ability tended to be psychologically depressed.

In an organizational context, Ford (1985) explained organizations' responses to performance downturns by their decision makers' causal attributions. He argued that decision maker attributions are affected by organization characteristics, decision maker characteristics, and performance downturn characteristics. This literature suggests that individuals interpret, and then, respond to environmental stimuli, and that this interpretation process is influenced by contextual factors.

Strategic Issue Interpretation

A strategic issue is defined here as any event or development that is perceived by decision makers to have a potential impact on the future effectiveness and strategies of the organization (Ansoff, 1980; King, 1982; Dutton, Fahey, & Narayanan, 1983). Most strategic issues are unstructured, complex, and with no clear cut formulation (Schwenk, 1984). Some examples are diversification into other activities, major changes in organizational design, or allocation of large amounts of resources for funding a new technology.

Prior research explored the effect of such constructs as organizational characteristics (Milliken, 1990; Thomas & McDaniel, 1990; Thomas et al., 1993), managers' belief structures (Walsh, 1988), and decision framing (Bateman & Zeithaml, 1989) on strategic issue interpretation. Bateman and Zeithaml (1989) explored how the 'psychological context' in which decisions are made affect the strategic decisions. In 1983, Dutton et al. identified strategic issue diagnosis (SID) as a process by which decision makers comprehend different stimuli. They explicated inputs, process characteristics, and outputs of an SID with emphasis on interpretation and judgment. The inputs that they described were cognitive maps and political interests of decision makers, and the issue characteristics. In the "general perception process" (Figure 1), SID corresponds to all

activities that lead to the behavior, in this case a decision. Dutton and Duncan (1987) presented a model of strategic issue interpretation with emphasis on decision maker perceptions of issue urgency and feasibility. Dutton, Stumpf, and Wagner (1990) recently refocused on perceived issue characteristics such as the perception of importance, immediacy, duration, and visibility of issues. In summary, recent research on strategic decision making has followed this perception process approach and has focused on how top managers interpret strategic issues in organizational contexts. Most studies have emphasized strategic issue characteristics (e.g., issue immediacy, duration, urgency), and organization context (e.g., structure, information processing) as primary determinants of issue interpretation.

Fredrickson (1983) stressed that for researchers to understand the underlying mechanism of issue interpretation, they first have to identify why the same issues are interpreted differently by decision makers. Although the salient issue characteristics are important factors in interpreting issues, sometimes interpreting these salient features becomes automatic due to the several cognitive simplifying mechanisms individuals employ at different decision making stages (Schwenk, 1984). A simplifying strategy in this direction is the utilization of cognitive categorization in giving meaning to the complex and unstructured strategic issues.

Dutton and Jackson (1987) have taken the initial steps in addressing these concerns by focusing on how labeling issues as 'threats' and 'opportunities' affects decisions and organizational responses. They proposed that attributes of "negative", "loss", and "uncontrollable" are associated closely with the threat category while the attributes of "positive", "gain", and "controllable" are associated closely with the opportunity category. Jackson and Dutton (1988) found that managers put more emphasis on information supporting or suggesting threats than information supporting or suggesting opportunities. However, they have not addressed the influence that individual, organizational or environmental contexts within which the decision is made, may have on threat and opportunity concept formation. In addition, it is unlikely that the categories of threats and opportunities be applied to every strategic issue. Recently, researchers have attempted to construct broader categories for strategic issues. For example, Thomas, Shankster, and Mathieu (1994) have addressed "political" and "strategic" issue interpretation separately. In summary, this paper attempts to construct valid specific categories for a particular type of issue, in this case, innovation adoptions. Then, it identifies at multiple levels of analysis different contexts that may influence how decision issues are categorized or labeled.

Cognitive Categorization Theory

Rosch and her colleagues (Rosch 1975; 1978; Mervis & Rosch, 1981; Rosch & Mervis, 1975) developed a theory of categorization of natural objects. According to this theory, categories consist of objects or events that are perceived by people to comprise similar features (or attributes), and thus, are considered to be equivalent. Categories are designated by names (or labels). Category members carry features that are associated with one another at varying degrees. Category members are similar because they share some common features, but they may also be different from one another on several other attributes. These objects or events (category members) receive equivalent treatment; for example, individuals may label them under the same name or perform the same act on them. Although individuals receive different stimulus cues, they tend to treat them similarly if these situations are perceived to hold some attributes characteristic to a category. Stimulus cues get a response from the individual based on his/her past experience with the situation and categorization.

The fundamental idea behind cognitive categorization theory is that individuals rely on getting the maximum amount of information from categories with the least amount of cognitive effort. In other words, when objects, issues or events are ordered around a taxonomy of categories, the

perceived complexity and ambiguity of environmental stimuli decrease. Maximum information with minimum cognitive effort is one of the two basic principles of categorization that Rosch (1978) calls "cognitive economy". In order for a stimulus to be a member of a category it should be 1) similar to other stimuli in that category, and also 2) different from stimuli that are not in that category. Yet Mervis and Rosch (1981), in their review of categorization literature, point out that category boundaries are not always well defined.

The second principle of cognitive categorization theory is that the perceived attributes of different stimuli follow a structure that is not necessarily uniform in the real world. Some attributes may appear in combination more often than others. For example, if high levels of organizational innovation, diversification, and profitability are attributes of organizations, one may perceive that, in the real world, high levels of innovation and high profitability appear more often than do high levels of diversification and high profitability.

Categorization theory identifies vertical and horizontal dimensions of category systems. Vertical dimension refers to the level of inclusiveness of a category (Rosch, 1978). The highest level of inclusiveness is the level of superordinate categories in which categories have few common attributes (e.g., journals). Basic level

categories are one level less inclusive than the superordinate level (e.g., academic journals and practitioner journals). Subordinate level categories are at the least inclusive vertical level (e.g., The Academy of Management Review, The Administrative Science Quarterly, and The Academy of Management Executive, Harvard Business Review, respectively). Horizontal dimension consists of categories that are at the same level of inclusiveness, such as academic and practitioner journals.

Salient characteristics of different strategic decision issues may make them members of different cognitive categories. Within an innovation adoption decision framework, 1) specific categories with salient attributes to innovation adoption decisions can be developed, 2) they can be labeled with innovation specific labels, and finally, they can be explored to understand how decision makers 3) interpret and 4) respond to them. The next two sections will first give an overview of the innovation literature and then explore how innovation alternatives could be interpreted with a cognitive categorization process.

Organizational Innovation

An innovation is defined as any product, service, or system that is perceived to be new by the adopting organization (Dewar & Dutton, 1986; Zaltman, Duncan & Holbek, 1973). The field of innovation holds several research avenues. For example, researchers have not only

identified stages of innovation such as initiation and implementation (Rogers, 1983; Zaltman et al., 1973), but also distinguished between types of innovation such as radical versus incremental (Dewar & Dutton, 1986), technical versus administrative (Damanpour & Evan, 1984; Kimberly & Evanisko, 1981), process versus product innovations (Ettlie, 1983). Damanpour (1991) defined the initiation stage as inclusive of all activities that are associated with decision makers' perception, attribution, interpretation, and evaluation which eventually lead to the decision to adopt. This paper's focus, intentions to adopt innovations, is central to the initiation stage of innovations.

Downs and Mohr (1976), in their critical review of the innovation literature, pointed out that there is high variance in the results of innovation studies. They attributed this variance to the ambiguity of several conceptual issues concerning innovations. Downs and Mohr focused on the primary and secondary attributes of innovations. Primary attributes are objective characteristics of innovations and do not vary across organizations. For example, according to Downs and Mohr, cost of an innovation is a primary attribute that does not change from organization to organization. It is either low cost or high cost regardless of the organization size, age, structure, etc. Secondary attributes are subjective, in that they are perceived innovation characteristics. For

example, the same innovation may be perceived as radical by some organizations yet routine by other organizations. Tornatzky and Klein (1982) argued that all primary innovation attributes become secondary since they will be perceived one way or another by the decision maker in deciding on the innovation's adoption. Tornatzky and Klein (1982) hypothesized, opposite to Downs and Mohr, that perceived innovation characteristics predict innovations with consistency across organizations. They conducted a meta-analysis of the relationship of ten innovation characteristics to innovation adoption and implementation in 75 studies. They found that only the innovation characteristics of "compatibility', "relative advantage", and "complexity" were related to innovation adoptions consistently.

Damanpour (1991) also did a meta-analysis of the relationship between 13 potential determinants of innovations and innovation adoptions. He found significant positive relationships between innovation and specialization, functional differentiation, professionalism, centralization, managerial attitudes toward change, technical knowledge resources, slack resources, administrative intensity, and communication; a negative relationship between innovation and centralization; and no significant relationship between innovation and

formalization, managerial tenure, and vertical differentiation.

CHAPTER III

THEORETICAL MODEL AND HYPOTHESES

For the purposes of this study, the focus will be on the strategic decision makers' perceptions of potential innovation attributes, how these attributes are interpreted (cognitive categorization process) and how these interpretations, in turn, influence decisions concerning innovations' adoption to the organization. Before investigating any of these issues, however, one needs to identify the contextual determinants of the particular innovation interpretation. Figure 2 exhibits these relationships more specifically in a model from which hypotheses will be developed.

Insert Figure 2 about here.

The main antecedent variable categories in the model are environmental factors, organizational factors, and individual differences among decision makers. Both organizational and individual constructs affect the categorization and interpretation of the potential innovation adoption. The model captures environmental

context with the construct of perceived environmental uncertainty.

The Innovation Adoption Categories

Among the several schools of thought on strategy formulation and implementation (Mintzberg, 1990a), the most prominent one is the classic "design school" that has influenced research in strategic management (Mintzberg, 1990b). According to this school of thought, a fit between the organization and its external environment is essential for the successful formulation and the subsequent implementation of strategy. Basic design school (Christensen, Andrews, Bower, Hamermesh, & Porter, 1982) argues that there are threats and opportunities in the external environment and strengths and weaknesses in the organization that need to be assessed through an environmental and an organizational analysis, respectively. Once these analyses are completed, the organization must match its strengths and weaknesses with the opportunities and threats in the environment. This match leads to the formulation of strategies. Following this school, and strategic decision making researchers (Nutt, 1984; Mintzberg et al., 1976) who have indicated that different environmental stimuli initiate different decision mechanisms, Dutton and Jackson (1987) proposed that, in a very general sense, strategic issues can be categorized as either threats or opportunities.

Threats and opportunities refer to very general categories of strategic issues within the external environment, as conceptualized by the design school, and subsequently by Dutton and Jackson. Innovation adoptions, however, are unique strategic issues that are more specific to the internal organizational environment. Innovation adoptions are unique responses of the organization to an opportunity or a threat that is assessed in the external environment (Zaltman et al., 1973). Thus, they cannot be categorized as a threat or an opportunity. Even when the opportunity in the external environment is an innovation itself, its adoption is a strategic issue that involves the internal organizational environment.

For example, assume an organization's environmental analysis indicates high growth in the market for product X. Product X is new, with potentially high profits and market share. The organization does not currently have a product line that is designed to address this market. Organizational analysis indicates that one of the strengths of the organization is its strong cash position. So, the organization pursues a product innovation adoption, creating a product line of X, by the investment of this cash. Thus, the organization has addressed an opportunity that it has detected in the external environment, and the means to address it has been the innovation adoption. In conclusion, an innovation adoption is an organizational phenomenon, not

an environmental one; and thus we cannot use the general labels of threats and opportunities within this specific context of innovation adoptions. More appropriate labels to employ in this context come from the innovations literature.

In 1973, Zaltman, Duncan, and Holbek wrote a landmark book on innovations: Innovations and Organizations. In this book, the authors defined "performance gaps" and argued that performance gaps initiate a need to change which leads to the search for an innovation (solution).

> "Performance gaps are discrepancies between what the organization could do by virtue of a goal-related opportunity in its environment and what it actually does in terms of exploiting that opportunity. The performance gap may be characterized by new marketing opportunities brought about by changes among consumers, or by loss of market because of new competition. The performance gap may also occur when new technical specifications are required by governmental regulatory agencies. In these and many other cases a change has occurred in the structure and/or functioning of the megasystem, creating or widening a gap between the organization's current performance and its normative performance in light of the changes in the external environment. A performance gap may be increased by changes within the organization, such as when a key expert on some part of the environment permanently leaves the organization." (1973:2)

According to Zaltman et al., a performance gap may be perceived as a result of an environmental opportunity or a threat as well as a weakness/strength within the organization. Organizations innovate for the purpose of closing this perceived performance gap. The most appropriate alternative essentially has to be chosen to reach that end. Therefore, decision makers are mainly concerned with whether the innovation alternative is "functional" (supportive) or "dysfunctional" (non-

supportive) in terms of closing the perceived performance gap. In other words, an innovation alternative could be perceived as functional in addressing this perceived performance gap effectively, and thus, increasing the current organizational performance level. Another innovation alternative, however, could be perceived as dysfunctional in addressing this perceived performance gap effectively, and thus, either impeding performance or making no change at its current level[1].

In parallel to Zaltman et al.'s (1973) assertion that performance gaps stimulate innovation adoptions because they have the potential to improve organizational performance, and thus reduce the performance gap, Damanpour (1990) argued that the rate of innovation adoption would be positively associated with organizational performance. He found a lagged effect of innovation adoption on performance, in that the adoption of innovation would influence organizational performance at a later period of time rather than immediately. Damanpour (1991) stated that innovations are adopted with the intention of improving the organizational performance. Rogers and Shoemaker (1971) classified consequences of innovations as functional and dysfunctional

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[1] This linguistic representation of categories-functional versus dysfunctional-, indicating the contribution of the phenomenon or issue to the organizational performance, has been previously used in other organizational behavior research areas; for example, functional versus dysfunctional group conflict, functional versus dysfunctional turnover, etc.

where functional referred to "desirable effects of an innovation in a social systems" and dysfunctional to "undesirable effects of an innovation in a social system" (p. 330). Collectively, this literature suggests that at the decision stage of innovation adoptions, potential innovations could be categorized as either functional or dysfunctional in terms of their potential contribution to the future organizational performance.

It is important to focus on issue-specific labels in cognitive categorization theory because labels start the categorization process; they are like road-maps to subsequent cognitions. That is why we need to explicate labels that will tie the innovation alternative to a potential change in the current organizational performance level[2].

Innovation Attributes and Relationships with Innovation Adoptions

To define the attributes that describe the categories of functional and dysfunctional, the meaning of cue validity should be clarified. Rosch (1978: 30) gave this definition: "Cue validity is a probabilistic concept; the validity of a given cue X as a predictor of a given category Y (the

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[2] It is possible to employ different terminology in categorizing innovations with respect to their contribution to potential organizational performance, such as favorable vs. unfavorable, beneficial vs. harmful, positive vs. negative, conclusive vs. questionable, constructive vs. destructive, facilitator vs. impediment, etc.

conditional probability of Y/X) increases as the frequency with which cue X is associated with category Y increases and decreases as the frequency with which cue X is associated with categories other than Y increases (Beach, 1964a; 1964b; Reed, 1972)." The more a cue or an attribute is associated with one category, the higher its predictive validity. The next step is to ask the question: What are the innovation attributes that will be perceived by top management group decision makers as potentially influential on the organization's future effectiveness? In other words, what are some innovation attributes that have high cue validity for 1) the functional category and 2) the dysfunctional category?

Innovation adoptions and diffusion is an eclectic area of research that has attracted attention in several different disciplines such as anthropology, sociology, rural sociology, education, medical sociology, geography, marketing, and organizational behavior (Lancaster & Taylor, 1986). The following is a review of literature from these disciplines that provides supporting evidence for the hypothesized effects of the perceived innovation attributes on the categorization (and subsequent adoption) of innovation alternatives. This study includes those attributes that have received significant and consistent support in literature.

Work in this area can be traced to Rogers (1962) who proposed five innovation attributes. He specifically argued that the attributes of relative advantage, compatibility, complexity, divisibility (later revised as trialability), and communicability (later revised as observability) influenced the adoption of innovations. This typology has dominated the research on perceived innovation attribute effects on decision makers' adoption behavior. Table 1 provides the definitions of these perceived innovation attributes.

Insert Table 1 about here.

Rogers and Shoemaker (1971) and Rogers (1983) summarized past research in this area and developed this typology further. In his review, Rogers concluded that strongest support is found for attributes of relative advantage, compatibility, and complexity, "with somewhat weaker support for the existence of trialability and observability" (Rogers, 1983: 212). Relative advantage has several subdimensions that are directly related to perceptions of adopters about an innovation's contribution to potential organizational performance. Rogers (1983) identified the subdimensions of "degree of economic profitability, low initial cost, a decrease in discomfort, a savings in time and effort, and the immediacy of the reward"

(p. 217). High compatibility, on the other hand, reduces the perceptions of uncertainty by displaying consistency with the present values, past experiences, and current needs of the organization. Complexity is a significant attribute, in that complicated innovations involve several factors that are interrelated with several different organizational systems or with other innovations, making them less manageable to contribute to organizational performance. For example, the operation of a calculator or a fax machine is relatively easier to learn and less complicated to use, and so less intimidating to the user, than the operation of a micro computer. Low complexity is associated with high definability, high perceived control, low risk, and high predictability.

There is consistent and significant support for these three attributes. For example, Kivlin and Fliegel (1967) found that relative advantage (labeled as savings of discomfort) was positively correlated with the rate of adoption among dairy farmers while complexity was negatively associated. Fliegel and Kivlin (1962) found that the highest rate of adoption happens for farm practices of lowest complexity and highest compatibility. Allan and Wolf (1978) also noted a negative relationship between complexity and the innovation adoption among a sample of educators. In marketing, Holak (1985) found a significant impact of relative advantage and compatibility on purchase intentions

for product innovations. Gatignon and Robertson (1985) proposed relationships, in the same direction with Rogers, for innovation attributes of relative advantage, compatibility, and complexity with the speed of diffusion, again in consumer behavior research. Finally, Tornatzky and Klein (1982) conducted a meta-analysis of ten innovation attributes (including Rogers' set of five, and also cost, communicability, divisibility, profitability, social approval) in 75 empirical studies. They found significant relationships with complexity, compatibility, and relative advantage.

Another commonly examined attribute is the risk that is associated with the innovation. If the innovation exposes the organization to lower risk, it is more desirable because it indicates higher chances of potential profit. Highly risky innovations are likely to be categorized as potentially dysfunctional for the organization. For example, Nord and Tucker (1987) described a radical innovation as something substantially new to the organization and also different from the current practices, or previous experiences/operations of the organization. Routine innovations, on the other hand, are new yet similar to a prior experience or practice. Thus, radical innovations involve both originality and risk. Routine innovations have lower risk. A routine innovation could be a new development in an existing product line. A radical

innovation could be the development of a new product that will have a new market (perhaps diversification), and will require different manufacturing facilities, and structural changes in the organization design, which are all high risk projects.

Marketing research, in particular, provides support for the proposition that risk is negatively related to the adoptions of innovations. Perceived risk was first introduced by Bauer (1960). Bauer and Wortzel (1966) and Cox and Rich (1964) supported the negative association between perceived risk and new product purchase (innovative behavior). Ostlund (1974) found a negative relationship between perceived risk and speed of adoption. Holak (1985) also noted that perceived risk significantly impacts the purchase intention for product innovations.

One innovation characteristic that has not been evaluated theoretically or empirically is controllability of the innovation. The innovation task by itself is a challenging process, in that the decision maker may perceive the task to be one over which only little control is possible. Innovations are perceived as more uncontrollable when the decision maker does not know how to approach them. For example, the development of a new product that is not similar to any other product in the current product portfolio, and so the lack of prior experience, may contribute to perceptions of uncontrollability as opposed to

a new product that is compatible with the current products. The decision makers may also perceive an innovation's future success as largely dependent on the external market conditions, like the strategic moves of competitors in the industry, or the economic conditions. No matter how successful the implementation or adoption of the innovation could be inside the organization, the ultimate success may be largely perceived to be determined by external environmental conditions. This instability of and dependence on external factors essentially define the perceptions of uncontrollability. On the contrary, for some organizations, the innovation's contribution to organizational effectiveness may mainly be an internal issue, with success being dependent on how effective internal organizational systems work. Then, the innovation could be perceived as controllable within the existing system.

The primary research support for controllability comes from the stress literature, and was proposed by Dutton and Jackson (1987) to be related to categorization of strategic issues. Stress researchers (McCrae, 1984; Lazarus & Launier, 1978) have differentiated among challenges, threats, and losses in life events. Challenges are characterized by their controllability and positive tone as opposed to the connotation of negative and less controllable that threats and losses suggest. Dutton and Jackson (1987)

have argued that challenges parallel opportunities and have associated high controllability with the perception of issues as opportunities. There is further evidence that associates uncontrollable life events more closely with subsequent illnesses than the controllable life events (Benight & Kinicki, 1988). In a parallel vein, Smart and Vertinsky (1984) found that an executive's decision to adopt a strategy depends on the perceptions of the organization's ability to control its environment. Hence, it can be argued that perceived control over something new will contribute to executive perceptions that, in the long run, positive outcomes to come from this adoption is likely.

Collectively, this literature suggests that the most important innovation attributes that impact the adoption of innovations are relative advantage, compatibility, complexity, risk, and controllability. These are the attributes that are included in the study and are proposed to differentiate the categories of functional and dysfunctional innovation adoptions distinctly. Following Zaltman et al.'s (1973) argument that performance gaps stimulate innovation adoptions, then, it can be argued that high compatibility, high relative advantage, and high controllability will have high cue validity for potential innovation adoptions that are categorized as functional. High complexity and high risk, on the other hand, will have high cue validity for potential innovation adoptions that

are categorized as dysfunctional. Table 2 provides the definitions of the attributes that are included in this study and the suggested direction of their relationship to the categorization of innovation adoptions.

Insert Table 2 about here.

Summary

In the innovation attributes literature, several studies have operationalized the same constructs under different names. For example, there are studies that examined profit potential under such labels as payoff (financial or non-financial) or profitability. Relative advantage has been operationalized as efficiency, savings of time, or savings of discomfort. Communicability has been studied under the title of visibility, clarity of results, and observability. Compatibility has meant congruence, or association with the major enterprise in some studies. Cost attributes have been operationalized as initial cost and continuing cost. Thus, it is very hard to compare the results across studies. The literature review above identified the most commonly examined, consistently supported, and clearly delineated dimensions of innovation attributes, drawing specifically from rural sociology, marketing, and education literatures. Summarizing these points, the following hypothesis is forwarded:

Hypothesis 1.

Attributes of "controllable", "high relative advantage", "compatible", "uncomplicated", and "low risk" will have high cue validity for the potential innovation adoptions that are categorized as "functional".

Rosch and Mervis (1975) noted that category members do not share attributes equally with other category members. For example, an innovation may be perceived as very complicated, hard to control, and risky, yet as having high relative advantage with respect to its profit potential. Such an innovation could still be categorized as a dysfunctional innovation for the organization. The representativeness of category members for a given category varies, with most members carrying attributes that are highly associated with that category (Mervis & Rosch, 1981). In other words, not all category members have to share all of the attributes that are proposed to have high cue validity for the categories. The following section reviews contextual factors that could influence how innovations are categorized. These factors include individual psychological, cognitive, and demographic differences, organizational characteristics, and perceived environmental uncertainty.

Individual Differences-- Personality, Cognitive, Demographic

March and Simon (1958) argued that every decision maker brings his or her own unique perspective to the decision making context. They proposed that decisions consist of

1. the alternatives that the individual perceives to exist,

2. the consequences that the individual perceives to accompany these alternatives, and

3. the individual goals that direct the evaluation and choice of alternatives.

These three factors reflect the values attached to consequences of alternatives by the individual. Theorists (March & Simon, 1958; Cyert & March, 1963) also assert that complex decisions have behavioral components, rather than being just an outcome of individual rational optimizing. Hambrick and Mason (1984) applied this general behavioral theory of the firm to the strategic choices that top management group members make. They asserted that strategic choices under conditions of bounded rationality are a function of managerial perceptions which reflect the decision maker's cognitive base and values as well as observable demographic characteristics. There is limited research to date that has explored either the personality or the cognitive factors that influence strategic outcomes (Miller, Kets De Vries, & Toulouse, 1982; Hage & Dewar, 1973). Such research may prove fruitful in examining how strategic decisions are evaluated. For example, Schwenk (1984; 1988) examined how individual differences in cognitive style affects strategic decisions. This paper develops specific hypotheses about the effects of individual

personality, cognitive, and demographic differences on cognitive categorization of potential innovations.

Individual Personality Differences. Two personality variables that seemed to have much potential in explaining strategic decisions are risk propensity and self-efficacy of the decision makers.

Risk Propensity: Individuals have different tendencies to take risks, which will be called the risk propensity. At the executive level, such tendencies may affect the strategic choices executives make (Baird & Thomas, 1985). Gupta and Govindarajan (1984) found that executives with high tolerance for ambiguity tend to take more risks than executives with low tolerance for ambiguity. Innovation adoption decisions are risky and unstructured in the sense that they concern the introduction of something new and uncertain, at least at the stage of initiation. As the risk propensity of executives increases, they will tend to categorize innovations as more functional than dysfunctional.

Hypothesis 2a.

> The higher the risk propensity of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Self-efficacy: Self-efficacy is one's beliefs about his/her ability of accomplishing a task (Bandura, 1989). Drawing from the works of Bandura (1989) and Wood and Bandura (1989) four sources of self-efficacy can be

identified: prior experience, behavior models, persuasion from others, and assessment of individual physical and emotional states that foster self-confidence.

Building on Bandura's earlier work (1977), Sherer, Maddux, Mercandante, Prentice-Dunn, Jacobs, and Rogers (1982) developed a general, non-situation specific, dispositional measure of self-efficacy. They proposed that individuals tend to develop general self-efficacy expectations in terms of the success and failure situations they encounter over time which they carry to the new situations. Sherer et al. (1982) provided evidence of reliability and validity of the scales they developed.

Accordingly, high self-efficacy individuals are more active, manage the situation, try hard, and creatively solve problems. Low self-efficacy individuals avoid difficult tasks, easily quit or become discouraged, and are passive. High self-efficacy executives, then, will tend to support and/or initiate innovative decisions and activities in the organization. Innovative issues will be complex and challenging and will align best with executives who hold high self-perceptions about their ability to manage such challenging and unstructured situations. Individuals who are high in self-efficacy can be expected to see innovations as more related to internal factors, controllable, or generally more achievable than will individuals who are low in self-efficacy.

Hypothesis 2b.

The higher the self-efficacy of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Individual Cognitive Differences. As for the cognitive differences among decision makers, cognitive complexity is examined.

Cognitive Complexity: Cognitive complexity can best be described by the number of constructs a person uses to build perceptions. Schneier (1979) described cognitive complexity as the structural complexity of one's cognitive scheme and strategy. Individuals who use a larger number of constructs in interpreting issues, perception, understanding and predicting phenomena, or in any other cognitive activity have a more complex cognitive structure. For example, Hambrick and Finkelstein (1987) argued that managerial discretion and cognitive processing ability is positively related. Executives who are cognitively more complex will perceive a wide variety of alternatives and process more information regarding these alternatives. For these individuals, complexity of the innovation, or the fact that there are several external factors that might affect the outcomes, or the uncertain structure of the innovations, will not be as threatening as they will be for the individuals who are less cognitively complex. Downey and Slocum (1982) found that the cognitive ability of executives

affected the way they perceived environmental uncertainty as having an impact on their own managerial performance.

Cognitive complexity is proposed to have two structural dimensions of differentiation and integration (Harvey, 1966; Harvey, Hunt, & Schroder, 1961; Hendrick, 1990). "Differentiation can operationally be defined as the number of dimensions extracted from a set of data and integration as the number of interconnections between rules for combining structured data (Bariff & Lusk, 1977)" (Hendrick, 1990: 511). Concrete, or cognitively simple, individuals use little differentiation in concept structuring. They further are described as "poor at integrating conceptual data in assessing complex problems and developing creative or unique, insightful solutions" (Hendrick, 1990: 512). Thus, it is proposed that executives with high cognitive complexity will tend to perceive innovation alternatives as more functional than will the executives with low cognitive complexity.

Hypothesis 3.

> The higher the cognitive complexity of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Individual Demographic Differences. Executive demographic characteristics influence the categories executives use in interpreting innovation issues.

Education Level: Hambrick and Mason (1984) argued that an executive's education background is important in

determining strategic decisions because it points to individual skills, knowledge, and cognitive base. Education level, in particular, is an influential element in decisions of innovations. Higher formal education brings more focus and receptivity to innovations, simply by increasing the cognitive complexity of individuals. Higher formal education also opens new perspectives in the knowledge base of the individuals, making them more flexible and open to new ideas. Hambrick and Mason (1984) argued for a positive relation between formal education amount and innovation. They specifically proposed that as the level of education increases, the tendency to promote innovations increases also. Hitt and Barr (1989) found that managers' formal education levels affected the managerial compensation decisions they made. Higher formal education 1) brings a more in-depth focus to the perspectives the innovation adoption decisions are made with, and 2) increases the knowledge and skill level of the individuals, promoting self-confidence and self-efficacy in approaching innovation alternatives of little structure. Thus, it can be concluded that executives with higher education levels will tend to perceive potential innovation alternatives to be functional for the long term effectiveness of the organization.

Hypothesis 4a.

The higher the education level of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Age: Age influences the strategic decisions that executives make (Hambrick & Mason, 1984). Hambrick and Mason argued that younger executives pursue more risky strategies, as opposed to older executives who prefer more conservative methods or strategies. They also argued that firms with younger executives exhibit higher growth and variability in performance. Hitt and Barr (1989) found that age of the managers influenced the compensation decisions that they made. Hitt and Tyler (1991) found that strategic decision models vary by the age of the executive. In line with this research, the following arguments can be developed. First, younger executives are more recently educated, so their knowledge base is more current, superior, and open to new ideas. Second, cognitive and learning ability tends to be more pronounced at younger ages, diminishing with age. Since innovation refers to the development of a new product/service (technical) or to the changes in the organizational structure (administrative), younger managers can be expected to bring more diverse and current perspectives that align with the nature of the issue to the decision making context. Thus, it is hypothesized that younger executives will tend to perceive innovations as more functional for the future organizational performance.

Hypothesis 4b.

The younger the executives, the more likely the potential innovation adoptions will be categorized as functional.

Past Experience: The amount and type of experience an executive has had with innovations in the past might determine to what category he or she will categorize the innovation. This experience could include previous decisions the executive has made about innovations in the past within the same organization. Another possibility is that the executive might have experienced either the same innovation decision making context or a similar one in another organizational context during his or her career. In either case, if the past innovation decisions have been successful, the executive will have a tendency to categorize the innovation alternative as functional. Just like past success would promote one's self-efficacy, past success in innovation adoption decisions would boost the tendency to interpret new adoption alternatives as functional rather than dysfunctional. Similarly, Bateman and Zeithaml (1989) found that failure/success feedback from the past decisions significantly affected the subsequent strategic decisions.

Hypothesis 4c.

The more the successful past experiences of executives with innovation adoption decisions, the more likely the potential innovation adoptions will be categorized as functional.

Organizational Characteristics

Organizational characteristics examined in this study include organizational strategy, structural complexity, top

management team information processing capacity, and availability of resources.

Strategy. Hambrick (1981), Meyer (1982), and Thomas and McDaniel (1990) have argued that an organization's strategy influences the interpretation of strategic issues. In the innovation context, Ettlie, Bridges, and O'Keefe (1984) found that strategy-structure causal sequence differs for radical versus incremental innovations. Ettlie et al. used technology policy, market dominated growth strategy, and diversification to describe the organizational strategy. Thomas and McDaniel (1990) studied the effects of strategy on CEO strategic issue interpretation. Following their work, this paper uses Miles' (1982) domain offense-domain defense strategy dimension to explore the effects of organizational strategy on innovation adoption decisions, and in particular, on how the adoption alternatives are interpreted through the categorization process.

Organizations with domain defensive strategies have more stable and narrow product markets than the organizations with domain offensive strategies. Organizations with domain offensive strategies show more aggressive behavior in product diversity, deal with complexity in their internal and external environments. For the executives in domain offensive organizations, there definitely are more strategic issues or variables to deal with than there are for the executives in domain defensive

organizations. This is because the strategy that the domain offensive organizations follow is focused on new markets, new products, and new technology. For these organizations, innovation decisions and the uncertainty that accompanies them seem to be a natural part of their strategy. The executives in the organizations that follow domain offensive strategy can be expected to interpret innovation adoptions as more functional, related to gain and low cost, low risk, controllable, and uncomplicated. Domain defensive organizations can be characterized with more conservative executives who approach innovations cautiously. Within the same industry or the same product market, organizations may act differently in adopting some new innovation or some new technology. Domain offensive firms may be the first ones to perceive an innovation as functional and adopt it, most probably followed by domain defensive firms given the innovation proves to be successful.

Hypothesis 5.

Executives in organizations that follow a domain offensive strategy will tend to categorize potential innovation adoptions as functional.

Structure. Strategic decision making is influenced not only by the individual differences but also by the context in which they are made. Strategy of the organization is such a contextual factor. Another category comprises the structural characteristics of the organization. Structure

influences the decisions because it is within this system which the innovation will be initiated and implemented. Given the stimuli of each category as identified before--relative advantage, controllability, risk, compatibility, and complexity--, then, the question becomes "What structural factors will affect how the executive categorizes the innovation alternative?". Information processing capacity or structure, structural complexity or specialization, and availability of resources are hypothesized to influence the categorization of an innovation alternative as either functional or dysfunctional for the organizational effectiveness in a strategic decision making context.

Information Processing Capacity: Information processing structure (capacity) refers to the extent of interaction and subsequent information processing during strategic decision making (Thomas & McDaniel, 1990; Duncan, 1974). Thomas and McDaniel (1990) defined "information processing structure" by dimensions of participation, interaction, and formalization. They argued that these three characteristics have the potential to influence the way the information is used within a decision making unit. Accordingly, high levels of interaction and participation, together with a low level of formalization, expedites information processing (Galbraith, 1973). As more information reaches the top management team members, and

therefore, is processed and used, the perceived predictability of the innovation adoption alternative increases. Hence, perceptions of control over the issue, together with the understanding of its nature are promoted. Lower uncertainty that accompanies higher levels of information processing and use contributes to perceptions of attributes such as gain, control, and low complexity.

Hypothesis 6a.

The higher the information processing capacity of the top management team, the more likely the potential innovation adoptions will be categorized as functional.

Complexity: Specialization, professionalism, and functional differentiation depict structural complexity of an organization (Zaltman et al., 1973). Specialization refers to the variety of specialties and specialists within an organization. The existence of a wide range of specialties indicates the extent of, or how broad is, the in-depth knowledge base that employees hold. Thus, the broader the in-depth knowledge base, the faster the diffusion of innovation. Kimberly and Evanisko (1981) found that high specialization is positively related to technological innovation adoptions. Specialization of the workforce contributes to the perceptions of executives of innovations as more feasible, uncomplicated and understandable, and related to future gain or success. So, as specialization increases within an organization, strategic decision makers are expected to categorize

potential innovation alternatives as functional for the organizational effectiveness.

Professionalism refers to the extent of professional knowledge of the current employees. Pierce and Delbecq (1977) argued that professionalism will be positively related to organizational innovation initiation, adoption, and implementation. High levels of professionalism are accompanied with affluence of education and experience (Thompson, 1965). Damanpour (1991) found a positive association between professionalism and organizational innovation. Higher professionalism of current employees encourages adoption of new ideas, technologies, or development of new products. As the number of professional organizational members increases, strategic decision makers will be more confident that the innovation, if adopted, will be more controllable, less complicated to understand, and more related to high profitability with the current workforce. Consequently, professionalism could be argued to be positively related to functional categorization of the potential innovation alternatives by the executive decision makers.

Functional differentiation represents the extent to which an organization embodies different functional units or divisions. Functional differentiation has been argued to be positively related with innovation adoptions (Kimberly & Evanisko, 1981; Pierce & Delbecq, 1977). As the number of

functional units increases, the potential for more diversity in ideas, solutions and alternatives generated increases due to the greater number of specialists grouped together in these units. Multiple groups of specialists portray a broader and stronger knowledge base for the adoption of innovations. Such groupings also reduce the employee training expenses associated with new adoptions. Hence, as the functional differentiation in an organization increases, strategic decision makers will tend to perceive the potential innovation adoptions as more controllable, less complicated (easier to understand) due to several different coalitions of professionals, and related to high potential profit and low cost. Consequently, the structural complexity of an organization could be argued to affect positively the functional categorization of innovation adoption alternatives, and vice versa.

Hypothesis 6b.

The higher the organization's structural complexity, the more likely the potential innovation adoptions will be categorized as functional.

Resource Availability: Bourgeois (1981) defined slack organizational resources as the actual or potential resources through which organizations adjust to their internal and external environments. There are several arguments in literature that link positively the availability of resources and innovations (Aiken & Hage, 1971; Daft & Becker, 1978; Miller & Friesen, 1982). Cyert

and March (1963), in their theory of organizational behavior, associated innovations with successful organizations through their availability of resources to invest in innovations. Bourgeois (1981) viewed slack resources as those that are present beyond what is essentially needed to maintain the current operations of the organization efficiently. Viewed in this manner, as the availability of resources, or as slack, increases, there will be more room to be creative, innovative, or proactive because of the buffer that is present to absorb the cost associated with the adoption of innovations, or any failure related to it. Hence, executives in organizations with either slack financial or human resources (or both) can be expected to categorize innovation adoption decisions in more favorable terms and positive for the organization than the executives in organizations with scarcity of resources. Availability of resources will contribute to perceptions of innovation alternatives as related to gain, low cost, and definitely controllable within the boundaries of the organization.

Hypothesis 6c.

The higher the availability of organizational resources, the more likely the potential innovation adoptions will be categorized as functional.

Environmental Context

Environment is a composition of variables that are external to organizational boundaries (Javidan, 1984).

Several conceptualizations of environment as it relates to organizational functioning exist. From an industrial economics perspective (Bain, 1956; Scherer, 1980) industry structure affects industry profitability, and thus indirectly has impact on the strategic decisions (Barney & Ouchi, 1986). The other major view grew from organization theory, that is the two dimensional perspective of stability and complexity.

Perceived Environmental Uncertainty. Duncan (1972) suggested that environmental stability and complexity affect the perceived uncertainty in the environment, such that as instability and complexity increase, perceived environmental uncertainty also increases. Complexity in an environment represents the number of factors that need to be considered in strategic decision making. Stability refers to the change that takes place in these environmental factors. Together they represent the environmental uncertainty. An important point is that environmental uncertainty is not the same for every organization that operates within the same environment. One organization may perceive an environment as simple and stable, whereas another may perceive the same environment as complex, unstable, and with high uncertainty. Therefore, organizational responses to the same environment may vary greatly. Empirical results from Smart and Vertinsky (1984) and Meyer (1982) support this argument.

Milliken (1987) proposed three types of uncertainty, state, effect, and response, in the perception and interpretation of specific changes in the environment. State uncertainty refers to the perception of a particular change in the environment whereas effect uncertainty indicates the perception of the effect of this change on the organization. Response uncertainty refers to the "perceived knowledge of response options and their likely effectiveness" (Milliken, 1990: 47). Milliken's research shows that examination of the interpretation of specific changes in the environment with respect to different types of uncertainty is an effective way to understand why organizational responses to the same change differ within the same environment.

Environmental uncertainty has been linked positively to organizational innovation initiation, adoption, and implementation (Pierce & Delbecq, 1977). Baldridge and Burnham (1975) has found that environmental uncertainty is a determinant of organizational innovation adoption. How would environmental uncertainty affect strategic decisions that concern innovation adoptions? Environmental uncertainty stimulates innovative behavior through which the continuously changing demands for services and products in the environment can be met successfully by the organization. When change is accompanied by the heterogeneity of the environmental factors, diversity and competition for scarce

resources also enter the picture. Innovation adoptions may then be a form of survival or a strategy to either maintain or improve the current market position for the organization. Then, in environments of high perceived uncertainty, strategic decision makers can be expected to categorize innovation adoption alternatives as more functional for the organization. Innovative behavior will align with the varying nature of the complex environment, both allowing the organization to maintain at least temporary stability and increasing its chances to stay profitable or to capture more of the current market.

Hypothesis 7.

The higher the perceived environmental uncertainty, the more likely the potential innovation adoptions will be categorized as functional.

Intention to Adopt

Executives who categorize innovation adoptions as functional for the organization will intend to decide in favor of adopting these particular innovations. The rationale behind this argument is that the effectiveness or the profitability of the organization strengthens the position of the executive. The executive will be perceived (by board members or by other external constituencies) as someone who makes good decisions that lead the company to success.

Hypothesis 8.

Executives that have categorized potential innovation adoptions as functional for the organizational performance will intend to decide in favor of adopting these innovations.

Summary

Cognitive categorization theory was used to examine how strategic decision makers interpret innovation adoption issues. Specific cognitive categories of innovation adoptions are proposed and the attributes of these categories are defined. This paper emphasized the role of multi-level contextual variables as determinants of the cognitive categorization of innovation adoptions. Hence, it specifically developed hypotheses relating environmental, organizational, and individual difference factors to how strategic decision makers perceive and give meaning to strategic innovation decisions.

CHAPTER IV

METHOD

This chapter presents the methods to be used in the operationalization of constructs and collection and analysis of data. The first two sections describe the industry in which the sampling will be done and the participants of the study. The third section explains the operationalization of the study variables, and finally the last two sections provide the data collection and analyses techniques.

Sample

Sampling was done from a single industry to control for cross-industry effects on innovation interpretations. Organizations innovate with respect to their own industry competitors to gain, or not to lose, their competitive edge. Organizations compare themselves to other organizations that operate within the same industry group. A second important reason for focusing on one industry is to control for industry-specific effects. Innovations tend to be radically different in different industries. It is difficult to make comparisons across industries with respect to the specific innovation adoptions the organizations make. To conduct the study in different industry groups would mean developing different lists of innovation items for each industry and

also revising each measure that will be used for the respective industry. It is important that this industry be one that is dynamic and high technology driven for innovation adoptions to be common strategic issues that are considered by top level executives.

Hansen and Hill's (1991) study focused on the following industries as technology driven: Pharmaceutical (SIC 2834), Chemical (SIC 2800-2899, excl. 2834), Computer (SIC 3680-3689), and Aerospace (SIC 3720-3728). In addition, in the innovations literature, the industry that was predominantly studied is health care, particularly the hospitals as major consumers of health care innovations (PsychLit search, 1974 through 1993). A recent trend in innovation studies is also to focus on banks (Bantel & Jackson, 1989; Jackson et al., 1991; Pennings & Harianto, 1992; Schneier & DeMeyer, 1991) as major innovating organizations because banking industry has recently undergone deregulation which has resulted in major innovation shifts among organizations.

Among the industries listed above, hospitals/health care was the most suitable industry group to investigate for the purposes of this study. There are several reasons for conducting the study in hospitals. First, many studies (Ashmos, 1988; Meyer, 1982; Thomas & McDaniel, 1990) suggest that top managers in hospitals interpret the same issues differently, e.g., either as a potential gain or a potential loss. This is an important point since this dissertation

essentially focuses on issue interpretation as part of the decision making process. Thus, the industry to be chosen needed to be one in which within-industry variance in top management interpretations of strategic issues was likely.

Second, medical innovations are clearly definable and refer to a general top executive audience. In other industries such as the chemical materials or computer-related products, there are several differentiations with respect to the specific line of business the organization is in. In other words, the technology, or innovation, tends to be domain-specific, varying among organizations in an industry group. On the other hand, hospitals could be representatively sampled from different geographic regions in the U.S., e.g., Northeast, South, etc. in order to have a more generalizable sample.

Kimberly and Evanisko (1981) explored the influence of individual, organizational, and contextual variables on technological and administrative innovation adoptions in a single industry, hospitals. They stated that "One way to move toward a general understanding of innovation adoption is through intensive analysis in one particular sector of the economy. Although the applicability of findings in one sector to those in another is clearly problematic, concentration of the research focus can help to identify and isolate factors that clarify the nature of the phenomenon in that sector and, at the very least, can be helpful in

suggesting hypotheses that may be generalizable beyond that sector and tested in others" (1981: 691).

In summary, the sample for this dissertation came from hospitals due to the high definability of industry-specific innovations that refer to a general top management audience, the generalizable nature of the sample, and past evidence on the variability of the interpretations of similar strategic issues by hospital decision makers.

The sampling of organizations within this industry was done nationwide. AHA Hospital Statistics classifies hospitals with respect to control type (government nonfederal; government federal; nongovernment not-for-profit; investor owned for-profit), length of stay (short-term, average stay < 30 days; long-term, average stay >= 30 days), and service (general medical and surgical; psychiatric; tuberculosis and other respiratory diseases; other specialty services). AHA's definition of "community hospitals" was adopted for this study which includes all hospitals that offer "short-term general and other special" services and are owned by nonfederal groups. This focus excludes from the sample 1) hospitals that offer principally "psychiatric", "tuberculosis and other respiratory diseases", "long-term general and other special" services and 2) hospitals that are owned by federal government.

AHA also classifies hospitals with respect to size (in terms of the number of beds) into 8 groups: 6-24 beds, 25-49

beds, 50-99 beds, 100-199 beds, 200-299 beds, 300-399 beds, 400-499 beds, 500 or more. Under "nonfederal short-term general and other special care" category, hospitals with 100-199 beds constitute the largest group. This group has been the focus here. Size of hospital is a particularly important variable for the purposes of this study because innovation adoption rates differ among organizations with respect to size (Cohen & Mowery, 1984). Large hospitals that are of over 200-300 beds are major consumers of innovations and thus were not suitable for sampling in this study since the survey questions focus on the intentions of executives to adopt innovations that are new and not adopted by the majority in that group. Hospitals under 100 beds were not suitable either because it is highly probable that financial resource availability could restrict their executives' intentions to adopt; in other words, executives may find the innovations very functional for the hospital's future performance, yet may not intend to adopt because they are too costly for their organization's limited resource base. Therefore, size of hospital has been controlled for by restricting the sample range to hospitals with 100-199 beds.

Participants

Past research has defined top management teams, or the group of strategic decision makers, in various ways, such as a) CEO, executive vice president, vice president (Hitt &

Tyler, 1991; Thomas et al., 1993), or b) CEO (Thomas & McDaniel, 1990), c) all executives that are listed in Dun and Bradstreet's Reference Book of Corporate Managements (Jackson et al., 1991) or d) top level managers who are also on the board of directors (White & Abelson, 1987). The definition of this group seems to vary with the research question addressed. In hospitals, Griffith (1987) categorized the "emerging organization of the executive office" as CEO, COO, CFO (or VP- Finance), and VP- Planning/Marketing.

Three top level hospital executives from different organizations were further interviewed to determine who comprises the 'top management team' responsible for making the final adoption decisions about innovations in hospitals of 100-300 bed size. The interviewees indicated that, as a core group, CEO, COO (or Vice President of Operations), and CFO (or Controller, or VP- Finance) were the executives who would mostly be involved in such strategic decisions. They also pointed out that in some hospitals top management groups would include Vice President of Nursing and Vice President of Patient Care. The executives further indicated that in larger hospitals the definition of a top management team could include up to 10 members or perhaps more. Accordingly, the top management team for a 100-200 bed size hospital is primarily defined as the CEO, COO, and CFO

together with the Vice Presidents that hospitals report to AHA as being on their top management groups.

Operationalization of the Constructs

Innovations. Hospitals are organizations with a wide variety of services which are not necessarily interrelated or interdependent. Thus, the decision about the adoption of an innovation in one service or field requires the consideration of much different criteria than an innovation adoption decision in another. If innovations from different hospital services such as cardiology or geriatry were aggregated to explore the relative impact of individual, organizational, and environmental contexts on their adoption decisions, the variability in the innovation characteristics would be ignored. This is why most innovation diffusion studies have either investigated the rate or effects of diffusion of only one innovation or have provided theoretical and empirical justification for using a summated index that aggregates the number of different innovations (Kimberly & Evanisko, 1981). Thus, for the purposes of this research, a focus area/service in hospitals needed to be determined.

Three experts were interviewed to define a hospital department most suitable to study for this dissertation's purposes. Experts were top level executives in hospitals, and they were asked the question: "Which are the most innovative, high-technology driven departments that

could also exist in the majority, if not all, hospitals in the United States?" Radiology (X-Ray, or Imaging as some call it) and Pathology (labs) were the common replies. However, during the interviews, radiology appeared as the most capital intensive department with a high rate of innovations. Experts pointed out that imaging has subspecialty groups such as Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and Nuclear Medicine that are constantly evolving and demanding innovations and new technology which require very short periods of decision making time. Therefore, new developments in the area of radiology were chosen as the focus of this study.

Naturally, concentration on a specific area may limit the generalizability of the results of the study; however, many illnesses and injuries require diagnosis by X-ray, and other subfields of radiology such as CT, MRI, and Ultrasound, and several require treatment by radiological technology such as radiation therapy and nuclear medicine. Thus, it can be argued that radiological innovation adoption decisions are fairly generalizable to decisions relating to medical technology in general.

For the purposes of this research, an innovation was defined as any product, service, system, process, or program that is new to the field of radiology (e.g., techniques, procedures, new equipment). In order to provide a stronger theoretical foundation for aggregating the innovation items,

only the technological innovations were included in this study. Technological innovations pertain to the use of X-ray, ultrasound, nuclear medicine, MRI, or CT scanning, or other imaging modalities for the diagnosis, treatment, and management of disease.

A panel of five experts from different health care organizations were asked to define the innovations that they expect to become available to hospitals in the next 2-5 years. Four of these experts were directors of radiology departments in medium-sized hospitals, and one was the director of a health center and former executive of a medium-sized hospital. These experts were told that these innovations should be those that are currently adopted by a few medium-sized hospitals (defined as 100-200 beds) but rapidly diffusing or expected to diffuse in hospital settings very soon, within the next 1-2 years. There was broad agreement among experts on the innovation items. A total of 21 innovations emerged from these interviews. Each expert was asked to provide information as to what each innovation is, where it is used, what it is for, approximately how much it costs, and how radical a departure it is from the previous techniques for diagnosis, treatment, or prevention. Three of the experts were interviewed twice to confirm this information. These innovations, as presented in Table 3, are Digital Radiography, Digital Subtraction Angiography, SPECT (Single Photon Emission

Computed Tomography), Spiral Acquisition Computed Tomography, Teleradiography, PACS (Picture Archiving and Communication System), ART (Acoustic Response Technology), RIS (Radiology Information System), MRI, MR Mammography, MR Angiography, Digital Mammography, PET (Positron Emission Tomography), Gamma Knife, Radiation Therapy, Dry Laser Film Processing, Echocardiology, Transesophageal Echocardiology, Stereotactic Breast Biopsy, CT Angiography, and Monoclonal Antibodies. Among these innovations, PACS, RIS, and Teleradiography were identified as administrative innovations by the expert panel.

Insert Table 3 about here.

From this list of 21 items, 3 innovation items were chosen based on the following criteria: early stage of diffusion in medium-sized hospitals; significant to the field of radiology, costly or complex for a hospital to adopt; radical departures from existing method or technology. Three innovation items that met these criteria were selected: Digital Radiography, Stereotactic Breast Biopsy, and Spiral Acquisition CT. Digital radiography refers to recording, storing, and displaying of images through computers; Stereotactic breast biopsy allows radiologist to accurately remove a sample from a radiographically suspicious area of a woman's breast with a

needle; and Spiral acquisition CT allows 3-D imaging of anatomic structures for surgical and interventional procedure planning.

Dependent Variables. Two dependent variable measures, "functional/dysfunctional interpretation" and "intent to adopt" were developed. Functional/dysfunctional interpretation: After clearly defining what functional and dysfunctional labels mean in the questionnaire (please see Appendix A for the survey questions), for each innovation item, the respondents were asked to rate the functionality of the item for his/her organization. A seven-point scale was used. More specifically, respondents rated each innovation item on a seven-point scale, ranging from "extremely dysfunctional" to "extremely functional".

For measuring "intent to adopt", respondents were asked to answer the question: "If the decision were totally up to you, what is the probability that you would adopt this innovation for your organization?". Response options ranged from 0% to 100%.

Independent Variables. Risk propensity was measured by using the risk taking scale of the Jackson Personality Inventory (Jackson, 1976). Jackson, Hourany, and Vidmar (1972) have supported the validity of JPI risk taking scale as a measure of generalized risk taking. Jackson (1977) reported 0.81 and 0.84 internal consistency reliability coefficients for two different samples. JPI is the only

measure that contains items suitable for business decision making situations and has acceptable reliability at the same time. Sexton and Bowman (1985) revised this scale from 20 items down to 8 items and found 0.78 reliability. Busenitz (1992), using this 8-item measure, found a 0.77 reliability in his study of entrepreneurs. The short version of JPI was used in this study.

Cognitive complexity is a construct that has been operationalized in several different ways in the literature. In this study, the Abstract Orientation Scale (AOS) developed and validated by O'Connor (1972) was used. AOS measures concreteness-abstractness in thinking, in that abstract, or cognitively complex, individuals tend to exhibit differentiation and integration in their thinking (Harvey, 1966). O'Connor empirically supported significant relationships between AOS and other cognitive complexity measures such as Harvey's This I Believe (TIB) Test (Harvey, 1966), California F Scale (Adorno, Frankel-Brunswik, Levinson & Sanford, 1950) and several others (Hendrick, 1990). Hendrick (1979) found 0.83 test-retest reliability for AOS in a sample of 102 male military personnel. AOS contains 30 items but only 18 are scored. Fifteen of the 18 items were used in this survey because a) two of the 18 items were inappropriate in terms of the content of the questions asked in this survey, which was primarily due to the year (1972) the instrument was first developed; these

were "Many people who take LSD are trying to escape from responsibility" and "If I wanted to find out information about communism, I would seek information from a communist"; and b) one item, "I feel that nothing is 'off limits' for exploration in psychology", was found difficult to understand in the pretest of the instrument and was removed from the survey.

Self-efficacy has typically been measured as a situation-specific construct. However, Sherer et al. (1982) developed the first and only dispositional measure of self-efficacy with two subscales, General self-efficacy (reliability coefficient = .86) and Social self-efficacy (reliability coefficient = .71). They assessed its construct validity by correlations with other personality measures. Sherer and Adams (1983) in a follow-up study further showed construct validity of this scale. General self-efficacy scale was used in this study.

Strategy was operationalized on items that are based on Miles (1982) conceptualization which describes an organizational strategic pattern in terms of the type of service/product, extent of service/product, competition in the market, the customer portfolio, extent of innovative services/products. A 7-point Likert format was used for each item. Items in the survey were taken from Thomas and McDaniel (1990), and they reflect the strategy of the hospitals, with a Cronbach's alpha of .77.

Information processing capacity was measured by the eleven-item scale adopted from Thomas and McDaniel (1990). Thomas and McDaniel drew this scale from Duncan (1973; 1974). High scores on this scale indicate low formality, high interaction, high participation in the group. Thomas et al. (1993) reported the Cronbach's alpha to be 0.88.

Overall complexity is generally measured by the availability or the number of special or distinct services in the organization (Baldridge & Burnham, 1975; Meyer & Goes, 1988; Meyer, 1982). AHA Annual Guide Book provides a listing of 80 product-service categories. This list was used to measure how specialized the hospital is.

Availability of resources was measured in the same format as of Miller and Friesen's (1982) study. Miller and Friesen (1982) asked the respondents to rate the abundance of four general resources (e.g., labor, capital) in their firms on a scale of 1 to 7 (1= this resource is very scarce and/or prohibitively expensive, 7= this resource is quite plentiful). They reported a Cronbach's alpha of 0.68. Scale format and anchors were kept the same here; however, ten specific hospital resources were adapted from Griffith's (1987) book-- The Well-managed Community Hospital. A higher reliability coefficient was expected because the scale became domain-specific for hospitals and included ten very distinct resources.

Perceived environmental uncertainty has been operationalized in several different ways. The most commonly used measures are of Duncan (1972), Milliken (1990), and Daft, Sormunen and Parks (1988). Milliken's measure was used here because 1) it is theoretically developed from Daft and Weick's (1984) model of environmental interpretation, and so is theoretically relevant to the research question that this study addresses, and 2) the scale itself focuses on the individuals' "perceptions and interpretations of a particular change in an environment, not on global attributes of the environment" (Milliken, 1990: 51). In addition, there is recent evidence that Duncan's (1972) items correspond to Milliken's three types of uncertainty (state, effect, and response uncertainty) (Gerloff, Muir, & Bodensteiner, 1991). For Milliken's measure, a specific change element needs to be identified to the respondents, and then, questions need to be asked about this element. Since the major current source of uncertainty in the health care sector is President Clinton's 1993 Health Care Reform, an element from this Act, universal coverage, was chosen for this purpose. Milliken reported 0.75 Cronbach's alpha for the Response Uncertainty scale. The other two scales in this measure were one item multiplicative indices.

Data Collection Procedures

The survey was sent to CEOs, COOs, CFOs and Vice Presidents identified by AHA as top level administrators in hospitals of 100-199 bed size. The mailing list was obtained from the AHA data base. An introductory letter stating the purpose of research accompanied the questionnaire. Appendix B contains this letter.

Data Analyses Techniques

To test hypothesis 1, respondents were provided with an explicit attribute definition. For example, for the attribute of "controllable", an explanation was given for "controllable". Then, respondents were asked to rate how well this attribute fits their understanding of an innovation that is functional for their organization. A seven-point scale ranging from (1) extremely dysfunctional to (7) extremely functional was used. This procedure was repeated for attributes of high relative advantage, compatible, uncomplicated, and low risk.

According to cognitive categorization theory, an attribute that defines category membership should be similar to other attributes defining the same category. In the analysis, first, t-tests were used to test the differences between an attribute that is proposed to have high cue validity for functional category and the theoretical mean of the functional / dysfunctional scale (4) to explore the association or cue validity of the attribute with the

proposed category. Then, correlations were examined among the attributes of functional category to establish similarity.

To test hypotheses 2 through 7, zero-order correlations were conducted since, for each one of the independent variables, either a positive or a negative correlation with the functional interpretation was hypothesized. Stepwise forward regression was also used to find a linear combination of independent variables that best predicts interpretation of innovations; and thus, the explanatory power of the theoretical model was assessed. For hypothesis 8, a simple regression was used since the purpose was to predict the changes in intention to adopt in response to changes in functional categorization.

To analyze the relative effect of personality, cognitive, demographic, organizational, and environmental variable sets on the categorization process, hierarchical multiple regression analyses were also run. The functional categorization was regressed onto individual and environmental context variables, and then variables from the organizational characteristics set were added. The incremental increase in r^2 was examined.

CHAPTER V

RESULTS

This chapter presents the results of the survey pretest, data collection and analyses. The first three sections summarize the results of the pretest of the survey instrument, the data collection, and the descriptive statistics for the variables measured in the study, respectively. The last section presents the findings for each hypothesis. Finally, an overall summary of results is provided.

Pretest of the Survey Instrument

The survey instrument was first examined by four experts in survey research. As a result, the density of the pages, the length of the questions and the survey itself, the centering of scale anchors, in addition to several other visual adjustments (such as font changes, framing, line length adjustments, etc.) that contributed positively to the appearance and approachability of the survey were made.

Second, five pretests in the form of structured interviews were conducted. Interviews lasted about an hour, ranging from 40 minutes to 1 hour 30 minutes. Three of the interviewees were hospital top level executives and two were experts in survey design and administration at the

Department of Statistics (OSU) and OSU Computer Center. Each individual completed the survey, examining the questions thoroughly, and provided valuable information as to the wording of several questions and instructions in the survey. These editorial changes were incorporated.

Further, top level executives expressed concern about the first part of the questionnaire that started directly with the innovation adoption questions. One of them stated that when it looks too hard at the beginning, it usually ends up in the trash and recommended that the organizational and individual characteristics type easy-to-answer questions be put to the beginning so that the executives would not be scared off. These changes were incorporated too. The survey started with the organizational characteristics questions, continuing with innovation related questions and ending with personality questions. The executives also had problems understanding the innovation "monoclonal antibodies" which is a rather new and specific innovation for the cancer treatment domain (nuclear medicine technology). The executives had not even heard of it before. This innovation was taken out of the questionnaire. The interviewees had no trouble understanding the other three innovations, and they all indicated that they have either heard or read about them before.

Data Collection

Four thousand six hundred twenty five questionnaires were mailed to the top executives of 1181 hospitals nationwide. Nine hundred ninety eight executives responded to this first mailing. Two months later, 804 follow-up surveys were mailed to the non-responding executives of the hospitals from which at least one executive has already responded. A total of 1096 executives responded, representing 627 hospitals. There were 23 surveys that came back unusable. A response rate of 23.8% was attained.

Power Analysis. A power analysis (Cohen & Cohen, 1983) with 11 independent variables indicated a minimum required sample size of 175 to have statistical power = .80, assuming r^2= .09 and alpha = 0.05.

Representativeness of the Responses. Table 4 shows the distribution of responses by metropolitan statistical areas (MSA)[3] / U.S. Census Divisions. (AHA Hospital Statistics divides the United States to nine census areas (MSAs) in its annual reports.)

To test the representativeness of the responses, chi-square tests were conducted on the frequencies of the number

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[3] "An MSA is a geographical designation that represents an integrated social and economic unit with a large population nucleus. Under these standards, an area qualifies for recognition as an MSA if there is a city within the area of at least 50,000 population or an urban area of at least 50,000 with a total metropolitan population of at least 100,000" (AHA Hospital Statistics, 1992: 147). AHA provides separate MSA maps for each of the nine U.S. census divisions.

of responses received from hospitals in the nine U.S. census divisions. The observed value of chi-square on the test of nine classes, 15.09, is less than 15.51 which is the critical chi-square value that separates the rejection region from the acceptance region at p = .05 and df=8. This suggests that there is no bias in the responses received based on geographic divisions.

Insert Table 4 about here.

In summary, considering that previous researchers have noted that it is difficult to collect data pertaining to individual personality characteristics from top level managers (Hambrick & Mason, 1984) and have reported much lower rates of response even for organizational level data (Nayyar, 1992), this response rate is quite favorable. The total number of responses was much greater than the minimum required as indicated by the power analysis.

Table 5 illustrates the response rate by the position of the executive, showing a higher response rate for chief operating officers. A chi-square analysis was conducted to test whether there was a significant difference in response rate based on position of the executives. The observed chi-square value, 53.97, was greater than the critical value, 9.49, at p=0.05, df=3. This finding was primarily due to the high response rate (37%) received from the COOs. A

potential explanation is that COOs would be more involved in the current operations of the hospital than any other position explored and thus would be more knowledgeable about and interested in the radiological operations and innovation in general.

Insert Table 5 about here.

Demographic Data. Table 6 indicates the gender distribution of the responding executives. Table 7 gives the statistics on age distribution in the sample. Table 8 presents the number and percent of executives with respect to their levels of education. Examination of these tables shows that 68% of the subjects were male. Average age of respondents was 44. The majority of the respondents (73%) had a Masters degree. 72% of the respondents were from institutions where none of the three innovations had been adopted.

Insert Tables 6, 7, and 8 about here.

Descriptive Statistics

General descriptive statistics and reliability coefficients of all the dependent and independent variables used in this study are listed in Table 9. Examination of

the means in Table 9 shows that top managers generally interpreted innovations as functional (mean = 5.13 on a 7-point scale) with a 66% (on a 0-100% scale) intention to adopt on the average. Among the innovation attributes, controllability, relative advantage, and compatibility of innovations were viewed as more functional than the attributes of low complexity and low risk.

Insert Table 9 About Here.

Reliability Analysis. The internal consistency reliabilities of all scales, with the exception of cognitive complexity (0.64), were equal to or above 0.70, an acceptable level for exploratory research (Nunnally, 1978). Among the individual context variables, risk propensity measure yielded a Kuder-Richardson reliability coefficient of 0.79 in this study. Since the risk taking scale was composed of dichotomously-scored items, the appropriate formula to use was Kuder-Richardson-20 (KR-20) (Carmines & Zeller, 1979). As for the cognitive complexity scale, one item was found difficult to understand by the respondents during the pretest of the instrument. This item, "I feel that nothing is 'off limits' for exploration in psychology", was not included in the final survey instrument. Coefficient alpha for cognitive complexity was 0.64. One item was found to be correlated negatively with the total.

Deletion of this item increased the reliability to 0.67 but did not change the results of the overall data analysis. Cronbach's alpha for the general self-efficacy was 0.81.

Among the organizational context variables, Cronbach's alpha for strategy was found to be 0.70. Deletion of one item from the scale that was the least correlated with total increased the reliability coefficient to 0.72 but did not affect the overall results of the data analysis. The reliability coefficient for information processing capacity was found to be 0.74. There was one item that was the least correlated with the other items in the scale. Deletion of this item increased the alpha to 0.81 but did not affect the results of data analysis. Utilization of the resource availability scale in this study yielded a reliability coefficient alpha of 0.82. As for the environmental context, use of the response uncertainty scale items yielded an alpha reliability coefficient of 0.70.

Innovation Adoption Measures. Table 10 shows the number of executives who stated whether or not their hospital had already adopted the particular innovation. Table 11 presents the total number of responses indicating whether one, two, all, or none of the innovation items listed on the survey had been adopted.

Insert Tables 10 and 11 about here.

In the sample, there were respondents that marked either none, or one, or two, or all three of the innovations as already adopted. Thus, aggregating the interpretation or the intention score of the three innovation items would not have given valid results because in some cases there would not have been all three scores to aggregate. Rather the aggregation of two innovation items, three innovation items, or just one item would have been considered in the same batch of results. In order to standardize the measurement and analysis of these dependent variables, averages of these items were taken into consideration. For example, if none of the items had been adopted, the summation of scores on functional/dysfunctional scale was divided by 3 whereas if one have been adopted, the summation was divided by two. The same procedure was applied to "intent to adopt" scores.

Hypothesis Testing

Innovation Attributes. The relationship between innovation attributes and functional categorization of innovations was examined.

Hypothesis 1 stated:

> Attributes of "controllable", "high relative advantage", "compatible", "uncomplicated", and "low risk" will have high cue validity for the potential innovation adoptions that are categorized as "functional".

Following cognitive categorization theory propositions, attributes of a category should define category membership and should be correlated to one another positively. Thus,

to test this hypothesis, 1) correlations among these five attributes were examined, and 2) means of these attributes were compared by t-tests to the theoretical mean of the scale, designating the neutral category. Table 12 shows the correlation matrix for the five attributes. All of the correlations were significant ($p < .01$). T-tests were also conducted to examine if the attributes significantly differed from the neutral category to accurately conclude that they designate either functional or dysfunctional category. The results were given in Table 13. All of these t-tests showed significant differences ($p < .01$), indicating that these attributes were associated with decision makers' perceptions of functional innovations. Thus, hypothesis 1 was supported.

Insert Tables 12 and 13 about here.

Individual Context Variables. Hypotheses 2a through 8 were analyzed by examining the correlation matrix of the variables.

Hypothesis 2a stated:

> The higher the risk propensity of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Table 14 presents the zero-order correlations between study variables. Risk propensity has a positive significant correlation ($r = .12$, $p < .01$) with functional

interpretation of innovations in hospitals. Therefore, hypothesis 2a was supported.

Insert Table 14 about here.

Hypothesis 2b stated:

> The higher the self-efficacy of the executive, the more likely the potential innovation adoptions will be categorized as functional.

This hypothesis was also supported. A significant zero order correlation was found between self-efficacy and functional interpretation of innovations by the executives ($r = .22$, $p < .01$).

Hypothesis 3 stated:

> The higher the cognitive complexity of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Correlation matrix in Table 14 shows that cognitive complexity is not related to interpretation of innovations in any significant degree ($r = .03$, $p = .42$, n.s.). Thus, no support was found for Hypothesis 3. These results show that while the two personality measures, risk propensity and self-efficacy, were found to have significant relationships with the positive interpretation of innovations, cognitive complexity, an individual cognitive difference measure, was found to have no significant correlation.

Three individual demographic differences were proposed to vary with the functional categorization of innovations.

Hypothesis 4a stated:

> The higher the education level of the executive, the more likely the potential innovation adoptions will be categorized as functional.

Level of education was not significantly associated with functional categorization of innovations ($r = .02$, $p = .65$, n.s.). Hypothesis 4a received no support.

Hypothesis 4b stated:

> The younger the executives, the more likely the potential innovation adoptions will be categorized as functional.

Age of the respondent was found to have a negative, but insignificant, correlation ($r = -.01$, $p = .76$, n.s.) with functional categorization of radiological innovations. Hypothesis 4b received no support.

Hypothesis 4c stated:

> The more the successful past experiences of executives with innovation adoption decisions, the more likely the potential innovation adoptions will be categorized as functional.

Hypothesis 4c was supported. Successful and profitable innovation adoption decisions made at the hospitals were significantly and positively correlated with functional categorization of innovations ($r = .12$, $p < .01$).

In summary, of the individual effects examined in this study, risk propensity, self-efficacy, and successful past experiences of executives were found to be related positively to functional categorization of innovation adoptions.

Organizational Context Variables. The next step was to examine the relationships of organizational level variables with individuals' functional categorization.

Hypothesis 5 stated:

> Executives in organizations that follow a domain offensive strategy will tend to categorize potential innovation adoptions as functional.

Domain offense strategy was found to be significantly positively associated with innovation adoptions' functional categorization ($r = .21$, $p < .01$). Thus, hypothesis 5 was supported.

Hypothesis 6a stated:

> The higher the information processing capacity of the top management team, the more likely the potential innovation adoptions will be categorized as functional.

This hypothesis was not supported. Information processing capacity of the top management team exhibits no significant relationship with the functional categorization of innovations ($r = .004$, $p = .91$, n.s.). This correlation was also run at the hospital level rather than individual level. The result did not change ($r = .02$, $p = .65$, n.s.).

Hypothesis 6b stated:

> The higher the organization's structural complexity, the more likely the potential innovation adoptions will be categorized as functional.

Specialization (or structural complexity) was not related to functional categorization of innovations significantly ($r = .06$, $p = .10$, n.s.). Thus, hypothesis 6b was not supported.

Hypothesis 6c stated:

> The higher the availability of organizational resources, the more likely the potential innovation adoptions will be categorized as functional.

Hypothesis 6c was supported. Resource availability and functional categorization had a significant positive zero order correlation ($r = .19$, $p < .01$).

In summary, of the organizational effects examined in this study, strategy and resource availability of hospitals were found to be related positively to functional categorization of innovation adoptions.

Environmental Context Variables. Three different types of environmental uncertainty were examined: (1) uncertainty about the state of the environment, (2) uncertainty about the effect of the environment on the organization, and (3) uncertainty about the response of the organization to the environment. These uncertainty types were measured with respect to a specific change in the environment, universal health care coverage.

Hypothesis 7 stated:

> The higher the perceived environmental uncertainty, the more likely the potential innovation adoptions will be categorized as functional.

Results from perceived environmental uncertainty with respect to state of the environment, in other words, uncertainty about whether universal coverage will occur by 1996, was marginally significant; showing a positive relationship between perceived environmental uncertainty of

state and functional categorization of innovations ($r = .06$, $p < .10$). Neither effect uncertainty, meaning uncertainty about whether the hospital will be affected by this change in the environment, nor response certainty, meaning the uncertainty about the response alternatives available to the hospital, did not show any significant relationship ($r = -.05$, $p = .16$, n.s.; $r = -.01$, $p = .86$, n.s., respectively). Thus, hypothesis 7 received partial support, depending on the form of uncertainty being measured.

Intention to Adopt. The effect of categorization of innovation alternatives on intention of executives to adopt was examined.

Hypothesis 8 stated:

> Executives that have categorized potential innovation adoptions as functional for the organizational performance will intend to decide in favor of adopting these innovations.

This hypothesis was supported. A simple regression was run between these two variables, $r^2 = .40$, $p < .01$. There was a significant positive relationship between decision makers' functional interpretation of innovations and intentions to adopt.

Interpretation of Innovations and Intentions to Decide

Test of the Main Model. This study developed a model of interpretation of innovation adoptions. The purpose was to examine how interpretations were associated with decision makers' intentions to adopt organizational innovations and the contextual determinants of these cognitions.

Insert Table 15 about here.

The model was first tested with a stepwise forward regression analysis. The results are presented in Table 15. The first variable that entered the model, explaining the highest amount of variance in innovation interpretation, was self-efficacy (r^2 = .06, F = 34.52, p < .01). Self-efficacy was followed by, in order, strategy, resource availability, risk propensity, and information processing capacity. The model r^2 was .12, F = 4.64, p < .05. No other variable met the .05 significance level for entry into the model.

A regression analysis was also run with the backward selection method. This procedure yielded the same pattern of results. The analysis first eliminated past experience, which explained the least amount of variance. Other variables removed in order were specialization, perceived environmental uncertainty of effect, level of education, perceived environmental uncertainty of state, age, cognitive complexity, and response uncertainty. This analysis left in the model the variables of self-efficacy, risk propensity, information processing capacity, strategy and resource availability as the combination of variables that best predicts functional categorization of innovations.

Stepwise forward regression analysis was also run on data sorted by position and gender of the executives to

explore if the results will change by these variables. Results are presented in Tables 16 and 17. Findings showed that resource availability and cognitive complexity were the two variables that best predicted categorization of innovations for females (r^2 = .05, $p < .05$). For males, self-efficacy, strategy, resource availability, risk propensity, and perceived environmental response uncertainty entered the equation (r^2 = .16, $p < .05$). The variance explained also varied by the position of the executive. Vice presidents had the lowest r^2 (.06) among the positions explored in this sample. Further sorting the data by both gender and position yielded a different set of results indicating that in a sample of female CEOs and females CFOs variance (r^2_{ceo} = .29, r^2_{cfo} = .41) explained in the interpretation of innovations is higher than the variance explained in a sample of male CEOs and CFOs (r^2_{ceo} = .15, r^2_{cfo} = .18) respectively. These results are given in Table 18.

Insert Tables 16, 17, and 18 about here.

Research Question

Although not formally stated as a hypothesis, a primary research question in this study addressed the relative impact of individual, environmental, and organizational context variables on interpretation of innovations. This question was addressed by running three multiple regressions

hierarchically. Individual and environmental context variables only were entered into the first multiple regression. The results are presented in Table 19. The model r^2 was .08, F = 6.52, p < .01.

Insert Tables 19, 20, and 21 about here.

A second multiple regression was run with only the organizational context variables. Table 20 exhibits these results. The model r^2 was .07, F = 12.59, p < 0.01.

Finally, a multiple regression was run with all the variables. Table 21 gives the results of this regression. The model r^2 was .13, F = 6.47, p < 0.01. These results indicate that individual/environmental context variables accounted for 8% of variance in the dependent variable while organizational context variables explained 7% when examined separately. Entered together into the same regression model, they explained 13% of the variance in the interpretation of innovations. Separately, individual / environmental context variables appear to have a slightly higher explanative power than the organizational context variables. When entered together, there was not much shrinkage observed in r^2 ($r^2_{indiv/envr}$ = .08; r^2_{orgz} = .07; $r^2_{combined}$ = .13). These results indicated a relatively independent effect of individual and organizational context variables on the dependent variable. The increase in r^2

(Cohen & Cohen, 1975) after the addition of organizational context variables to the regression equation was significant ($p < .01$).

To determine the appropriateness of this predictive model, partial regression plots that show the relationship of each independent variable with the dependent variable were examined. No nonlinear relationship was observed. The presence of unequal variances of the error terms, heteroscedasticity, was not observed for any of the independent variables from the residual plots. Normal probability plots were checked for normality of the error distribution. Plotted residuals and the histogram showed a normal distribution. Durbin-Watson statistic was 1.960, indicating that error terms were independent.

Another assumption that should be checked is the independence of independent variables, or multicollinearity. To check for this assumption, variance inflation factors (VIF) were examined. A VIF value of 10 was taken as the cutoff threshold (Hair, Anderson, Tatham, & Black, 1992). Large VIF values indicate high collinearity. All of the VIF values for the model variables were under 1.18. Also examined were the correlations in the correlation matrix which did not exhibit any substantial collinearity (Hair et al., 1992).

The inter-rater reliabilities of organizational context variables among the members of hospital top management teams

were also examined for hospitals from which four or more responses were obtained. The purpose of this analysis was to investigate if there were similarity of interpretation of hospital characteristics among the members of hospitals. There were 28 hospitals from which four or more respondents have provided information about hospital strategy, information processing capacity, and resource availability. The average inter-rater reliability, calculated by Pearson's r, on strategy, information processing capacity, and resource availability were .45, .37, and .37, respectively, for this sample of 28 hospitals. In addition, an intraclass correlation (Ebel, 1951) was also computed. The intraclass correlations on strategy, information processing capacity, and resource availability were .30, .24, and .24, respectively, indicating variability in the interpretation of hospital characteristics among top management team members. Due to the small number of individuals included in each of these interrater reliability analyses, results should be viewed with caution. These reliability coefficients would be higher if there were multiple responses from group members in a larger number of hospitals.

CHAPTER VI

DISCUSSION AND CONCLUSIONS

A model of innovation interpretation in adoption decisions was developed and tested. The test of the model used specific radiological innovation decision contexts in hospital settings. Discussion of the results is organized around two main themes. The first theme was the use of categories in giving meaning to innovations, the attributes that define these categories, and how they are related to intentions to adopt organizational innovations. The second theme was the contextual determinants of these cognitions, or categories, in particular.

Use of Categories

Association of Attributes with Categories. Results of this study provided support for the hypothesized associations between innovation attributes and functional / dysfunctional innovations. In particular, innovations that were perceived to be controllable, compatible, uncomplicated, with high relative advantage and low risk were interpreted by the executives as functional for the hospital's future performance. The findings of the study also showed that functional and neutral (neither functional nor dysfunctional) innovation categories were distinct from

one another. These findings provided support, within an innovation decision making context, for the cognitive categorization theory propositions that individuals employ categories to give meaning to elements or issues in their environments, and that members of one category share common perceived attributes that also distinguish them from members of another category.

Dutton and Jackson (1987) applied cognitive categorization theory propositions to organizational decision making in general and argued that strategic issues can be categorized as threats and opportunities. They developed attributes that were proposed to have high cue validity for each category: negative-positive, loss-gain, and uncontrollable-controllable. Jackson and Dutton (1988) empirically provided support for the issue characteristics, developed in their 1987 paper, that decision makers would associate with categories of threat and opportunity. The results of this study, in parallel to Jackson and Dutton's prior work, integrated cognitive categorization theory propositions with innovation decision making and found empirical support that specific innovation attributes differentiate between innovation interpretation categories.

The contribution of the exploration of this theme in particular has been the development of an empirically founded understanding of the innovation attributes that top managers associate with functional and dysfunctional

innovations. Thus, it can be argued that functional innovations are associated with decision makers' perceptions of low risk and ease in understanding, use and manageability of innovations. Functional innovations, seen as having positive potential contributions to hospital performance, are associated with feelings of superiority over, as well as compatibility with, the existing technology in the organization. These findings are highly generalizable to hospital contexts in that a nationwide, representative sample of 627 hospitals were used, corresponding to 1096 executives' responses. The use of radiological innovations reinforces the applicability of results to an innovation decision making context in hospitals in general, due to the extensive use of radiological technologies in diagnosis and treatment of diseases.

Intentions to Adopt. Issue interpretation affects subsequent organizational actions (Meyer, 1982; Schneider & DeMeyer, 1991). A primary purpose of this study was to explore the relation between innovation interpretation and intentions to adopt the innovation. It was hypothesized that top managers who perceive innovations as functional for the hospital's future performance will intend to adopt them. The more the top managers perceived innovation alternatives as having the potential to make a positive contribution to the hospital's performance, the more they reported that they intend to adopt them.

These results provide support for the general perception framework presented in Figure 1. Incoming stimuli, i.e., the innovations, trigger the cognitive categorization process through which they are interpreted. The meanings associated with the innovations later motivate decision makers to act in a certain way, specifically intention to adopt. The interpretation of an innovation as functional, and thus controllable, uncomplicated, compatible, with high relative advantage and low risk, had a positive link to executives' intentions to adopt these innovations.

Support provided for the hypothesized relationship between executives' interpretation of innovations and intentions to adopt reinforce the findings of prior research in this area. For example, there is evidence that top managers from different hospitals vary in their attendance to and processing of environmental information as well as in their responses to the same environment (Meyer, 1982; Shortell & Zajac, 1990; Smart & Vertinsky, 1984; Thomas et al., 1993). In this line of research, Thomas and McDaniel (1990) found a positive association between CEOs' interpretation of a strategic issue as controllable and the product-service changes in hospitals. Their results indicated no link between the interpretation of issues as positive and related to gain and the subsequent action of the hospitals.

Although their results synchronize with this study's use of controllable and uncontrollable as two of the attributes of innovations, gain-loss and positive-negative were characteristics focused at a more general level. One of the reasons that attributes such as gain-loss, and positive-negative have not been included in this study was because of their highly general nature, and hence, not being domain-specific for an innovation decision making context. Findings support my argument that there is a need to analyze issues with respect to the particular decision domain, and not with general issue labels and characteristics.

Collectively, findings of this dissertation suggest that decision makers associate specific cues of innovations with distinct categories. These cues and the relevant categories that they identify motivate a particular response from the decision maker as to either intend to adopt or not particular innovations.

Contextual Determinants of Issue Interpretation

In line with the second theme this dissertation addressed, contextual determinants of categorization were examined. More specifically, individual personality, cognitive, and demographic differences, and perceptions of the environmental and organizational contexts were explored.

Personality differences. Results showed that both of the personality variables examined, risk propensity and

self-efficacy, were significantly directly associated with functional interpretation of innovations.

Theoretically, these results indicate that executives with high tolerance for risk and a strong self-perception about their ability for accomplishing tasks in general tend to interpret innovations as more functional. Among the few studies that incorporated personality measures into strategic decision making, Hitt and Tyler (1991) tested the moderating effect of risk propensity between objective criteria used in strategic decisions and strategic choices of executives. They did not find any significant moderating effect. Methodologically, their results might be attributable to the risk propensity measure that they have used. They used Job Preference Inventory of Williams (1965) which is not a very widely used scale for measuring personality differences with respect to risk taking, primarily because it asks the respondents to choose between statements that describe a specific job, rather than directly focusing on the general risk orientation. The coefficient alpha that Hitt and Tyler reported in their study was 0.66, which was relatively low. Risk taking scale of the Jackson Personality Inventory (Jackson, 1976) was used in this study, considering the various studies that have reported high internal consistency reliability coefficients for this scale, and its suitability for studying business decisions in survey research.

Self-efficacy has often been used as a situation-specific construct in research. To the author's knowledge, no study has been reported that conceptualized or tested this construct in any strategic decision making context. Both theoretically and methodologically, the use of self-efficacy as a general personality variable that affects the strategic issue interpretation and decision making process is very unique to this dissertation. The results indicate that executives who hold a high self-perception and self-confidence about their ability to do things in general, show more of a tendency to interpret new technology as functional for their organizations.

Among the executive personality variables studied to date by other researchers are locus of control (Miller, Kets De Vries, & Toulouse, 1982), need for achievement (Miller & Droge, 1986), Jung's personality types (Stumpf & Dunbar, 1991), and CEO flexibility (Miller & Toulouse, 1986). Results of these studies establish that personality differences among executives may have significant effects on strategic decisions (Miller et al., 1982; Miller & Toulouse, 1986; Stumpf & Dunbar, 1991). Findings of this dissertation are consistent with the results and implications of prior research, suggesting the importance of influences of personality on strategic decision making processes and outcomes.

The upper echelon theory (Hambrick & Mason, 1984), the first theory to stress the importance of individual characteristics in strategic decisions, asserted that executives do matter and that their individual characteristics should be considered in strategic decision making studies. Results of the present research provide general support for upper echelons propositions. However, it also is interesting to note that "most empirical research on upper echelons treats psychological phenomena as a 'black box' -the unobserved intervening mechanisms- that causes associations between more observable executive characteristics and organizational outcomes" (Hambrick, Geletkanycz, & Fredrickson, 1993: 401). Other researchers (Eisenhardt & Zbaracki, 1992; Pettigrew, 1992) have also recently directed attention to the need to blend psychological contexts into strategic decision making studies. These results indicate that individual personality differences are important predictors of strategic issue interpretation. Although strategic decisions involve the whole organizational context and thus demand focus on organizational characteristics and needs, findings of this study suggest that, for an accurate examination and understanding of strategic decision processes, researchers should consider effects of the psychological characteristics of the decision maker.

Cognitive differences. Individual cognitive differences were investigated by measuring the cognitive complexity of top managers. No link was found between the cognitive complexity of executives and their interpretations of innovation alternatives. This finding should be viewed with caution, however, due to relatively low internal consistency reliability found for the cognitive complexity scale used here (0.64). Similar to these results, Hitt and Tyler (1991) found no significant moderating effect of cognitive complexity on the relationship between objective criteria and strategic choices of executives. One explanation for these results and the low alpha levels could be the inadequacy of the measures used in terms of 1) the content of the questions, and 2) survey research. Although the measure used in this study (O'Connor, 1972) was suitable for survey research, the content of the questions was ambiguous from time to time. A pretest identified some of the problem spots and they were modified before the survey went out. Yet there were still some items on the scale that appeared to have rather low correlations with the rest of the items. The scale Hitt and Tyler used was Bieri et al.'s (1966) 10 * 10 grid, quite long and time consuming for survey research. Considering these points, results of this study suggest caution in concluding that cognitive complexity is insignificant in decisions concerning

strategic issues, in general, or organizational innovations, in particular.

Demographic differences. This study also tested for the effects of education level and age of the executive on interpretation of innovations. These demographic characteristics did not show any significant relationship with functional categorization of innovations.

This finding is somewhat inconsistent with those of prior research. For example, Hitt and Tyler (1991) found a moderating effect of age but not of education level on the relationship between objective criteria and executive strategic choices. Kimberly and Evanisko (1981) suggested by their results that highly educated executives affect technological innovations positively. Bantel and Jackson's (1989) and Wiersema and Bantel's (1992) results indicated that lower average age and higher average educational level in top management teams are associated with higher levels of organizational innovativeness and with more frequent strategic changes organizations go through, respectively. Pettigrew (1992) provided an excellent review on managerial elites, drawing attention to the inconsistent findings of research on top management team demography and its effects on various outcomes such as team performance or firm performance.

There are several possible explanations for the findings of this study with respect to demographic

differences. First, it is important to note that none of the studies cited above actually explored the individual cognition process or interpretation as a dependent variable. In all studies in which education level and age showed significant effects, a specific action, either an individual response or behavior or an organizational response, has been tested as the dependent variable. This study measured the effects of demographic characteristics on individual cognitions. Results suggest that there might be other mechanisms intervening the relationship between individual cognition and the actual organizational or individual behavior.

Second, this study differs from most past research on top team demographics because it uses individual responses of executives rather than an average group score of the archivally collected data on these variables. Third, industry differences should be considered. Top teams may exhibit change in their compositions with respect to the industry. With the exception of Kimberly and Evanisko (1981), none of the studies cited above were conducted in the health care industry. It is possible that, in hospitals, education level and age of the executive is not as significant a determinant of strategic decision making as they may be in other industries. Finally, the constraining effect of selection and socialization processes of top managers on their observable individual differences should

also be acknowledged (Hambrick & Brandon, 1988; Hitt & Tyler, 1991). In the present research there may not be sufficient variance in the executives' education levels (73% had a Master's degree) to find an effect on individual interpretations.

Overall, the results further suggest a refinement of the upper echelon theory (Hambrick & Mason, 1984). Refinement is needed in terms of the emphasis put on demographic versus the psychological characteristics of executives. The results of this study clearly suggest that researchers need to consider and give equal weight to individual personality differences in the examination of strategic decisions. Top manager personality characteristics are just as measurable, but perhaps not as easy to measure, as the demographics. Pettigrew (1992) explicitly addresses the drawbacks and the rather narrow focus of the use of demographic data. Although, in essence, these results denote that the influence of the executive characteristics on strategic decisions does matter, and thus provide some general support for the upper echelons theory, more accent is clearly needed on the psychological context and its conceptual development.

This study also measured the top managers' perceptions about the extent of success and profitability of the innovation adoption decisions their hospitals are involved in. Results showed that executives' past experiences with

successful hospital level innovation decisions are positively correlated with their interpretations of future innovations as functional for their hospitals.

These findings suggest that the perceptions of decision makers about the success of past decisions influence the subsequent decisions. These results are in agreement with the Bateman and Zeithaml (1989) findings that feedback from past decisions affects following decisions. Strategic decision makers seem to be affected by information incoming from previous innovation adoption decisions, in that potential new alternatives is more readily perceived as functional when this information is positive. This variable could be also thought of as an organizational context variable since it involves the past experience of the top managers with the innovation decisions made in their hospitals.

Organizational Differences. Among the various contexts studied in this dissertation, organizational context is captured by the perceptions of top managers about the hospital strategy, resource availability, information processing capacity. Hospital specialization is also measured. Results show that hospital strategy and resource availability are positively associated with top managers' functional interpretations of potential innovations. Information processing capacity and specialization did not show any significant link to functional interpretations.

More specifically, results suggest that top managers in organizations with domain offense strategies and with slack financial and human resources tend to think about potential innovations more positively. These findings are consistent with past research findings and arguments (e.g., Thomas & McDaniel, 1990; Miles, 1982; Bourgeois, 1981; Miller & Friesen, 1982). For example, Thomas and McDaniel (1990) results indicated that, in hospitals with a domain offense strategy, top executives use more variables to interpret issues in their environments. Bourgeois (1981) views slack as a facilitator of strategic behavior and suggests that organizational slack allows an organization to explore new products, markets, and search for new opportunities. Awareness of organizational resource availability reinforces the perceptions of affordability of experimentation with new innovations. Further, high resource availability secures congruence with domain offense strategy which is characterized by diversity and change in products and services offered. Consequently, innovative behavior is viewed favorably in organizations with high resource availability and domain offensive strategies.

Information processing capacity of the top management team refers to the degree of interaction, participation, and information processed in decision making processes. The findings of Thomas and McDaniel (1990) and Thomas et al. (1993) both indicated that high information use facilitates

positive interpretations of strategic issues. Results of the present research do not align with their findings in an innovation decision making context and suggest that although more interaction and information processing in a top management team may promote understanding and accurate perception of issues, this does not necessarily mean that it also encourages innovative alternatives. Stated in another way, more interaction and information use in a top management team may actually surface some facts about the feasibility of novel and expensive innovation projects, such as the availability of a patient base for new technologies, that may not have unfolded otherwise.

Hospital specialization was not related to top managers' interpretations of innovation alternatives. Contrary to the hypothesized relationship, the in-depth knowledge base of employees in hospitals did not influence the perceptions about possible innovations. Past research in hospitals indicate a positive relationship between hospital innovativeness and specialization (Kimberly & Evanisko, 1981). In parallel, the initial argument forwarded in this paper was that the presence of professionals, specialists, and highly trained personnel in the hospital will contribute to top managers' perceptions of functionality of innovations. Results, however, suggest that the specific nature of the innovations should be taken into account. The innovations that the top managers

evaluated in the survey were notably new to the field of radiology. All of the three innovations interpreted, digital radiology, stereotactic breast biopsy, and spiral acquisition computed tomography, required special training of personnel that would operate them. The presence of other specialties in the hospital may not have contributed to the top managers' perceptions of operability of these new technological developments with ease. As Moch and Morse (1977: 717) noted: "To the extent that both knowledge and skill required to utilize innovations are necessary prerequisites for adoption, organizations with more specialists may be expected to adopt more innovations when the innovations are compatible with the specialists' needs and interests." Consequently, researchers need to consider the specialties that are related to the field of technology being measured.

Environmental differences. Environmental context in which decisions are made affects the decision making process. Environmental context was captured in this dissertation by the variable of perceived environmental uncertainty. Perceived environmental uncertainty was measured with respect to the uncertainty about the state of the environment, about the effect of the environment on the hospital, and about the response alternatives available to the decision makers in this environment (Milliken, 1990). Milliken's (1990) framework was adapted from Daft and

Weick's model of environmental interpretation. According to Daft and Weick, managers first scan the environment, then interpret the threats and opportunities, and finally analyze their options for response. Results of the present research showed that uncertainty with respect to state of the environment was positively related to functional interpretation of innovations whereas effect and response uncertainty did not have any significant effects.

In the measurement of perceived environmental uncertainty of state, perceptions of the executives about the occurrence of universal health care coverage by 1998 and their certainty about this estimate were inquired. Results suggested that the more the executives were uncertain that universal coverage would occur by 1998, the more they thought of innovation alternatives as functional. This finding might have rooted from executives' impressions that the health care plan will bring stricter governmental impositions and restrictions on the operations of hospitals. During the preliminary interviews with the CEOs at the beginning of this study, one common concern that has surfaced was the uncertainty about the latitude hospitals will have in allocation of their financial resources if the health care plan were implemented. Consequently, administrators seemed to be viewing investments more favorably today, or simply following a philosophy of "invest or buy now while you still can", since they do not know if

they would be able to have the same discretion if and after the health care bill passes.

Another implication of these results is that perceived environmental uncertainty should be analyzed separately with respect to different interpretation dimensions. In other words, respondents' understanding of the environment may vary with what is being perceived in relation to the environment. Is it perception about what is in the environment? Is it perception about the possible effects of the issue or issues in the environment? Or is it perception about the organizational responses to the issue or issues?

Further, effect and response parts of environmental uncertainty are related to the organization in a way that the former is about the effects on the organization while the latter is about the response of the organization. State uncertainty, however, is a change in the environment which is not directly within the immediate influence range of the hospital. Thus, perceived environmental uncertainty of effect and response may not have represented as big a source of ambiguity for the executives to affect major innovation decisions as would perceived environmental uncertainty of state because of the perceptions of the extent of control on the issue.

Relative impact of individual, environmental and organizational contexts. This study also explored the relative impact of individual, environmental, and organizational contexts on the interpretation of innovations. Individual / environmental context variables and organizational context variables exhibited independent effects on the interpretation of innovations. When both individual / environmental and organizational variables were entered to the regression equation, relatively little shrinkage was observed in the r^2 of the model containing the combined effect of the variable sets ($r^2_{indiv/envr}$ = .08; r^2_{orgz} = .07; $r^2_{combined}$ = .13). There was a slight dominance of the individual and environmental context variables; but had other organizational context variables been considered in this study, this dominance could have lessened. Overall, these findings imply that researchers need to attentively focus on effects of different contexts, environmental, organizational, and individual, on decision processes.

Test of the model with a stepwise forward regression method indicated that the independent variables explored in this study explained 12 percent of the variance in functional categorization of innovations. When the stepwise forward regression analysis was run with data sorted by position and gender of the executive, the results changed. First, they indicated that Vice Presidents explained the least amount of variance (6 percent) among the positions

explored. For example, when only the CEOs were sampled, the variance explained was 15 percent, and for only CFOs it was 17 percent. When only female CEOs were sampled, variance explained was 29 percent and for only female CFOs it was 41 percent. These significant increases in r^2's suggest attention to position effects. Although at first the low overall r^2 found in this study may be interpreted as a gender effect, since females explained only 5 percent of variance and males explained 16 percent, this is misleading, because 52% of the females were Vice Presidents. Furthermore, females at CEO and CFO positions explained considerably higher variance than male CEOs and CFOs, with equal variance accounted for by COOs for both gender groups. This sorted data analysis suggest that the overall study results should be viewed with careful consideration of the influence of sample position and gender distribution on innovation interpretation.

Contributions of the Study

The contributions of this study are primarily about what was studied and what was found. What was studied? This study contributed to the literatures on managerial cognition and innovation diffusion. Most studies involving strategic issue interpretation have examined the effects of organizational characteristics on top managers' modeling of reality. This study examined three contexts of influence: environmental, organizational, and individual. Further,

studies of managerial cognition in top management teams that explored individual differences exclusively looked at the effects of demographic attributes on issue interpretation. Again, this study is unique in its addressing the personality characteristics. The contribution to literature on innovation diffusion and management lies in the integration of innovation adoption processes and managerial cognition. What was found? First, the conceptualization of the innovation adoption process through the lens of managerial cognition provided a holistic picture of top managers' concepts of functional and dysfunctional innovations. The data confirmed the attributes that top management decision makers associate with functional and dysfunctional innovations. Second, this study found that environmental, individual, and organizational contexts have independent effects on the interpretation of innovations. Particularly, the individual and organizational contexts appear to play an important role in innovation interpretation. Opposite to studies that did not show any significant contribution of individual differences (due to mostly the study of demographic variables) (Thomas et al., 1994), this study pointed out that individual personality differences are just as influential as organizational context on how innovations or strategic issues are interpreted and acted upon. The results thus suggest new directions for research in that rather than merely focusing

on demographic differences among decision makers we need to be more attentive for the differences in personality. Even when the issues decided upon are organizational level in nature, still the decision involves the interaction or independent contributions of individual and situational variables.

Study Limitations

This study was conducted in the health care industry using hospitals of 100-199 beds. This focus controlled for effects of industry environment (Dess, Ireland, & Hitt, 1990) and for organization size (Bantel & Jackson, 1989). These controls may have imposed some limitations on the generalizability of the results to other industry contexts and also to other hospital contexts with different sizes. For example, there may be differences between industries in their rates of innovation diffusion. Regardless of innovation type or innovation characteristics, organizations in some industries may tend to show positive inclinations toward innovations, in general, as opposed to organizations in other industries. This may be related to industry stability and complexity.

With respect to size, in smaller hospital contexts that are characterized by limited resources, a different set of variables might better explain differences in executives' interpretations of innovations. Similarly, different results are likely in very large and resourceful hospital

contexts. Yet, considering that the largest group of hospitals in the U.S., according to AHA classification, is the category of 100-199 beds, results are fairly generalizable to the population of hospitals examined.

This study inquired about the intentions of top managers about adopting radiological innovations. This variable is of course a clearer, yet limited, indicator of what executives might actually do or decide. There are a number of intervening factors that might influence the relationship between intentions and actual decisions such as top management team dynamics, and patterns of power and politics that may be prevalent in strategic decision making contexts.

Several individual and organizational difference variables have been explored in this study; and several more exist that the author did not address, such as organizational culture, leadership style, or power and politics. The choice of variables was guided by past research and theory. Other variables might be identified by an inductive approach or an in-depth analysis of particular decision making processes. Such research methods are rare in the literature of strategic decision making.

Another limitation is asking the respondents to categorize innovations in pre-determined categories and to associate pre-determined innovation attributes with these categories. Again, the determination of categories and

attributes was guided by prior research and theory. An alternative design could have allowed respondents to identify the innovation categories and attributes.

A significant limitation of this study was that it did not allow any causal inferences. Because of the cross-sectional nature of the data collected, this research does not permit one to reach conclusions about whether the independent variables actually caused interpretations of innovations in a particular way.

Since this study is the first attempt to include both individual, environmental, and organizational context variables to the study of innovation adoptions, some of the scales used may demand more research in terms of establishing their reliability and validity. For example, the cognitive complexity measure used here yielded a low reliability coefficient. The content of the items that make up this scale may be questionable in terms of these items' relevance to the 1990's. There were other scales that yielded higher reliabilities when an item or two were deleted, such as the information processing capacity and the strategy of the hospital. This indicates a need for additional research on revising some of the scales used for examining these variables.

The use of self-report data in this research may also pose some limitations. This study essentially measured the impact of perceptions of executives about their hospitals'

characteristics, hospitals' environment and personality on their interpretation of innovations and intentions to adopt. Alternatively, the use of objective measures, particularly for organizational and environmental context variables, may provide insight to individual level dependent variables such as executives' interpretations of innovations.

Implications for Theory and Research

There is need for future research that explores other industries separately, or multiple industries simultaneously, with respect to innovation diffusion in organizations. Thus, one research question might be: "Do different industry contexts influence perceptions of functionality of innovations?" To better understand this issue, we need to replicate the results of this research in different characteristic industries.

Another factor to consider may be organization size. There is prior research evidence that organization size affects innovation diffusion (Bantel & Jackson, 1989; Ettlie, 1985; Kimberly & Evanisko, 1981). In parallel, resource availability was a significant predictor of functional interpretation of innovations in this study. It would be interesting, for example, to explore the set of constructs that affects the decision making processes in large and resourceful hospitals where resource scarcity would not be a constraint on innovation adoptions. Future research could continue the same line of research in

different groups of hospital size. This may lead to theory development where organization size is considered as a moderator in the relationships proposed.

The link between intentions to adopt innovations and actual decisions made about adoption is a promising area of future research, particularly if data can be collected from the same hospitals and the same executives at a later period of time. Longitudinal research will advance our knowledge on decision maker perceptions and interpretations of and decisions on potential innovations. More time-series data is particularly needed to examine how executive personalities and perceptions about the organization and environment affect strategic decision outcomes.

A case study approach might further bring different perspectives in that the actual decision processes can be observed. Although case studies put limitations on the generalizability of results to other organizational settings, direct observation or a rather inductive approach to innovation interpretation and technological decision making processes would highlight other process variables such as information acquisition and processing that this study did not address. Using such inductive approaches, researchers could also develop process theories about innovation decision making. Methods such as verbal protocol analyses or controlled experiments might allow more in-depth analyses of these innovation decision making processes.

Critical innovation attributes could be developed by directly asking decision makers what they think is most critical in their decisions about adopting innovations. Categories or other perception and interpretation schemas could thus be developed inductively. Structured interviews with executives would be valuable in following this type of a research method. A comparative approach to find convergence or divergence between the results of studies that use pre-determined categories and attributes and those that directly develop them would provide insightful cognitive theory perspectives to future studies of innovation adoptions.

This study focused on decision making processes of individuals in a group. A subsequent step would be to extend the theory and analyses presented in this research to group level, and explore the effects of group processes and dynamics with variables such as group conflict resolution styles, group level of agreement, participation of individuals in the group decision, group cohesiveness, communication, leadership, power and politics, and group heterogeneity on innovation diffusion to organizations.

This study examined individual decision making at the top management level of the organizational hierarchy. Future studies should explore innovation decision making and initiation processes at lower hierarchical levels in the organization. Issue interpretation at different departments

and levels will vary due to differences in the immediate environment, resources, and complexity. Theory building in areas such as innovation interpretation, initiation, and implementation must take into account the level in the hierarchy. The present research built innovation decision making theory considering the strategic nature of issues dealt with at top management levels.

Finally, issues other than innovation adoptions need to be examined within an issue interpretation or sense-making framework. It is important to have specificity in the theories developed and the analyses conducted with respect to the issues addressed. Using cognitive categorization theory, this study developed categories that are specific to the issue investigated, i.e., innovation adoptions. Future research needs to develop sense-making frameworks for issues within their respective contexts.

Implications for Practice

Hospitals are major consumers of health care innovations in the health care industry. Radiology is the most capital-intensive and new technology driven department in hospitals. Interviews indicated 21 technological and administrative innovations that were diffusing rapidly into the field of radiology and hospital settings. None of these 21 innovations could be implemented for under $70-80,000, and several were in the range of $300-400,000. There were a few that cost millions of dollars. Considering the

tremendous amounts of resources these technologies demand, the success of such adoption decisions is critical for a hospital. Imaging is a rapidly growing and changing area, and organizations need to establish and maintain good boundary spanning points to keep up with these continuous changes in their environment.

This research focused on three innovations that were considered to be at a very early stage of diffusion to hospital settings, that were perceived as very significant to the field of radiology, and that were radical departures from existing methods. 72% of the respondents reported that their hospitals had not adopted any of the three technologies. Generally, these innovations were viewed positively. The mean for functional interpretation for digital radiography was 5.32, for Spiral Acquisition Computed Tomography (SACT) 4.68, and for Stereotactic Breast Biopsy (SBB) 5.39 on a 1 to 7 scale. The means for intent to adopt were, for Digital Radiography, 70%, for SACT, 56%, and for SBB, 73% on a 0-100% scale. These averages indicate a high positive inclination of the health care executives for the adoption of these innovations, though much higher for Digital Radiography and SBB than for SACT. One possible reason might be that a majority of the hospitals already have a Computed Tomography (CT) unit; and SACT, although quite different, improved and a radically better technique than CT, might presently have been viewed as somewhat

redundant by executives who already have a CT unit in their hospitals. Of course, if the sampling included hospitals of larger size, more adoption rates would have been likely.

There apparently is a trend among mid-size hospital executives to keep up with the new technological developments in the imaging field, which could be explained by the highly competitive and dynamic nature of hospitals' environment. Within hospital contexts, the results of the present research pose important implications for this trend in practice. Results indicated independent effects of individual differences and organizational differences on adoption decisions. This finding implies that hospital executives do consider the organizational context in which innovations will be adopted. If a predominant effect of only individual characteristics had been found, it would have meant that these significant decisions are primarily influenced by the executives' personality or individual characteristics with little regard to the context in which they will be implemented. Considering the amount of time such strategic decisions demand from the executives, and the high cost of innovations as well as the significance of new technology to hospital patient base, the finding that situational considerations are as consequential as individual and environment context effects becomes more significant.

The highly dynamic nature of new technological developments in health care domain, in general, and in the field of imaging, in particular, further demands from executives to develop a work force that can respond to the rapid changes. For example, in implementing these technologies, executives may need to follow a hospital strategy that weights a flexible and change oriented culture, developing employees' receptivity to change through human resource practices such as employee selection, socialization, training, and promotion processes.

Gupta (1984) suggested matching manager-employee characteristics' to organizational strategy. In the present study, findings indicate that there is an inclination to follow a domain-offense strategy among hospital executives. For organizations that follow a domain-offense strategy in the industry, information from boundary spanning units is crucial. Management practices could accordingly encourage research, information seeking and gathering about new technology emerging in any respective field. For example, in this study, radiology administrators were the main sources for information about new technological developments in the field. Several of them had the funds to attend conferences, seminars, and get publications focusing on new technological developments. The information that they collected was important in influencing top management innovation decision making.

An interesting finding of this study is the substantial predictive effect of executive personality variables such as risk propensity and self-efficacy on interpretation of innovation alternatives. One future avenue to explore is whether it is the executive personality that affects decisions about the organization, or the organization's selecting and socializing employees in such a way that only the ones that fit the corporate culture could make it to this level of strategic decision making. Does the organization affect the personality of the executive, or vice versa? Exploring the answer to this question might provide several suggestions for future personnel practices.

This research highlighted the uncertainty executives are experiencing with respect to the 1993 Health Security Act. Results suggest that increased uncertainty about whether universal coverage will happen by 1998 produced a positive outlook for prospective innovations. Results reinforced the arguments that perceptions of uncertainty triggers innovative activity. Sensitivity to differences in environmental interpretation, especially in periods of turbulence, will enable practicing hospital executives to make differentially effective decisions in response to their environments.

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APPENDIXES

APPENDIX A--SURVEY QUESTIONS

Below are listed new technological innovations in radiology. Please rate each innovation in terms of its potential contribution to your hospital's performance. A functional innovation, if adopted, will enhance your hospital's performance. A dysfunctional innovation, if adopted, will impede your hospital's performance. (If you have already adopted this item, please check the box next to the item). (1 = extremely dysfunctional, 7 = extremely functional)

Digital Radiography (also called filmless imaging; record, store, and display of images through computers, later sent to a laser printer for hard copy) ☐

Spiral Acquisition Computed Tomography (also called helical scanning; allows 3-D imaging of anatomic structures for surgical and interventional procedure planning) ☐

Stereotactic Breast Biopsy (allows radiologist to accurately remove a sample from a radiographically suspicious area of a woman's breast with a needle, replacing surgical biopsy) ☐

If the decision were totally up to you, what is the probability that you would adopt this innovation for your hospital?

Digital Radiography _____%
Spiral Acquisition CT _____%
Stereotactic Breast Biopsy _____%

Below are listed several characteristics of innovations in general. Please rate each characteristic in terms of how well it fits your understanding of an innovation that is functional or dysfunctional for your hospital.
(1 = extremely dysfunctional, 7 = extremely functional)

controllable (refers to how manageable the innovation is)

complicated (refers to how difficult the innovation is to understand and use)

high relative advantage (refers to how better the innovation is than the idea it supersedes in terms of profitability, savings in time and effort, and the immediacy of the reward)

high risk (refers to the degree of risks associated with the specific innovation situation)

compatible (refers to how consistent the innovation is with current technology and equipment as well as with the values, past experiences, and needs of its users)

APPENDIX B--COVER LETTER

March 30, 1994

Dear Administrator :

I am a Ph.D. candidate in Management at Oklahoma State University. I would like to request your participation in my dissertation. The topic of this study is innovation adoption decisions of top level executives in the health care industry. This study explores the relative influence of organizational characteristics, executive characteristics, and environmental uncertainty on radiological innovation decisions.

Please participate by completing the enclosed questionnaire. The questions will ask about your hospital's strategy and resource availability, your top management team, your perception of the environment with respect to President Clinton's 1993 Health Security Act, and finally about your individual characteristics.

In return for your participation, I will send you an executive summary of the results within 90 days. This will include a) an explanation of top management teams' interpretation of radiological innovations, b) intentions of executives to adopt these innovations, c) an explanation of the importance of hospital characteristics versus executives' individual characteristics in innovation adoption decisions, and d) a description of the perceived environmental uncertainty by the executives.

Your responses will be kept strictly confidential. No findings or responses that can be traced to any individual or hospital will be written or published, or released in any other form. Maximum response rate is essential for the validity of the findings from this research. After completing the questionnaire, please staple it so that the Business Reply Mail side is visible, and please return it by April 8. Return postage is prepaid.

Thank you in advance for considering this professional contribution to both the management discipline and the hospital community.

Sincerely,

Filiz Tabak

APPENDIX C--HUMAN SUBJECTS CERTIFICATION

OKLAHOMA STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD
HUMAN SUBJECTS REVIEW

Date: 03-03-94 **IRB#:** BU-94-012

Proposal Title: INTERPRETATION OF ISSUES THROUGH CATEGORIZATION: LINKS TO ORGANIZATIONAL INNOVATION ADOPTION DECISIONS

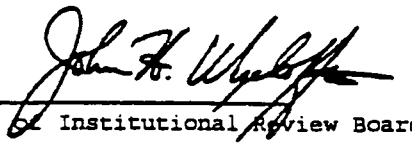
Principal Investigator(s): Steve Barr, Filiz Tabak

Reviewed and Processed as: Exempt

Approval Status Recommended by Reviewer(s): Approved

APPROVAL STATUS SUBJECT TO REVIEW BY FULL INSTITUTIONAL REVIEW BOARD AT NEXT MEETING.
APPROVAL STATUS PERIOD VALID FOR ONE CALENDAR YEAR AFTER WHICH A CONTINUATION OR RENEWAL REQUEST IS REQUIRED TO BE SUBMITTED FOR BOARD APPROVAL. ANY MODIFICATIONS TO APPROVED PROJECT MUST ALSO BE SUBMITTED FOR APPROVAL.

Comments, Modifications/Conditions for Approval or Reasons for Deferral or Disapproval are as follows:

Signature:  Date: March 3, 1994

Chair of Institutional Review Board

APPENDIX D--TABLES

Table 1. Rogers' Innovation Attributes and Definitions (from Rogers, 1983)

Perceived Innovation Attribute	Definition	Proposed Direction of Relationship to Rate of Adoption
Relative Advantage	"...the degree to which an innovation is perceived as being better than the idea it supersedes" (p. 213).	Positive
Compatibility	"...the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (p. 223).	Positive
Complexity	"...the degree to which an innovation is perceived as relatively difficult to understand and use" (p. 230).	Negative
Trialability	"...the degree to which an innovation may be experimented with on a limited basis" (p. 231).	Positive
Observability	"...the degree to which the results of an innovation are visible to others" (p. 232).	Positive

Table 2. Selected Innovation Attributes and Definitions

Perceived Innovation Attribute	Definition	Proposed Direction of Relationship to Innovation Adoption Categorization
Relative Advantage	"...the degree to which an innovation is perceived as being better than the idea it supersedes" (Rogers, 1983: 213).	Positive
Compatibility	"...the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1983: 223).	Positive
Complexity	"...the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers, 1983: 230).	Negative
Risk	"degree to which risks are perceived as associated with the innovation" (Ostlund, 1974: 24).	Negative
Controllability	perceived degree of control in a specific innovation adoption situation.	Positive

Table 3. Recent Radiological Administrative and Technical Innovations

Innovation Items
Digital Radiography
Digital Subtraction Angiography
Single Photon Emission Computed Tomography (SPECT)
Spiral Acquisition Computed Tomography (SACT)
Teleradiography (Administrative)
Picture Archiving and Communication System (PACS) (Administrative)
Acoustic Response Technology (ART)
Radiology Information System (RIS) (Administrative)
Magnetic Resonance Imaging (MRI)
MR Mammography
MR Angiography
Digital Mammography
Positron Emission Tomography (PET)
Gamma Knife
Radiation Therapy
Dry Laser Film Processing
Echocardiology
Transesophageal Echocardiology
Stereotactic Breast Biopsy
CT Angiography
Monoclonal Antibodies

Table 4. Distribution of Responses by Region

MSA[4]	# of surveys mailed	# of respondents	Response rate
MSA1	326 (7.08%)	58 (5.29%)	18%
MSA2	638 (13.86%)	129 (11.77%)	20%
MSA3	788 (17.12%)	192 (17.52%)	24%
MSA4	795 (17.28%)	206 (18.80%)	26%
MSA5	308 (6.69%)	66 (6.02%)	21%
MSA6	289 (6.28%)	86 (7.84%)	30%
MSA7	558 (12.13%)	144 (13.14%)	26%
MSA8	188 (4.09%)	46 (4.20%)	24%
MSA9	712 (15.47%)	169 (15.42%)	24%
Total	4602 (100%)	1096 (100%)	24%

[4] MSA1 (New England) Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
MSA2 (Middle Atlantic) New Jersey, New York, Pennsylvania
MSA3 (South Atlantic) Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia
MSA4 (East North Central) Illinois, Indiana, Michigan, Ohio, Wisconsin
MSA5 (East South Central) Alabama, Kentucky, Mississippi, Tennessee
MSA6 (West North Central) Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota
MSA7 (West South Central) Arkansas, Louisiana, Oklahoma, Texas
MSA8 (Mountain) Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming
MSA9 (Pacific) Alaska, California, Hawaii, Oregon, Washington + U.S. Associated Areas (American Samoa, Guam, Marshall Islands, Puerto Rico, Virgin Islands)

Table 5. Distribution of Responses by Position

Position	# of surveys mailed	# of respondents	Response rate
CEO / Administrator	1379 (29.96%)	285 (26.18%)	21%
COO	630 (13.69%)	232 (21.30%)	37%
CFO	987 (21.45%)	232 (21.30%)	24%
VP	1606 (34.90%)	340 (31.22%)	21%
Total	4602 (100%)	1089 (100%)	24 %

Table 6. Descriptive Statistics for Gender

Gender	Count	Percentage
Male	742	68.1%
Female	347	31.9%
Total	1089	100%

Table 7. Descriptive Statistics for Age

Age N	Mean	Std. Dev.	Minimum	Maximum
1077	44.46	8.05	24	79

Table 8. Descriptive Statistics for Education Level

Education Level	Count	Percentage
Doctorate	50	4.6%
Masters	786	72.5%
College Degree	238	22.0%
Some College	7	0.6%
High School	3	0.3%
Total	1084	100%

Table 9. Means, Standard Deviations, and Coefficient Alphas for Study Variables

Variable	N	Mean	Std. Dev.	Alpha
Age	1087	44.46	8.05	--
Level of Education	1084	3.81	0.52	--
Past Experience	1092	5.03	1.22	--
Speciali-zation	997	36.54	8.89	--
Strategy	1087	33.05	6.07	0.70
Information Processing Capacity	1086	44.42	7.32	0.74
Resource Availability	1048	49.68	7.36	0.82
Perceived Environmental Uncertainty (State)	1073	14.12	89.58	--
Perceived Environmental Uncertainty (Effect)	1070	74.95	73.24	--
Perceived Environmental Uncertainty (Response)	1072	26.06	5.42	0.70
Risk Propensity	1061	4.27	2.48	0.79
Self-efficacy	1067	98.07	9.89	0.81
Cognitive Complexity	1035	68.07	9.04	0.64

Table 9. (Continued)

Variable	N	Mean	Std. Dev.	Alpha
Functional / Dysfunctional Interpretation	763	5.13	0.96	--
Intention to Adopt	742	65.88	22.66	--
High Controllability	1082	5.36	1.02	--
Low Complexity	1082	4.68	1.40	--
High Relative Advantage	1082	5.80	1.00	--
Low Risk	1082	4.77	1.44	--
High Compatibility	1081	5.60	1.03	--

Table 10. Descriptive Statistics for Innovation Items I

Innovation Item	Have Already Adopted	Have Not Adopted	Total
Digital Radiography	143 (13.2%)	940 (86.8%)	1083 (100%)
Spiral Acquisition Computed Tomography	135 (12.5%)	948 (87.5%)	1083 (100%)
Stereotactic Breast Biopsy	153 (14.1%)	930 (85.9%)	1083 (100%)

Table 11. Descriptive Statistics for Innovation Items II

Innovation Items	# of Positive Responses
Adopted None	783 (72.2%)
Adopted Only One	188 (17.4%)
Adopted Only Two	93 (8.6%)
Adopted All	19 (1.8%)
Total	1083 (100%)

Table 12. Correlation Matrix for Innovation Attributes

Attribute	Controllable	Uncomplicated	High Relative Advantage	Low Risk	Compatible
Controllable	1.00				
Uncomplicated	0.23***	1.00			
High Relative Advantage	0.38***	0.17***	1.00		
Low Risk	0.24***	0.74***	0.16***	1.00	
Compatible	0.41***	0.19***	0.47***	0.16***	1.00

*** $p < 0.01$

Table 13. T-tests Between Innovation Attributes

Attribute	Mean	T-Value
Controllable	5.36 4.00	43.87***
Uncomplicated	4.69 4.00	16.05***
High relative advantage	5.80 4.00	60.00***
Low risk	4.78 4.00	17.73***
Compatible	5.61 4.00	51.94***

*** $p < 0.01$

Table 14. Pearson Correlation Coefficients for Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
1 Age											
2 Cognitive Complexity	-.11***										
3 Strategy	.05	-.02									
4 Information Proc. Capacity	.06**	.07**	.22***								
5 Resource Availability	.15***	-.05	.32***	.24***							
6 Perceived Envr. Uncert.-Effect	-.01	-.03	-.04	-.03	-.03						
7 Perceived Envr. Uncert.-State	.06*	.02	.00	.03	.08***	.15***					
8 Perceived Envr. Uncert.-Response	-.07**	-.06**	-.08***	-.09***	-.14***	-.03	-.03				
9 Specialization	.05	.05	.09***	.03	.11***	-.01	-.01	-.09***			
10 Level of Education	.00	.09***	.02	.08***	.05*	-.02	.00	-.09***	.08***		
11 Risk Propensity	.00	.18***	.09***	.04	.04	-.03	-.05*	-.12***	.10***	.15*	
12 Self-efficacy	.00	.12***	.13***	.11***	.17***	-.06*	.01	-.07**	.09***	.07**	.22***

Table 14. (Continued)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
13 Past Experience	.02	.01	.52***	.38***	.32***	-.04	.02	-.15***	.04	.06**	.10***	.12***		
14 Intention to Adopt	.06*	.01	.18***	-.01	.15***	-.06*	.03	-.01	.04	-.02	.13***	.15***	.12***	
15 Functional Interpretation	-.01	.03	.21***	.00	.19***	-.05	.06*	-.01	.06	.02	.12***	.22***	.12***	.63***

*** $p < 0.01$
** $p < 0.05$
* $p < 0.10$

Table 15. Regression Analysis with Forward Selection Method

Step	Variable Entered	Partial r^2	Model r^2	F	Prob>F
1	Self-efficacy	0.055	0.055	34.52	0.0001
2	Strategy	0.036	0.091	23.71	0.0001
3	Resource Availability	0.010	0.102	6.93	0.0087
4	Risk Propensity	0.011	0.112	7.06	0.0081
5	Information Processing Capacity	0.007	0.119	4.64	0.0317

Table 16. Stepwise Forward Regression Sorted by Gender

Males

Variable entered	Cumulative Model r^2	F	Prob>F
Self-efficacy	.08	34.34	.0001
Strategy	.13	22.85	.0001
Resource Availability	.14	5.57	.0187
Risk Propensity	.15	4.98	.0261
Perceived Response Uncertainty	.16	5.74	.0170

Females

Resource Availability	.03	4.94	.0274
Cognitive Complexity	.05	3.95	.0483

Table 17. Stepwise Forward Regression Sorted by Position

Variable entered	Cumulative Model r^2	F	Prob>F
CEOs			
Self-efficacy	.07	11.00	.0011
Resource Availability	.10	5.28	.0229
Perceived response uncertainty	.12	4.55	.0344
Perceived state uncertainty	.15	3.94	.0489
COOs			
Strategy	.12	14.97	.0002
CFOs			
Self-efficacy	.10	15.08	.0002
Resource Availability	.15	8.66	.0038
Perceived effect uncertainty	.17	4.49	.0359
VPs			
Risk Propensity	.04	7.22	.0079
Strategy	.06	4.00	.0469

Table 18. Stepwise Forward Regression Sorted by Gender and Position

Males				Females			
Variable entered	Cum. Model r^2	F	Prob>F	Variable entered	Cum. Model r^2	F	Prob>F
CEO				CEO			
Risk Propensity	.09	13.03	.0004	Risk Propensity	.29	8.06	.0102
Strategy	.15	9.39	.0026				
COO				COO			
Past Experience	.10	7.49	.0080	Resource Availability	.18	9.63	.0034
Self-efficacy	.18	6.49	.0133				
CFO				CFO			
Resource Availability	.14	19.11	.0001	Perceived effect uncertainty	.41	14.77	.0009
Self-efficacy	.18	6.61	.0114				
VP				VP			
Strategy	.07	6.44	.0130	Risk Propensity	.05	5.33	.0232

Table 19. Multiple Regression with Individual Context Variables

Variable	Parameter Est.	Std. Error	T	Prob>T
Level of Educ.	-0.0315	0.0690	-0.457	0.6476
Age	-0.0023	0.0046	-0.510	0.6100
Cognitive Comp.	-0.0000	0.0040	-0.009	0.9926
Self-efficacy	0.0205	0.0038	5.480	0.0001
Risk Propensity	0.0315	0.0148	2.127	0.0338
Past Expr.	0.0836	0.0288	2.911	0.0037
PEU-State	0.0007	0.0004	1.809	0.0708
PEU-Effect	-0.0004	0.0005	-0.974	0.3303
PEU-Response	0.0035	0.0067	0.520	0.6036

Table 20. Multiple Regression with Organizational Context Variables

Variable	Parameter Est.	Std. Error	T	Prob>T
Specialization	0.003	0.004	0.639	0.5227
Information Processing Cap.	-0.010	0.005	-2.050	0.0407
Strategy	0.029	0.006	4.628	0.0001
Res. Availability	0.019	0.005	3.710	0.0023

Table 21. Multiple Regression with All Study Variables

Variable	Parameter Est.	Std. Error	T	Prob>T
Level of Education	-0.025	0.073	-0.341	0.7329
Age	-0.005	0.005	-0.936	0.3495
Cognitive Comp.	0.004	0.004	0.974	0.3305
Self-efficacy	0.016	0.004	4.012	0.0001
Risk Propensity	0.043	0.016	2.714	0.0068
Past Experience	0.009	0.037	0.235	0.8140
PEU-State	0.000	0.000	0.828	0.4082
PEU-Effect	0.000	0.001	-0.322	0.7475
PEU-Response	0.010	0.007	1.412	0.1584
Specialization	-0.001	0.004	-0.211	0.8326
Info. Proc. Cap.	-0.011	0.005	-2.075	0.0384
Strategy	0.025	0.007	3.438	0.0006
Res. Availability	0.018	0.006	3.185	0.0015

APPENDIX E--FIGURES

Figure 1

OVERVIEW OF THE GENERAL PERCEPTION PROCESS

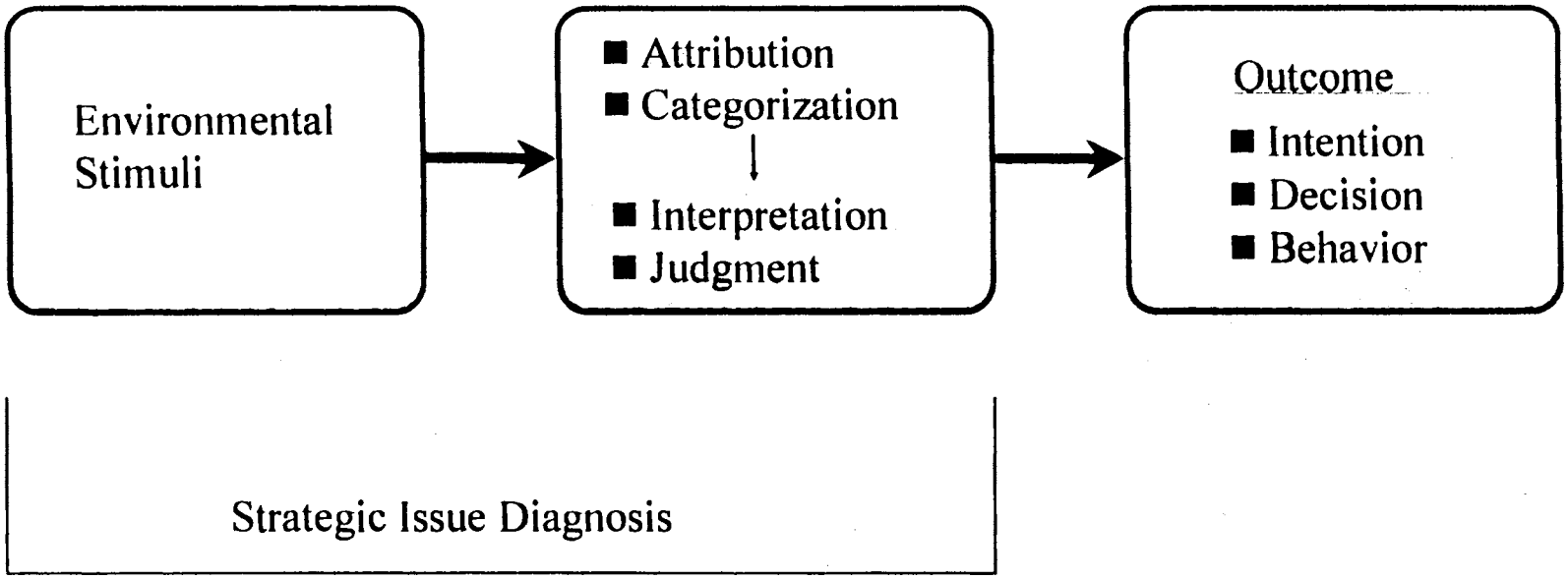
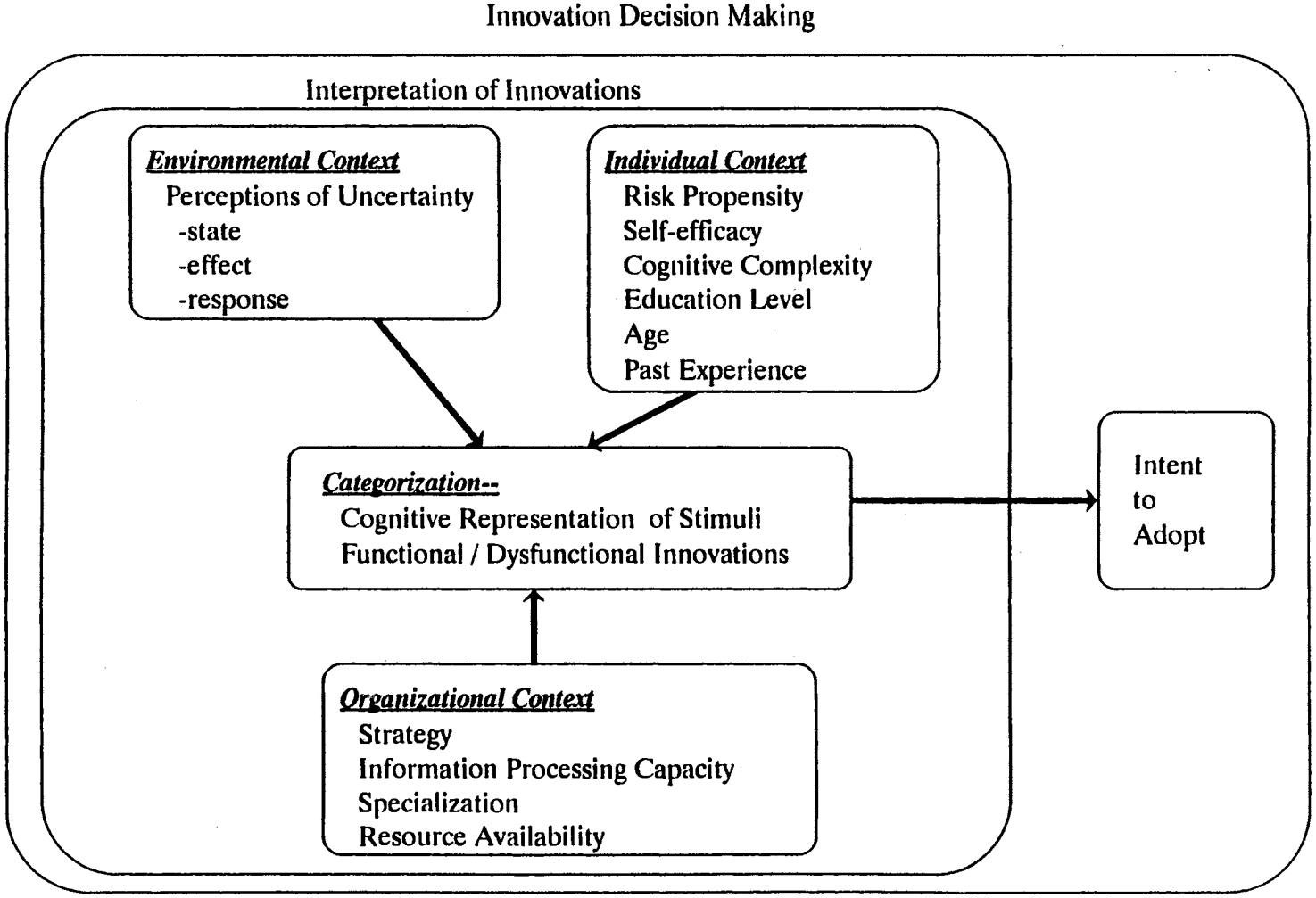


Figure 2

Interpretation of Organizational Innovations Through Categorization



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