ORGANIZATIONAL CLIMATE AND THE ADOPTION OF TECHNOLOGICAL INNOVATIONS BY HOSPITALS

by

Alla L. Wilson

A Dissertation Submitted in
Partial Fulfillment of the
Requirements for the Degree of

Doctor of Philosophy

Management Science

at

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The University of Wisconsin-Milwaukee, 1996
Under the Supervision of
Dr. P. C. Nystrom and Dr. K. Ramamurthy

Organizations vary greatly in their ability and propensity to adopt innovations. Recent research has reported that organizational climate operates as one factor that helps explain differences in organizations' inclination to adopt technological innovations. The hospital industry is chosen as the context of this study. Medical Imaging is the specific process technology chosen to assess as a technological innovation.

This study investigates three attributes of organizational climate: risk-orientation, achievement-orientation, and external-orientation. This dissertation also investigates two major attributes of technological innovations: degree of radicalness and relative advantage. Using the Pearson product-moment correlation coefficient and multiple regression analysis, this dissertation tests hypotheses and finds that risk-orientation had a significant

positive relationship with the adoption of innovations that were more radical and provide more relative advantage. Risk-orientation also has a significant positive relationship with the total number of innovations adopted, which corroborates previous empirical research. Neither external-orientation nor achievement-orientation exhibit any significant relationships with the measures of innovation adoption.

Using hierarchical regression, this study also engages in an exploratory analysis of the impacts of different levels of organizational size, slack, and age on the relationships between organizational climate attributes and innovation attributes. The contextual variables of organizational size and slack are both found to function as quasi-moderators of the relationship between organizational climate and innovation attributes in this study. By contrast, organizational age is not found to be a moderator of the climate-innovation relationship.

Contributions of this study include the rigor of research design used to gather data from the decision makers, the measure of Medical Imaging technology which advances organizational studies by adding innovation attributes as a measure of technological adoption, the results suggesting that hospitals that are more risk-oriented may achieve greater benefit from the adoption of the technology, and that organizational size and slack function as quasi-moderators of the relationship between climate attributes and innovation attributes.

This study is limited in that findings should not be generalized to the entire population of hospitals. The results of this study provide practicing managers of both large and small hospitals a better understanding of the attributes of organizational climate that may lead to the adoption of technological innovations with greater radicalness and relative advantage.

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[signature] — 12/10/96
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Chapter 1

Introduction

1.1 OVERVIEW

Technological innovation generates a powerful force for industrial development, productivity, growth, and our rising standard of living (Abernathy & Clark, 1985). Organizations vary greatly in their ability and propensity to adopt innovations. When a technological opportunity arises, an organization may not be positioned or ready to accept it (Ettlie, 1983). There are various factors that may influence an organization's ability to adopt an innovation. Organizational factors such as structure (Damanpour, 1987, 1991; Saleh & Wang, 1993) and climate (Scott & Bruce; 1994; Souder, 1987) influence the development or the adoption of innovation. The external environment has also been shown to influence the adoption of innovation in an organization (Ettlie, 1983).

The influence or ability of organizational climate in fostering the adoption of innovations is becoming widely accepted. A study by Abbey and Dickson (1983) in the semi-conductor industry found that the climate perceived by the R&D workers significantly influenced all stages of the innovation process including idea generation, initiation, adoption, and implementation. The link between climate and innovativeness is also reported in studies by Dunegan, Tierney, and Duchon (1992), Souder (1987), Vandermerwe (1987) and others (e.g., Baker & Freeland, 1972; Rubenstein, 1989; Sapolsky, 1967; Torrence, 1972; Vegso, 1976). Not only is there an intuitive link between climate and innovation, but recently a growing body of literature provided some empirical support for this link. Amabile (1988:125) states that

> "at a gross level, personal factors such as general intelligence, experience in the field, and ability to think creatively are the major influences on the output of creative ideas. But, assuming hiring practices at major corporations select individuals who exhibit relatively high levels of these personal qualities, the variance above the baseline may well be accounted for primarily in the work environment."

A major element in the above noted reference to work environment can be interpreted as the organizational climate. Paolillo and Brown (1979) stated that work climate is at least as important as the characteristics of the people involved. Managers can not assume that they can hire good employees and let the organization run by itself. Managers may have to create and sustain a climate that is conducive to innovative behaviors.

This study investigates the primary relationships between organizational climate attributes and technological innovations' attributes. This study also engages in an exploratory analysis of organizations of varying size, availability of resources or organizational slack, organizational age, and their impact on the primary relationships between organizational climate attributes and innovation attributes. The major research questions are:

1. Do particular types of organizational climates have a greater impact on the adoption of particular types of technological innovations?

2. Does organizational size impact the adoption of technological innovation? How does size impact the relationship between climate attributes and innovation attributes?

3. Does organizational slack impact the adoption of technological innovation? How does slack impact the relationship between climate attributes and innovation attributes?

4. Does organizational age impact the adoption of technological innovation? How does organizational age impact the relationship between climate attributes and innovation attributes?

This study also measures the adoption of technological innovation in ways not previously measured in the literature. In the past, the adoption of innovation has been measured as a dichotomous variable (adoption or non-adoption), or by identifying the number of innovations adopted over a particular period of time (Kimberly &

Evanisko, 1981; Damanpour, Szabat & Evan, 1989). This research measures the adoption of innovation not only as the number of innovations adopted, but goes beyond and measures the attributes of a comprehensive set of innovations adopted by the organization. The attributes of the innovations measured are radicalness and relative advantage. Just measuring the number of innovations adopted by an organization does not provide the depth of information about the innovations themselves. For example, typically in past research studies, if an organization adopts ten minor innovations, it is mistakenly considered five times as innovative as an organization that adopts two major break-through innovations.

The hospital industry was chosen as the context for this study because (a) it inhabits a rapidly changing environment requiring organizations to adopt technological innovations on a frequent basis, (b) there are a variety of types of organizations in the industry - both large and small, financially successful and struggling, and (c) hospital decisions in the adoption of medical technology result not from a decision made by one individual in the organization, but rather from decision systems requiring input from various individuals at the organizational level (Greer, 1984).

1.2 CONTEXT OF THE PROBLEM

Moss-Kanter (1983) argues that as America's economy experienced a lull in growth, innovation becomes a national priority. A clear and pressing need for innovations emerges because the United States is currently facing social and economic changes of unprecedented magnitude which past practices cannot accommodate. The ability of organizations to improve their performance by adopting innovations interests organizational researchers as well as management practitioners. Increasing environmental turbulence and industry competitiveness make the development, adoption, and implementation of innovations critical to the future success of organizations (Davis, 1986; Hetzner, Eveland & Tornatzky, 1986; Tushman & Moore, 1982). Peters (1987) states that organizations must poise themselves to innovate or risk decline and death.

Recent research finds that organizational climate is a factor that can explain the differences between organizations in their inclination to adopt technological innovations (Dunegan, Tierney & Duchon, 1992; Rubenstein, 1989; Vandermerwe, 1987). Other factors that have been found to affect the adoption of innovation are the structure of an organization (Damanpour, 1987,1991; Kimberly & Evanisko, 1981), managerial characteristics (Baldridge & Burnham, 1975; Damanpour, 1991; Hage & Dewar, 1973), the external environments (Ettlie, 1983), and the strategic orientation of the organization (Damanpour, 1991; Ettlie, Bridges & O'Keefe, 1984).

The climate of an organization has been found to be significant factor because adoption of an innovation is not the result of any one single organizational decision, or by any one individual within the organization. Not only is it difficult to identify specific decisions, but it is also difficult to identify the specific decision makers. Rarely can one decision maker take credit for the technological changes that occur in an organization. Innovation in organizations often involves many employees (Rubenstein, 1989). Therefore, the concept of organizational climate becomes a useful way of studying organizations and their relationship to adoption of innovations. A typical decision to adopt an innovation is likely to have many aspects of the garbage-can decision process (Cohen, March & Olsen, 1972), featuring combinations of problems and solutions. Often decisions are inferred by the behaviors of the decision makers. Behaviors in organizations can be related to the climate of those organizations.

The emphasis of much organization theory research has been on determining those factors that affect the design and adaptation processes found in organizations. There are three basic models of adaptation in the literature: natural selection, strategic choice, and resource dependence.

The natural selection model views organizations as organic systems whose participants share a common interest in the survival of the system (Scott, 1987). The research focus has been on identifying environmental forces which determine the emergence, growth, and survival of organizational forms (Rajagopalan, 1988). The strategic choice model suggests that a wide variety of internal and external factors influence organizational adaptations (Barnard, 1938; Bourgeois, 1980; Child, 1972; Miles & Snow, 1978). The influence of these factors on an organization's response is moderated by managerial choices (Andrews, 1980; Miles, 1982). At the same time, managerial choices regarding organizational systems, structures, and strategies lead to the formulation of different organizational climates. Managerial choices are also likely to be constrained by the existing organizational climate. The resource dependence model suggests two major motivating forces for strategic changes. The first arises out of the demands from external constituencies and the second emerges from changes in resource availability (Jacobs, 1974; Pfeffer & Salancik, 1978; Thompson, 1969).

For this study, the strategic choice model is the most appropriate because it assumes organizations to be open systems that confront, and respond to the various challenges and opportunities in their environments (Scott, 1987). Second, the focus of this research is on individual organizations, not the entire population of organizations as in the natural selection model. Finally, this research focuses primarily on the internal environment of organizations rather than the inter-organizational dependence, the dominant perspective of the resource dependence model.

Organizational climate influences the strategic choices of an organization in areas such as service quality, productivity, safety, or innovation (Schneider, 1990; Pettigrew, 1990). These authors argued that the variability in the strategic choices of an organization cannot be explained through one variable such as the structure and its effects on strategic orientation, but may be influenced by the organizational climate as well.

Technological Innovations

Much of the literature on innovation attempts to explain the factors that encourage or inhibit innovations (Nicholson, Rees, & Brooks-Rooney, 1990). The literature remains inconclusive as to the determinants of innovation in organizations because innovation has been classified in many ways, thus leading to confusion. For example, one approach classifies innovations into technological, administrative, and ancillary categories (Daft, 1978; Kimberly & Evanisko, 1987; Damanpour, 1987). Technological innovations occur in the operating component and affect the technical component of the organization. The technical component consists of the equipment and operational methods used to transform raw materials and information into products and services (Cummings, 1978). Administrative innovations change an organization's structure or its administrative processes (Damanpour, 1987). Ancillary innovations can be defined as organization-environment boundary innovations (Damanpour, 1987).

This study will focus on technological innovations because they are central to an organization's survival. There are several categories of technological innovations characterized by the sophistication of the innovation. First, there are complex systems of technological innovations such as the communications networks or weapon systems that are very complex accomplishments and take several years and millions of dollars to complete. This type of innovation typically requires long-range planning on the part of the developer. The success of this type of technological innovation depends on project teams to sort out the bad approaches to completion from the good approaches. This type of innovation is uncommon because few organizations face systems problems that accompany such complex innovations and even fewer are equipped to handle their development (Tornatzky et al., 1983).

Another kind of technological innovation is an invention or radical breakthrough in technology, which may change the whole nature of an industry. The jet engine, compact discs, and xerography are examples of major technological breakthrough. This type of innovation is rare and unpredictable and is usually accomplished by inventors or by research organizations outside the industry, because the technical core of organizations is usually occupied with short-term operations and daily activities. They are concerned with problems such as cost cutting, quality control and product improvement that will assist in their short-term goal of financial viability (Tornatzky et al., 1983).

The third kind of technological innovation is a prevalent innovation that is essential for organizations to survive (Tornatzky et al., 1983). It is either a process or product innovation used by organizations in the industry. An example of this type of innovation is the adoption of a computerized appointment scheduling system, rather than the continued use of a manual scheduling system. It is this general type of innovation that this study will examine because of their importance to organizations. Economic factors propel these types of innovations and failure to adopt such innovations risks the organization's demise (Marquis, 1969).

Innovation Adoption

Process research attempts to understand the stages that exist in the innovation process (Rogers, 1983, 1987). The most common model delineates a three-stage process of innovation: initiation, adoption, and implementation. This model is attributed to Thompson (1969) and restated by Pierce and Delbecq (1977). The first step, initiation, deals with an individual or individuals developing an innovative idea or proposal. The second step, adoption of an innovation, is represented by an organizational mandate for change. The third step, implementation of the innovation, is when it becomes ingrained within organizational behaviors. Innovative ideas primarily surface when organizational members become aware of a new way to meet a specified need (Delbecq, 1974). Organizational contexts that induce organizational members to adopt broad perspectives (Dewar & Hage, 1978) and to develop channels to relevant information sources (Allen & Yen, 1979) can be expected to experience more opportunities for innovation.

The adoption of an innovation can be viewed as a political process (Wilson, 1966) since adoption usually results in a reallocation of resources and changed behaviors. Organizational context characterized by a heterogenous group, or one that is resistant to change, might be expected to experience difficulty with an adoption. Organizational context characterized by a willingness for members to accept change, or a sense of openness and flexibility, may be important in the adoption of innovation.

The adoption of innovation is generally intended to contribute to the performance effectiveness of the organization (Hage, 1987). The study of the adoption stage of innovation is widely accepted throughout the organizational literature because it allows the researchers to analyze the correlates or determinants of innovation based on the one event, adoption. The present study will continue this accepted practice.

Organizational Climate

Past research demonstrates that organizational climate exists as an empirical construct (Drexler, 1977; Halfhill, Betts & Hearnsberger, 1991; Moran & Volkwein, 1992); O'Driscoll & Evans, 1988; Paolillo, 1982; Zohar, 1980).

Moran & Volkwein (1992:20) argued that organizational climate:

> "is a relatively enduring characteristic of an organization which distinguishes it from other organizations; and (a) embodies members' collective perceptions about their organization with respect to such dimensions as autonomy, trust, cohesiveness, support, recognition, innovation and fairness; (b) is produced by members' interactions; (c) serves as a basis for interpreting the situation; (d) reflects the prevalent norms and attitudes of the organizational culture; and (e) acts as an influence for shaping behavior."

Climate influences organizations in various ways: (a) the behavior and motivation of individuals in organizations (Bowers, 1976; DeCotis & Summers, 1987; LaFollette & Sims, 1975; Litwin & Stringer, 1968; Pritchard & Karasick, 1976; Schneider & Snyder, 1975); (b) the success of product innovations (Souder, 1987); (c) organizational performance (Franklin, 1973; Likert, 1961, 1967; Moss-Kanter, 1983; Mudrack, 1989), and (d) innovativeness (Abbey & Dickson, 1983; Dunegan, Tierney & Duchon, 1992; Rubenstein, 1989).

Organizational climate has been described as the shared perception of members of an organization who are all exposed to the same organizational structure (Joyce & Slocum, 1984). Zmud (1982) suggested that it is not the structure of the organization that triggers innovation, but rather, the organizational climate within which members recognize the desirability of innovation, and within which opportunities for innovation arise and efforts toward innovation are supported. Structure has also been viewed as an emergent property of ongoing action, or as a contour of human behavior (Barley, 1986). Thus, both perceptions and behaviors of the members of the organization may be critical for the successful adoption of technological innovations (Damanpour, Szabat & Evan, 1989).

Contingency Factors

Contingency theories have dominated the study of organizations and their performance for more than twenty-five years. All the models share common premises. The first is that the structure and the context of an organization must somehow fit together for an organization to perform well. The second premise is that assumptions exist about starting premises, boundaries and system states. The boundary specifies the ranges over which a relationship between the structure and context will hold. The system states specify the time and other conditions within which this relationship is to occur. This perspective proposes that there is no simple unconditional association among variables in a contingency model, but that relationships exist that are more complex based on the context of the relationship (Drazin & Van de Ven, 1985).

The contingency model suggests that contextual factors may affect the relationship between organizational climate and the adoption of technological innovation. The three contextual factors that have been chosen to be examined as contingency factors in the relationship between the adoption of innovation and the climate of an organization are organizational size, slack and age. Past literature has recognized the effects of some of the contextual factors on the climate attributes and innovation attributes, but little is known about how these contextual factors affect the relationship between organizational climate attributes and the attributes of the innovations.

Size of an organization has been identified in numerous studies as an important contingency variable. Through the years organizational size has been identified as a factor that has affected the innovativeness of a firm (Cooper, 1964; Fama & Jensen, 1983; Yeaple, 1992). A number of studies have suggested that small firms are more efficient at generating innovations than large firms. Yet, both small and large firms may be and have been innovative (Mintzberg, 1983).

Organizational slack has been recognized as a factor that explains a firm's innovative behavior (Bourgeois, 1981). Slack provides an organization a cushion of spare resources that can facilitate the adoption of a technological innovation.

Organizational age has appeared as a factor that leads to high levels of structural inertia (Hannan & Freeman, 1977, 1984). As organizations grow older, structural inertia increases because organizational members take time to learn, trust, coordinate with one another (Stinchcombe, 1965), and learn organization specific skills and routines (Nelson & Winter, 1982). This structural inertia may have a positive affect on the ability or propensity for older organizations to adopt technological innovations. Newer organizations typically have fewer available resources, low reliability, less ability to account rationally for organizational actions, all which lead to lower rates of innovation adoption.

Increasing organizational age has also been related to an organization becoming conservative and more traditional, similar to elderly individuals, who finds it difficult to change their ways (Khandwalla, 1977). On the other hand, older organizations have had the time to integrate for success through technological innovations (Shrivastava & Souder, 1987). A high level of integration tends to create and perpetuate an effective structure, climate, and planning process that makes it successful with technological innovations (Burns & Stalker, 1961; Souder, 1987; Souder et al., 1977; Souder et al., 1986).

1.3 POTENTIAL CONTRIBUTIONS OF THIS STUDY

This study has implications for both practicing managers and future research. The adoption of technological innovations can create a new surge of growth in an industry. Lacking the propensity to adopt technological innovations can be fatal to an organization competing in today's fast-paced economy. Within an industry, the adoption of innovations can lead to substantial competitive advantages, at least in the short term. This research will provide practicing managers a better understanding of the types of organizational climates that may position organizations to adopt technological innovations that are more radical and provide greater relative advantage. It will also identify the contextual factors that may affect the relationship between organizational climate and the adoption of more radical innovations and those with greater relative advantage.

The topic of adoption of innovation has inspired many researchers to examine why some organizations are more likely than others to adopt a technological innovation. Yet there is a significant gap in knowledge of the various factors and their interrelationships. This study will add to the innovation literature in several different ways. First, this study will extend the current literature by measuring the adoption of innovation differently than previous literature. Previously, adoption of innovation has been measured as a dichotomy, either an innovation is or is not adopted; or as a cumulative number of innovations they adopt over a period of time, without knowledge of the attributes of those innovations. This research will examine adoption of technological innovations as relative to the attributes radicalness and relative advantage.

Secondly, this study will provide a better understanding of how the attributes of organizational climate relate to the attributes of technological innovation. This study will provide an empirical assessment of past theoretic development on the correlations between attributes of organizational climate and innovation. It will also develop new theory in those areas where none has been developed concerning the relationship between climate and innovation attributes. Finally, this study will investigate beyond the main effects and explore how the contextual factors of organizational size, slack and age affect organizational climate attributes, innovation attributes, as well as the relationship between climate and innovation attributes.

Additions to the knowledge base of why and what makes certain organizations more inclined than others to adopt a technological innovation may provide a competitive edge to those organizations. In its study of technological innovation (Tornatzky et. al., 1983), the National Science Foundation suggested that a major question for future research is the relative importance of group dynamics and organizational context and how these factors influence the adoption of innovation by companies. This dissertation will examine the effects of some of the contextual factors that may affect the relationship between organizational climate attributes and technological innovation attributes. It will provide a comprehensive view of the effects of contextual factors organizational size, slack and age on the relationship between organizational climate and the adoption of innovation in hospitals.

Chapter 2

Literature Review

2.1 INNOVATION RESEARCH APPROACHES

The literature on innovations is vast and varied. Many disciplines have an interest in the process and outcome of innovation due to the assumption that innovation will generate a positive outcome for firms and individuals. Rogers (1983, 1987) found that at least ten different disciplines have studied innovation, including education, rural sociology, public health and medical sociology, marketing, and communication. Within the various disciplines there are over 3,000 publications on innovation. A major finding in reviewing the various studies is that there remains an inconsistency in the conclusions of the studies. Each discipline differs in its unit of analysis, data gathering method, and type of innovation studied. Although researchers have used a number of perspectives to study innovation (Hage, 1987), three of the perspectives will be introduced to provide an understanding of why the inconsistencies in results may have occurred. These three perspectives are: diffusion of innovation literature, innovation as a process or sequence of stages, and the organizational innovation adoption. All three of these perspectives have been used in innovation studies in management science. Each perspective's method of analysis, use in prior research, and applicability to this study is discussed.

2.1.1 Diffusion of Innovation

The first perspective focuses on diffusion of innovation. Diffusion of innovation attempts to predict the rate and pattern of spread of innovation over time among members of a social system (Rogers, 1983; 1987). Innovation diffusion has been one of the most widely researched areas. The most notable study is on the diffusion of hybrid corn (Mahajan & Peterson, 1985; Ryan & Gross, 1943). Although the initial interest may have been in the field of agriculture, by the 1950's there was additional interest in the diffusion of innovation in many other disciplines.

Organizational scholars were interested in the models and processes of innovation diffusion among organizations. Economists were interested in the factors affecting the transfer of technology. Sociologists were interested in the cultural outcomes and the social changes that occur due to the diffusion of innovation (Radnor, Feller & Rogers, 1978). Overall, these researchers have identified factors that influence innovation diffusion. These factors are environmental characteristics (e.g. munificence and dynamism), the communications process in organizations, the characteristics of the innovation (e.g. compatibility, complexity, relative advantage, trialability), the characteristics of the adoptor (e.g. age, education, cosmopolitanism), and the particular social groups that are affected or influenced by innovation diffusion (Rogers, 1983).

The original diffusion research initially dealt with the behaviors of individuals such as farmers with corn and doctors with medical technology. The earlier works in diffusion research were extended by examining the effects of the characteristics of individuals. In addition, researchers examined the relationship characteristics of managers and the structure of the organization had with the diffusion of innovation (Mort, 1953; Rogers & Shoemaker, 1971).

There were significant differences between the earlier individual innovation diffusion research and organizational diffusion research. In individual diffusion research the decision is voluntary and usually a simple decision made by one individual. In organizational diffusion research the decision to adopt or diffuse an innovation is not a simple decision made by an individual, but tends to be a complex decision process involving many decision makers. In organizational innovation diffusion research there are other factors that complicate the research process such as the organizational structure, the strategy, and inter- and intra-organizational relationships that can affect the process of diffusion. Therefore, the innovation diffusion approach has not been used successfully in organizational research because of the measurement difficulty it presents.

2.1.2 Innovation as a Process

The second perspective focuses on the process of innovation which considers innovation as identifiable stages. (Rogers, 1983). Various models in the process of innovation have been proposed. There is general agreement among the different models that innovations go through similar stages. The first stage is awareness and entails recognizing the existence of a problem or an opportunity for innovation. The second stage is an initial evaluation or experimentation, and entails matching a problem or opportunity to the innovation. The third stage is the evaluation stage and entails a cost-benefit appraisal of the innovation. The fourth stage is known as the persuasion stage, and entails an attempt to influence those individuals who may have a negative attitude toward the innovation or may hinder the innovation process. The fifth stage is the adoption stage and entails making the decision to adopt or reject the innovation. The sixth stage is the implementation stage and entails the implementation of an innovation. The final and seventh stage is institutionalization and entails reviewing the innovation decision and accepting it as a standard procedure.

Most research in this area deals with one stage of the innovation process because of the complexity involved in delineating all the stages. Some examples of these studies are Ettlie's (1980) transportation industry study and Pelz's (1983) solid waste management study. Each of the studies concentrated on the implementation stage. The methodology in these studies was longitudinal (during the period of implementation) and consisted of interviews and case studies. A major conclusion of these studies is that given a particular source and type of innovation, there will be a predictable order in the process of the innovation decision to implement an innovation.

The difficulty with the innovation process perspective is that by decomposing the organizational innovation, the researcher must focus on the determinants of each particular stage as well as the sequential nature of the events. Researchers have found it difficult to distinguish between the particular stages. The stages in the innovation process have no distinct lines of demarcation as to when one stage ends and the next stage begins. Not only are the stages not necessarily in the order described earlier, but they may not be sequential in nature. For example, frequently a prototype can be initially adopted, then evaluated and reconstructed, before going ahead with a full scale adoption. Therefore, the applicability of this perspective to organizational innovation research is limited because of the complex, dynamic and interdependent nature of organizations and their subunits, making it difficult to identify individual stages and their determinants. The innovation process perspective also requires a longitudinal study; to be able to study satisfactorily all the seven phases of a reasonably complex and important innovation may span five years which extends far beyond the resources available for most studies.

2.1.3 Organizational Innovation Adoption

The third perspective is organizational innovation adoption. The objective of this research stream is to understand the determinants of innovation adoption in organizations. There are three basic types of innovations: technological innovation, administrative innovation, and ancillary innovation (Daft, 1978; Damanpour, 1987, 1991, Kimberly & Evanisko, 1981).

Organizational innovation adoption research has evaluated determinants of innovation adoption at four different levels: organizational, environmental, individual, and strategic. The type of innovation has differed, but a majority of the studies focus on characteristics of organizational structure as the determinants of innovation adoption. Structural characteristics examined and found to have the greatest effect on innovation include differentiation, centralization, specialization, complexity and formalization (Damanpour, 1987, 1991; Ettlie, Bridges & O'Keefe, 1984; Kimberly & Evanisko, 1981). The strategic orientation of the organization has been examined as a determinant of innovation adoption in organizational innovation literature. The strategies examined include technology strategy, marketing strategy, growth strategy, and diversification strategy (Ettlie, 1983; Ettlie, Bridges & O'Keefe, 1984). A strong technological, marketing, growth and diversification strategy were all positively associated with the adoption of more radical innovations.

The environment has been examined as a determinant of innovation adoption in past research. Examples of how the environment has been viewed in past research include uncertainty, competition, heterogeneity, and change (Baldrige & Burnham, 1975; Ettlie, 1983; Kimberly & Evanisko, 1981). Individual characteristics of top management have been examined as a determinant of innovation adoption in organizational research. Examples of individual characteristics are education, tenure, area of expertise, and attitude toward change (Baldridge & Burnham, 1975; Kimberly & Evanisko, 1981; Ettlie, 1983; Zmud, 1984; Dewar & Dutton, 1986).

The most frequently used research methodology for the organizational innovation adoption studies is collection of cross-sectional, primary data, and analyzing these data using statistical techniques such as regression or correlation analysis (Baldridge & Burnham, 1975; Ettlie, 1983; Kimberly & Evanisko, 1981; Rogers, 1983). Innovation adoption is typically operationalized as the number of innovations a firm adopts in a specified time period, so it is a cumulative number (Baldridge & Burnham, 1975; Daft, 1978; Kimberly & Evanisko, 1981).

Recently, in his meta-analysis, Damanpour (1991) found that structural characteristics of an organization tend to be most closely related to those organizations that adopt innovation. He found (1) positive relationships between innovation adoption and specialization, functional differentiation, professionalism, administrative intensity, slack resources, and external and internal communications; (2) a negative relationship between innovation adoption and centralization; and (3) nonsignificant relationships between innovation and formalization and vertical differentiation.

The results of his meta-analysis confirmed the hypothesized relationships between the determinants and innovation adoption except for formalization, managerial tenure, and vertical differentiation. Other findings in Damanpour's (1991) study were: a weak positive relationship between adoption of innovation and slack resources, a strong positive relationship between size and innovation.

Even though organizational researchers can choose to use any of these three research streams, there are reasons why the organizational innovation adoption research perspective is the most attractive. As noted, applying the diffusion of innovation research perspective at an organizational level is complex because the decision to innovate is not a simple individual decision. It is complicated by the organization's hierarchy and the interrelationships among the many individuals who may be part of the decision process. The innovation process research perspective becomes complex in an organizational context. The lines of demarcation between stages is hazy at best. Not only are researchers required to be concerned with the sequential nature of the innovation process, but they must also seek to understand the determinants of every stage in the innovation process.

In organizational innovation adoption research, the innovation adoption is the stage which is studied at great depth, thus, eliminating the need for identification of each stage and its determinants. The type of innovation can be defined through its attributes, such as organizational focus (administrative, technical or ancillary), or radicalness of innovation. The determinants are recognized as evolving from one of four levels; the individual, organizational, environmental, or strategic. The research is usually cross-sectional, which allows researchers to complete their data collection in a reasonable period of time.

The majority of the innovation studies have pursued one basic approach to collecting innovation data. First the researchers choose a particular industry in which to proceed with their research. An inventory of innovations, whether it be administrative or technical innovations, is developed in the preliminary study. As an example, Damanpour (1987, 1991) and some of his colleagues researched innovations in the public libraries. A list of innovations was developed through a literature search, as well as through a series of individual interviews and group meetings with librarians, library executives, and educators in five locations. Approximately 100 innovations were listed under eight functional categories in the questionnaire. To preserve the integrity of the innovation scores for early adoptors, it was decided to exclude those innovations that were widely adopted before a specific time period. The criteria that determined the exclusions were :(1) whether more libraries terminated than implemented the innovation in the period between 1970-1982, and (2) whether more libraries implemented the innovation before 1970 than in 1970-1982.

Prior to this method, the measure of technical and administrative innovations was seldom based on a comprehensive list of innovations. Researchers usually focused on innovations adopted in one part of the organization or focused on several major organizations. The more recent studies use a comprehensive list of technical and administrative innovations that contain most, if not all, of the innovations in that industry adopted in a particular time period. It has been argued that obtaining data on the adoption of a large number of innovations provides a more valid profile of innovation adoption behavior (Daft & Becker, 1978; Damanpour & Evan, 1984). Damanpour and Evan (1984), for example, studied 40 technical and 27 administrative innovations in their analysis.

Past studies have measured innovations by initially consulting with experts in the industry who develop a list of innovations. The respondents are asked to acknowledge the innovations they have adopted from the experts' list of innovations in the industry. Consideration for the type of innovation (i.e administrative, technical or ancillary) was not always taken into account. However, research has shown that the determinants for any stage in the innovation process or any type of innovation, for example, implementation or adoption for administrative innovation, is not the same as the determinants of another innovation stage or type such as technological innovation (Baldridge & Burnham, 1975; Daft, 1978; Downs & Mohr, 1976, Pennings, 1975). Thus, we are unable to generalize the determinants of one innovation stage to another innovation stage. Meaningful results are dependent upon a clear recognition of the type of innovation, and the stage of the innovation process studied.

In most recent studies, as noted, adoption of innovation has been operationalized as the number of innovations with little regard for other attributes other than organizational focus (i.e. technical or administrative innovations). It has been suggested that by providing a common frame of reference, such as a specific typology of organizational innovation, it would afford more consistency and a more precise conceptualization of innovation (Hage, 1987; Zaltman, Duncan & Holbeck, 1973).

Due to the nature of this study, where a large number of organizations and how their climates influence the adoption of innovation is being studied, the organizational innovation-adoption research method seems most appropriate. In addition to evaluating the adoption of technological process innovations based on the primary accepted method of a cumulative number of innovations adopted by the organization, this study also evaluates the attributes of the innovations. The following section discusses the research on the attributes, including their classification and definitions.

2.2 ATTRIBUTES OF INNOVATION

Though many typologies have been proposed (Daft & Becker, 1978, Rogers & Shoemaker, 1971; Tornatzky et al., 1983), no accepted list of attributes has emerged. Rogers and Shoemaker (1971) proposed a typology based on three criteria: (a) recognition of the need for an innovation, (b) the innovative idea itself, and (c) whether the innovation emerged from within or from outside an organization. The authors identified five attributes of innovations: relative advantage, compatibility, trialability, complexity, and observability. Since the emergence of these initial attributes in the literature, a stream of attributes and characteristics of innovation has evolved. For example, Zaltman et al. (1973) extended Rogers' and Shoemaker's (1971) list of five attributes to a list of twenty-one attributes. Other typologies and attributes have appeared since then (Beyer & Trice 1978; Daft & Becker, 1978; Nord & Tucker, 1987).

Downs and Mohr (1976) differentiated primary and secondary attributes of innovation. Primary attributes are used as a means of differentiating innovation between organizations. Primary attributes are inherent to the innovation itself without reference to who adopts the innovation. Since they are invariant across organizations, they are considered more objective attributes of innovation. Secondary attributes are a means of differentiating innovations within organizations. Perceptions of organizational members are the basis for differentiating the secondary attributes. Secondary attributes are, therefore, influenced by the characteristics of the particular settings and actors involved in adopting that innovation.

The innovation-characteristics research describes the relationship between the attributes or characteristics of an innovation and the adoption of the innovation. According to Downs and Mohr (1976), this body of research focused on both the primary and secondary attributes of innovations, but fails to relate the distinctions and relative importance between the two.

2.2.1 Primary Attributes

Past research has proposed the following as the primary attributes of innovation: organizational focus (Daft & Becker, 1978; Nord & Tucker, 1987), physical properties (Rogers, 1983), pervasiveness (Beyer & Trice, 1978; Zaltman, Duncan & Holbeck, 1973), uncertainty (Zaltman, Duncan & Holbeck, 1973; Pelz, 1983), observability (Rogers &

Shoemaker, 1972; Tornatzky & Klein, 1983), radicalness (Pelz, 1983; Nord & Tucker, 1987; Zaltman, Duncan & Holbeck, 1973), complexity (Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982), magnitude (Beyer & Trice, 1978), centrality (Nord & Tucker, 1987), and adaptability (Zaltman, Duncan & Holbeck, 1973; Tornatzky & Klein, 1982).

2.2.2 Secondary Attributes

Innovation researchers have proposed the following attributes of innovation as secondary attributes: compatability (Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982), social approval (Tornatzky & Klein, 1982), relative advantage (Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982), slack vs. distress (Zaltman, Duncan & Holbeck, 1973), originality (Nord & Tucker, 1987; Pelz, 1983), and instrumentality (Zaltman, Duncan & Holbeck, 1973).

This research also evaluates the attributes of the innovations across firms. It must be noted, however, that the meaning given to the specific primary/objective attribute in reality is subjective as well, since the attributes will always be in the mind of the perceiver. For example, although complexity is considered a primary attribute, the complexity of the innovation is evaluated by the adoptors relative to their available skill base and sophistication level. Therefore the objective rating of a particular primary attribute will be, to a fair extent, a subjective rating as well.

Tornatzky and Klein (1982) provided suggestions as to how to improve innovation-characteristics research. Some of their recommendations to improve research quality were: (a) innovation characteristics should be able to predict the critical events of the phenomenon, so the characteristics should be assessed prior to, or concurrent with the decision to adopt, (b) innovation-characteristics research should use a richer concept of adoption as the dependent variable rather than a simple dichotomous variable, (c) studies should use quantitative methods that are reliable, replicable and allow some degree of statistical power, (d) innovation-characteristics research should use several characteristics of the innovations examined, and (e) research should be conducted on innovations adopted by organizations and not individuals, since the innovating organization is the researcher's real interest. Except for the first recommendation, all other suggestions have been taken into consideration in this research.

A criticism of innovation research is that there has been an assumption that a universal theory of innovation can be developed that applies to all types of innovations. Dewar and Dutton (1986) proposed that different models are needed to predict the adoption of technological innovation based on the type of innovation involved in the adoption. Previous empirical support for this proposition is found in the literature (Damanpour, 1987; Kimberly and Evanisko; 1981).

Innovations not only have attributes, both primary and secondary, but innovations can also be classified by type. The type is based on the aspect of the organization to which the innovation is most relevant and whether the innovation is a process or product innovation. The innovation type is discussed next.

2.2.3 Types of Innovation

Innovation is viewed from an organizational focus on three different levels: technological innovation, administrative innovation, and ancillary innovation. It is to be noted that all types of innovation do not have identical attributes and therefore do not relate equally to the same organizational factors, and that the process of implementation or initiation for the different types of innovation are not identical (Damanpour, 1987; Daft, 1978; Kimberly & Evanisko, 1981).

Technological innovations bring change to the organization by introducing changes in the technological core (Dalton, Barnes & Zaleznik, 1968). Technology is usually viewed in its most basic level; as a tool, technique, physical equipment, or systems by which the employees or the organization extend their capabilities (Schon, 1967). Therefore, technological innovations are the result of a new tool, system, or technique.

Administrative innovations are those that change an organization's structure or its administrative processes (Damanpour, 1987). These innovations are directly related to the management of the organization and indirectly related to the basic work activity of the organization (Kimberly & Evanisko, 1981). Some examples of administrative innovations are management by objectives, zero-based budgeting, job-rotation, and flextime.

Ancillary innovations span the organization-environment boundary (Damanpour, 1987). These innovations are developed specifically to assist the organization in its interrelationships with other environmental constituents. Examples of ancillary innovations are career development programs, tutorial services and adult continuing-education programs.

Product innovation has been described as both new product development and existing product modification (Romano, 1990). Process innovation is defined as the adoption of a process that is new to an organization (Damanpour, Szabat & Evan, 1989).

A review of the literature suggests that each empirical study has defined innovation in a way that is dependent on the industry in which the analysis was performed. As an example, Damanpour (1987) developed a list of library innovations adopted during the 1970's, through a literature review, and then refined it through a series of interviews and group meetings with librarians, library executives, and educators in several locations. The process resulted in three categories of innovations: 26 technological, 22 administrative and 13 ancillary innovations.

Baldridge and Burnham (1975) analyzed organizational innovation adoptions in school systems. They interviewed principals, superintendents, and department chairmen who specified innovations that were considered for adoption. They had to meet three conditions: "Extensiveness", the innovation had to cover a large number of people and/or processes in the school; "Importance", people knowledgeable in the field of education believed that the innovation had real promise for making a major change; and "Longevity potential", the innovations had to be well established and would continue for a significant period of time.

Product innovation and its adoption was the subject of Miller and Friesen's (1982) study that found that the determinants of product innovation in firms are to a great extent a function of the strategy being pursued. An entrepreneurial, rather than a conservative, strategy increases the rate of innovations in organizations. Process and product innovation were the focus of Ettlie's (1983) research that found that organizational size, perceived environmental uncertainty, and technological policy influenced the rate of innovation. Zmud (1984) in his research in 47 software firms found that receptivity was a determinant of technological innovation. Managerial attitude toward change was instrumental in the adoption of administrative innovation. Thus, variables at all organizational levels including individual, contextual, and organizational variables, have been found to influence the adoption of both administrative and technological innovations; with organizational variables having the greatest influence (Kimberly & Evanisko, 1981).

To summarize, innovation has been viewed in many different ways in the literature. Innovation are either process or product innovation, and can be considered from three perspectives (Daft, 1978; Damanpour, 1987, 1991; Kimberly & Evanisko, 1987); that of technological innovations, administrative innovations and ancillary innovations. This study will focus on the adoption of technological process innovations, specifically in the process of providing patient care.

Two specific attributes of technological innovations were chosen because of their inherent interest in past literature, pertinence to the characteristics of process innovation, and to maintain tractibility in developing a contingency approach to adoption of process innovation. One primary and one secondary innovation attribute were chosen for this study to capture both an objective measure and perceptual measure. The first attribute chosen in this study is radicalness, which has been proposed as a primary attribute in past research. Radicalness is the extent to which an innovation requires completely new behaviors for the organization or its members (Munson & Pelz, 1979; Nord & Tucker, 1987; Pelz, 1985; Zaltman, Duncan & Holbeck, 1973). The extent to which an innovation is either radical, containing a high degree of new knowledge, versus incremental, a low degree of new knowledge, has been recognized as one of the main attributes of an innovation (Dewar & Dutton, 1986). This attribute has provided a way of distinguishing innovation types, and has been used in empirical studies (Dewar & Dutton, 1986; Ettlie, Bridges & O'Keefe, 1984).

The second characteristic is the relative advantage of the innovation, which is a secondary innovation attribute. Relative advantage is the extent to which an innovation is perceived as being better than the idea which it supersedes (Rogers & Shoemaker, 1971; Tornatzky & Klein, 1982; Zaltman, Holbeck & Klein, 1982).

In the following section the two attributes of innovation that were chosen for study in this research, radicalness and relative advantage, will be explained more fully.

2.2.4 Radicalness and Relative Advantage

There is still considerable uncertainty in the innovation-characteristics research. Research has not confirmed whether the correlates of radical or incremental innovations differ (Dewar & Dutton, 1986). Dewar and Dutton's (1986) findings did provide support for their general contention that the predictors of radical and incremental innovation adopters differ, with the depth of technological knowledge and size of the organization as predictors of radical innovations.

While innovation has been defined as an idea, practice, or material good perceived to be new by the adaptor (Zaltman, Duncan and Holbeck, 1973), this general definition of innovation does not indicate the varying degree of newness that its adoption has to the adopting organization. This difference is captured, in part, by the concept of radicalness in innovation. Radical and incremental describe different types of technology in the innovations (Dewar & Dutton, 1986). A radical innovation, in addition to being new to the organization, is very different from what the organization has done previously. This type of innovation usually requires significant changes in the behavior of employees and degree of new knowledge embodied in the technology (Kaluzny, Veney & Gentry, 1972). It is widely believed that the requirements for successful radical innovation is different from those for a successful incremental innovation (Nord & Tucker, 1987). The more radical the innovation, the greater the change from the status quo, and the more changes in information, values, and incentives, among other things. As an example, Nord and Tucker (1987) found that a whole new organizational structure, the use of a project team rather than committees, was necessary to implement the NOW accounts at the First National Savings and Loan. The NOW account was considered a radical innovation for a Savings and Loan in the late 1980's.

An incremental innovation is a minor improvement or adjustment in current technology (Munson & Pelz, 1979). Incremental innovations only involve minor changes in the task system which can be accommodated without major adjustment in the organizational system (Nord & Tucker, 1987). The difference between the radical and incremental innovation is intuitively easy to understand, but has not been that easy to define or measure. Radical and incremental innovation has been perceived as the degree of new knowledge in the technology, and can be perceived differently based on a manager's experience and exposure to the technology (Dewar & Dutton, 1986; Nord & Tucker, 1987). The discrimination between radical and incremental innovation is then not one of rules of distinction, but is developed as a continuum that ranges from radical to incremental (Hage, 1987).

Ettlie (1983) also documented the importance of radical and incremental innovation distinctions. He stated that his theoretical model includes three factors thought to be associated with innovation adoption. The most important is the radicalness of an innovation and concerns the distribution of technological knowledge or the depth and diversity of technological knowledge, and the extent of exposure to information obtained from outside resources. Radical innovations incorporate a large degree of new knowledge, and organizational complexity in the number of specialists and the depth of the knowledge resources which may be represented for example, as the number of technical or engineering employees.

In contrast, the depth of technological knowledge and complexity of an organization should be less important for incremental innovations because adoption of this type of innovation requires less knowledge resources. It has been proposed that incremental innovations require less technological expertise and a more decentralized structure because the adoption can be facilitated by simple exposure to innovations in the external environment (Nord & Tucker, 1987).

The degree of relative advantage has been expressed in many different ways. It has been expressed as economic profitability, status given, initial cost, and savings of time and discomfort. The nature of the innovation largely determines what specific type of relative advantage (i.e., social, economic, or savings) is important to the adoptors. Martino, Chen and Lenz (1978) evaluated relative advantage by examining the new innovation relative to whatever that innovation replaced. Their relative advantage measure included profitability, productivity, and reduced labor requirements.

This researcher found that experts in hospital technology perceive three general reasons why a hospital would adopt a new medical technology. The first is due to the competition in their market, which would relate to a strategic relative advantage. The second advantage is that without the technology, they may be viewed as not practicing contemporary medicine which could result in a malpractice suit. The third advantage to acquiring a piece of new technology would be that the technology could prove to be a profit center to the hospital.

An important motivation for some organizations may be the desire to gain status. This status can be viewed as recognition and respect by their industry, or their customers. This position of status can also be seen as the status due to organization's competitive position in the industry, such as a gain in market leadership. The relative advantage of status may be true in the hospital industry where many of the smaller organizations are viewed by their customers as altruistic. There may be small rural hospitals that initially evolved to provide health care services to an under-served rural population. The hospital remains small, still maintaining their altruistic goal, while surrounding hospitals grow, develop or merge with a large health care conglomerate to maintain competitive. The recognition for the small hospital's altruism may be an over-riding relative advantage to that hospital. The small rural hospital may have a difficult time justifying the purchase of a CAT-scan due financial hardship and little need, but they still may ultimately purchase one to maintain their altruistic image.

To summarize, the primary innovation attribute of radicalness and the secondary innovation attribute of relative advantage, and their importance to adoption of innovation in this study were discussed. The concept of organizational climate and its development in the literature will be developed in the following section.

2.3 THE CONCEPT OF ORGANIZATIONAL CLIMATE

Climate has a long history in the fields of industrial and organizational psychology and organization theory. It also has a prominent place in present day research. The construct of organizational climate was first introduced in the late 1960's and there was little agreement amongst researchers about the definition of climate (Schneider, 1990). Early studies considered climate to be a correlate of work motivation and productivity (Litwin & Stringer, 1968) or salesperson success (Schneider & Bartlett, 1970).

Despite a praise-worthy beginning which employed empiricism, subsequent research was wrought with numerous conflicts. It can be inferred from the work of James and Jones (1974) that differences in the research resulted from varying approaches to defining and measuring the construct of climate. The conceptual and operational definitions, measurement techniques and results are diverse, and at times, contradictory. After reviewing the major theoretical concerns and relevant research related to organizational climate, Moran and Volkwein (1992) found four separate approaches to climate: structural, perceptual, interactive, and cultural. They are not mutually exclusive, but lead to distinct methods of analysis.

2.3.1 The Structural Approach

In the structural approach, climate is considered to be an objective manifestation of the organization's structure (Guion, 1973; Indik, 1965; Inkson, Pugh, & Hickson, 1970; Payne & Pugh, 1976). Climate is regarded as an attribute of an organization itself, and exists independently of the perceptions of individual members. The organization's climate evolves because the members are exposed to common structural characteristics of the organization. Since the organization's members are exposed to the same internal organizational environment, they tend to have similar perceptions that ultimately represent their organization's climate.

The structural approach considers the objective structural characteristics of the organization and its relationship with its members' perceptions of the organization's structure. Researchers have found that the setting and conditions of the organization affect the organizational members' attitudes, values, and perceptions of organizational events (Lawler, Hall & Oldham, 1974; Indik, 1965; Inkson, Pugh & Hickson, 1970; Payne & Pugh, 1976). Therefore, the organization's climate develops from the objective structural characteristics of the organization such as size, decentralization, vertical differentiation, nature of the technology employed and the extent of formalization.

Figure 2.1 provides a schematic representation of the structural approach. As noted earlier, the organization's structure produces the organization's climate with its own properties, perceived by the members of the organization. Therefore the organization climate is the objective manifestation of the organization structure which the members of the organization encounter. The climate becomes the common perception of members who are exposed to a common organizational structure.

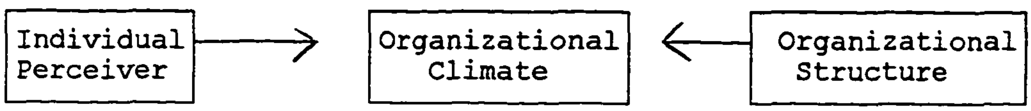


Figure 2.1

The Structural Approach to Climate

(from Moran & Volkwein, 1992)

2.3.2. The Perceptual Approach

The second approach is the perceptual approach. The perceptual approach places the basis for climate formation within the individual. A similar approach called the perceptual measurement-individual attribute approach is conceptualized by James and Jones (1974) which stipulates that climate should be measured by individual perceptions. This is interpreted to mean that climate includes not only descriptions of situational characteristics, but individual differences in perceptions and attitudes.

This approach is not based solely on the objective descriptions of structural attributes, but it incorporates the individual's interpretation and response to the organizational situation in a way that is psychologically meaningful to them. Climate is then an individual's psychological perception of the organizational situation. It is the product of perceptual and cognitive processes that are an interpretation of the situation in a manner that is psychologically important to the individual (James, Hater, Gent & Bruni, 1978; James & Jones, 1974).

The individual perceives organizational conditions and creates a psychological representation of climate. Organizational conditions are represented by the structure of the organization with its accompanying process characteristics. Some of the process characteristics are communication, influence, leadership, and decision making patterns that exist in the organization. It may be noted that the perceptual approach to organizational climate will be moderated by such variables as individual personality, task structure, and supervisory style (Field & Abelson, 1982).

There are two methods which lead the individual's perceptions to be aggregated as perceptions of organizational climate. The first method is the selection-attraction-attrition (SAA) approach which suggests that organizational members have common perceptions and have similar meaning of organizational situations because the members themselves are similar to one another (Schneider & Reichers, 1983). The other method is through the development of "Collective Climates" (Joyce and Slocum, 1982). Collective climates classifies people based on their agreement of perceptions of the organization climate; therefore, this leads from individual to aggregate perceptions. Figure 2.2 is a schematic representation of how individuals perceive organizational conditions creating a representation of climate (Moran & Volkwein, 1992).

2.3.3. The Interactive Approach

The third approach, called the interactive approach, builds on the previous two approaches. It is neither built on the premise that the origin of the climate is within the characteristics of the organization (the structural approach) nor does it suggest that the concept of climate is

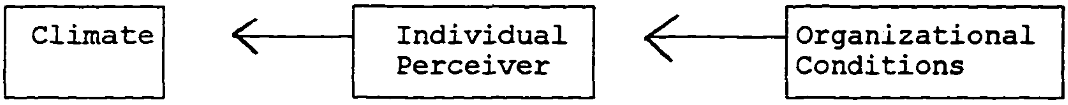


Figure 2.2

The Perceptual Approach to Climate

(from Moran & Volkwein, 1992)

strictly within the individual (the perceptual approach). It assumes that situational and individual characteristics interact to produce a third set of intervening perceptual variables. They are the individual attributes which provide a bridge between a situation and behavior. The basis of this approach is that the interaction of individuals in responding to their situation combines to develop a shared agreement which is the source of organizational climate (Moran & Volkwein, 1992).

Researchers who pursue this interpretation of climate have defined organizational climate as the combined effects of personality characteristics in interaction with structural elements of the organization (Gavin, 1975; George & Bishop, 1971). Recent empirical research on climate has suggested that communication is the central component in the construct of organizational climate (O'Driscoll & Evans, 1988).

There are a few ways that the interactive approach can be interpreted. In one interpretation, it can mean there is an interaction among individuals as they engage in interpreting organizational realities. In another interpretation, it can mean that there is an interaction between the objective conditions and the subjective awareness in the process of generating meaning to organizational situations (Moran & Volkwein, 1992). This implies different assumptions than the previous two approaches. The interactive approach assumes that both the subjective and objective nature of the organization are combined to create the realities of the organizational climate (Moran & Volkwein, 1992).

This approach, then, acknowledges that individuals create shared perceptions of their organizational surroundings and therefore a climate evolves (Ashforth, 1985). It further suggests that this common frame of reference is not static, based on an objective reality, but is fluid and evolves from the interaction of the individuals and their surroundings. Meaning derived from the organization can be considered "socially constructed" (Berger & Luckman, 1967; Mumby, 1988). Figure 2.3 displays the relationship among the variables: individual perceiver, the organizational conditions, the interaction among group members, and the organizational climate.

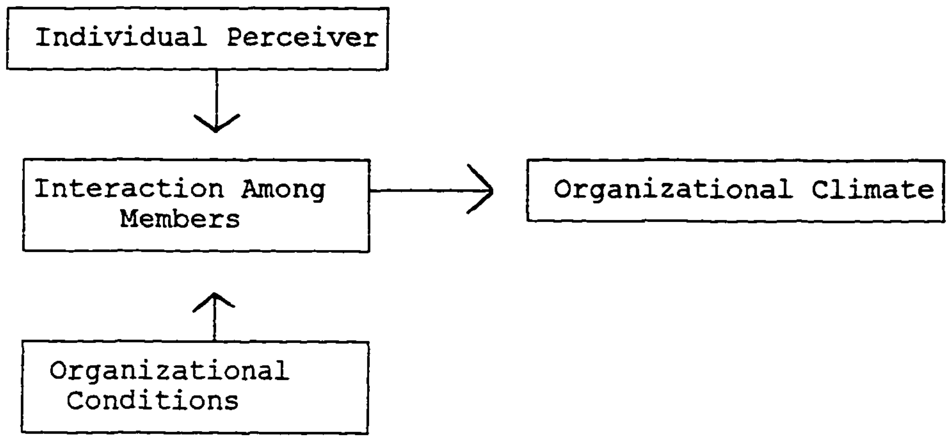


Figure 2.3

The Interactive Approach to Climate

(from Moran & Volkwein, 1992)

2.3.4 <u>The Cultural Approach</u>

The cultural approach focusses on the way in which groups interpret, construct, and negotiate reality through the creation of organizational culture. Organizational culture is a system of shared values communicated and perpetuated by members via traditions and practices. These organizational distinct values determine the degree to which internal practices are integrated with the external environment (Halfhill, Betts & Hearnsberger, 1990). Thus, culture exists in the interaction of individuals and their shared meanings.

The organizational conditions are the basis on which individual perceptions vary. Individual perceptions vary by the person's personality and cognitive characteristics. These perceptions are in turn influenced by the interactions of other individuals, which in turn influences the organizational climate. The schematic below (Figure 2.4) also depicts climate as influenced by the organizational culture which moderates individual perceptions and influences interaction among individuals. Whereas climate influences interaction within the organization, the interaction between individuals influences the organizational climate, and the climate can ultimately alter the culture. In summary, this approach suggests that the organizational climate is created by a group of interacting individuals who share a common meaning as they try to interpret and deal with organizational conditions.

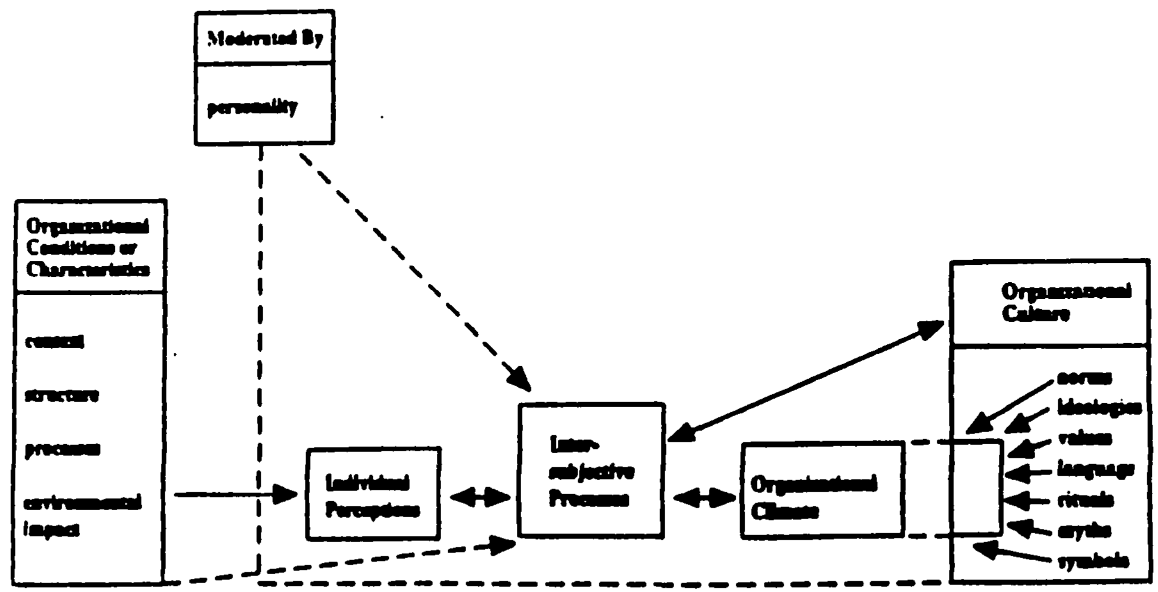


Figure 2.4

The Cultural Approach to Climate

(From Moran & Volkwein, 1992)

It is important to know which climate approach a researcher is assessing. Organizational climate refers to an organizational attribute, and a collective description of an environment, usually assessed through the average perception of organizational members. They perceive the way an organization deals with its members and environment (Hellreigel & Slocum, 1974). Schneider (1975) suggests that the longer individuals have been in contact with an organization, the more difficult it will be to affect their climate perceptions. Over time, the summery perceptions become less subject to change.

Many who use the term climate have also referred to interpersonal practices, which is the social climate of an organization. This is also called the psychological climate, because it refers to a psychological process whereby an individual employee translates the interaction between perceived organizational attributes and individual characteristics into a set of expectancies, attitudes, and behaviors (James & Jones, 1974; Joyce & Slocum, 1982).

The Interactive approach to organizational climate is defined as the combined effects of personality characteristics in interaction with the structural elements suggesting that there is a fluid nature to the organizational climate. The Cultural approach to organizational climate considers individual perspectives, individual and organizational values, and their interaction among groups of individuals within the organization.

These perspectives require the researcher to understand and evaluate the interaction among the members, the objective conditions and subjective awareness of each perceiver based on their personality characteristics. These approaches would require the researcher to track the various interactions and the consequential changes in the organizational climate over an extended period of time. Such an endeavor was beyond the scope of this study given the objective of this study was to investigate the relationship between climate attributes and innovation and not the formation of climate within organizations.

This study will therefore use the perceptual approach to organizational climate as the basis for analysis, which is at the organizational level. This approach suggests that the organizational conditions influence individual perceptions which lead to the aggregate perceptions of the organizational climate. The premise of this study is that climate is at the organizational level, but it is perceived by the individuals within the organization. Specifically, in the adoption of technological innovation, it is the perception of those individuals who make the decisions to adopt innovations that will influence the organizational climate.

Initial researchers in the field, Litwin and Stringer (1968) conceptualized and operationalized organizational climate by reporting six perceptual dimensions. Their studies were rigorously designed and the dimensions they proposed are widely used by climate researchers. They used the term "dimension" as an aid in visualizing and conceptualizing the construct. The dimensions they isolated and defined center around an organizational task or group of tasks: (1) structure and constraint, the feeling workers have about constraints in their work situation; (2) emphasis on individual responsibility, making decisions and implementing decisions without much supervision; (3) risk, moving the organization forward despite the challenge of uncertainty; (4) reward, the feeling of being rewarded for a job well done; (5) warmth and support, the feeling of general good fellowship and helpfulness that prevails in an organization; and (6) conflict, the feeling that management is not afraid of entertaining differing and conflicting opinions.

In the twenty-five years since their initial work, there have been differing beliefs about exactly how many dimensions of climate exist and how the dimensions are defined. Whereas most authors have used organizational climate as a descriptive concept, some have used it to classify organizations into categories (Burns & Stalker, 1961; Likert, 1967). Many organizational processes are related to climate, which in turn has been linked to satisfaction and performance (Lawler et al., 1974). Joyce and Slocum (1979) stated that all climates are perceptions that individuals have of their environment.

In Joyce and Slocum's (1979) study, organizational climates were identified by a series of analyses that clustered individuals on the basis of profile similarity for six dimensions: (1) rewards, the extent to which adequate rewards are available within the organization and are contingent upon performance; (2) autonomy, the extent to which employees are allowed to plan and schedule their work as they chose; (3) motivation to achieve, the degree to which members of an organization are viewed as attempting to excel or advance themselves; (4) centrality, the degree to which management is insensitive to the interests, needs, and aspirations of those reporting to them; (5) closeness of supervision, the extent to which superiors actively direct or intervene in the activities of their subordinates, and (6) peer relations, the degree to which supervisors at equivalent organizational levels maintain warm and friendly relationships.

An aspect of the climate construct that has been recently analyzed is the widely held view that climate is the shared perception of the way things are in an organization. Specifically, it is shared perceptions of organizational policies, practices, and procedures, both formal and informal (Schneider & Reichers, 1983). In keeping with that view, climate is then a concept which explains an organization's goal and the means used to attain it. Hellreigel and Slocum (1974) defined the construct by an adaption of conceptions from a number of researchers. They stated that organizational climate refers to a set of attributes which can be perceived by a particular organization and/or its subsystems, and may be inferred from the way an organization deals with its members and the environment. Implicit in this definition of organizational climate is the following: perceptual responses sought are primarily descriptive rather than evaluative; the level of inclusiveness of the times, scales, and constructs are macro rather than micro; the units of analysis of the organizational attributes are not specific to any individual; and the perceptions have potential behavioral consequences (Schneider & Reichers, 1983).

Pareek (1987) stated that climate can only be discussed in terms of how it is perceived or felt by organizational members. He postulated that only Litwin and Stringer's (1968) framework emphasized the effect of organizational climate on motivation of its employees. He reviewed two climate studies, Litwin and Stringer's (1968) and Likert's

(1967) and proposed twelve climate dimensions: (1) orientation, a climate is characterized as either control oriented or achievement oriented; (2) interpersonal relations, as reflected by the way informal employee groups are created; (3) supervision, the types of supervisory practices; (4) problem management, different ways of handling problems contribute to different climates; (5) management of mistakes, supervisor's attitude toward a subordinate's mistakes; (6) conflict management, process of dealing with conflicts; (7) communication, the flow of communication, either upward or downward; (8) decision making, the organization's approach to decision-making; (9) trust, the degree of trust and who is trusted; (10) management of rewards, what is rewarded in the organization; (11) risk taking, how people respond to taking risks; (12) innovation and change, how change and innovation are perceived and implemented.

Over the past 30 years, a number of attempts have been made to construct a measure of climate to tap various aspects of work environment (Likert, 1967; Campbell et al., 1970), but most of these instruments have been found to be methodologically inadequate (Pheysey & Payne, 1970; Payne & Pugh, 1976). More recently, valid measures for climate have been developed. Some of them were developed to measure climate in specific industries. For example, Taquiri's

(1968) Executive Climate Questionnaire was used to measure the climate of top management, Schnieder's (1973) climate survey instrument measured climate in the banking industry, and Bartlett's (1968) instrument measured climate in insurance companies.

Litwin and Stringer (1968) developed their Organizational Climate Questionnaire by experimentally manipulating different leadership styles, resulting in the creation of different climates (Dastmalchian, 1986). Stern's (1970) Organizational Climate Index, which has not been used in industrial situations but in education, was modified by Payne and Pheysey (1971) to be applicable to business organizations. They called the instrument the Business Organizational Climate Index (BOCI). The BOCI and its modified version by Payne and Mansfield (1973) were used in a number of studies to examine the relationship of climate with organizational structure and dependence on parent organizations (Pugh & Payne, 1977).

Of the twelve climate attributes, two are particularly relevant to innovation. The two climate attributes chosen to be evaluated in this study are orientation and risk-taking attitude. These two attributes were chosen because of their prominence in the past literature and their pertinence to the adoption of technological innovation.

Orientation can be viewed in two different ways. First, it refers to an organization's concern to excel (an achievement-orientation). Secondly, it refers to the organization's concern for organization-clientele relationship (an external-orientation). Achievement-orientation suggests being competitive, solving difficult problems and striving to accomplish goals (McClelland, 1975). The path-goal theory proposes that achievement-oriented leadership would set up very challenging goals continually seeking improved performance and expecting individuals to perform at their highest level (House & Dessler, 1974). An organization's achievement-orientation can be described as being competitive, expecting or exibiting a high level of performance, and constantly pursuing organizational goals.

External-orientation suggests boundary-spanning roles that function as a link from the organization's internal network to external sources of information; specifically, the organizations' customers. This attribute of climate was chosen because customers are the primary reason organizations exist. Meeting the needs and desires of the customers is a key reason for organizations to adopt innovations.

The potentially disruptive features associated with the adoption of innovations implies that managers need to be supportive of change in their organizations. Top management's attitude toward change has been found to have an impact on the adoption of innovation (Damanpour, 1991). Attitude toward change can also be considered as risk-taking attitude or orientation. For example, if people are risk averse they will likely have a negative attitude or orientation toward change; conversely, if people are risk prone, they will likely have a positive attitude or orientation toward change, since they believe it is acceptable behavior. Every manager is in a position of taking calculated risks in decisions that are made on a daily basis. If managers are too safe and conservative, or exhibit a risk averse orientation, then they are likely to lose out to an aggressive competitor. On the other hand, if managers tend to be too risk-oriented they can overinvest and overextend the organization, which can also lead to a loss. Therefore risk-orientation has been considered as a primary attribute of innovation in this study. The following section will discuss the contingency theory approach to this research.

2.4 CONTINGENCY THEORY

Contingency theory means "it depends"; that is, there is no one best method or prescriptive solution to a problem that exists. It is guided by the hypothesis that organizations whose internal features best match the demands of their external environments will achieve the best adaptation and, therefore, are more likely to succeed (Scott, 1987).

There are two basic approaches that will be briefly discussed to illustrate the two initial directions in the contingency theory. Lawrence and Lorsch (1967) coined the label "contingency theory" and argued that different environments place differing requirements on organizations. Environments characterized by uncertainty and rapid rates of change in technologies, for example, offer different opportunities and impose different constraints on organizations than environments that are stable and calm (Scott, 1987). Lawrence and Lorsch's (1967) studies in the plastics, food processing and container industries resulted in a better understanding of environments that ranged from high to low uncertainty and the differences in the internal features of each type of organization.

Lawrence and Lorsch (1967) also suggested that differing subunits within a given organization may confront different external demands and therefore need to respond in differing ways. In summary, their studies concluded that (1) the structural features of an organizational subunit should match the specific environment to which it relates, and (2) the differentiation and integration mechanisms within a large organization should be matched to the overall environment in which the organization must operate.

Galbraith's (1973; 1977) contingency theory stresses the role of information processing. Whereas in Lawrence and Lorsch's (1967) view of contingency theory the environment is characterized by the amount of uncertainty it poses, Galbraith (1973; 1977) connects environmental uncertainty with information processing in the following manner. The environment possesses uncertainty and effects the work or tasks the organizations perform, and "the greater the task uncertainty, the greater the amount of information that must be processed among decision makers during the task execution in order to achieve a given level of performance" (Galbraith, 1977: 115).

Contingency theory provides the orienting framework for this dissertation. In this dissertation the argument is that there is no single best climate for an organization that wants to adopt technological innovations. Rather, depending on contextual factors, such as organizational size, slack and age, the relationship between attributes of climate and attributes of innovation will vary. In the following chapter the research model will be introduced and hypotheses will be developed.

Chapter 3

Hypotheses

Past studies of innovation adoption have been limited by the lack of concern for the types and the attributes of the innovations which have been studied. Knowledge has also been limited by inconsistency in the use of the term innovation. Even though climate has been found to explain differences between organizations in their adoption of innovation, there is little understanding about how specific attributes of climate affect the nature of adoption of technological innovation as reflected by the attributes of innovation. Contingency factors such as organizational size, slack, and age, and their effects on the relationship between climate and adoption of innovation, are also not widely understood.

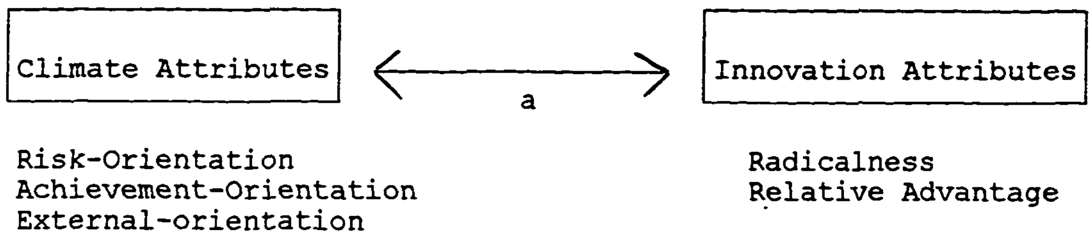
In this chapter the specific attributes of innovation and climate selected for this study, recognized as significant in past literature, have been developed into a research model. Hypotheses are developed. Contextual factors impacting the attributes of innovation and climate are discussed.

3.1 THE RESEARCH MODEL

Four conceptual research models have been proposed for this study. The first research model examines the relationships between certain attributes of organizational climate and attributes of adopted innovation. The second research model examines the impact of the first contextual variable, organizational size, on the relationship between attributes of climate and innovation. The third research model examines the impact of the contextual variable organizational slack on the relationship between attributes of climate and innovation. The fourth research model examines the impact of the contextual variable organizational age on the relationship between climate and innovation attributes. Past literature in innovation and climate provides theory and empirical support for some of the primary relationships of climate attributes and innovation attributes chosen for this study.

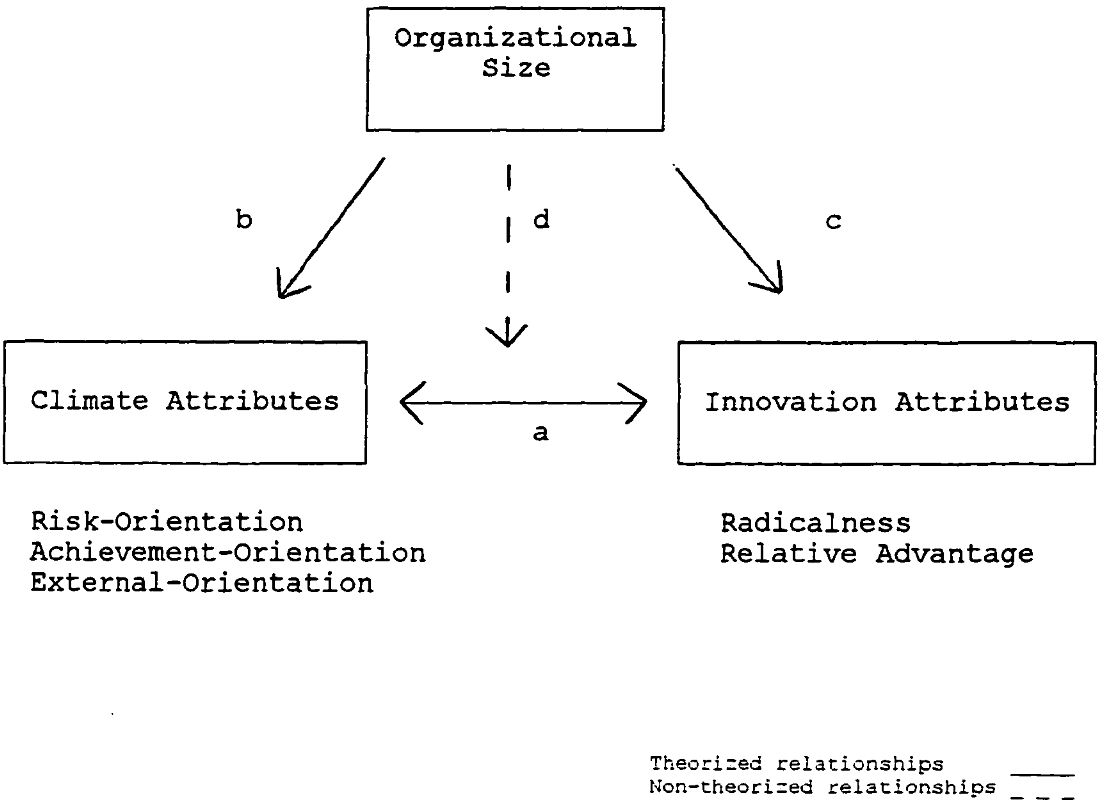
Past literature provides little insight into how the contextual variables of size, organizational slack, and organizational age affect the relationship between the climate and innovation attributes. It does, however, provide some guidelines on the direct effects of organizational size, slack, and age, on both organizational climate and attributes of adopted innovations. This study seeks to examine the nature of any direct and more importantly, any moderating roles played by the contextual variables. Therefore, this study's research models are based on previous empirical evidence or theoretical support (as indicated by a solid line in Figures 3.1, 3.2, 3.3 and 3.4); and proposed effects, which have not been theorized in past literature (as indicated by a dotted line). The conceptualization of the research models is shown in Figures 3.1 through 3.4.

Figure 3.5 defines the relationships between the climate attributes and innovation attributes. This matrix suggests that past literature theorized or supported the relationship between the climate attributes of risk-orientation and radicalness, achievement-orientation and radicalness, and achievement-orientation and relative advantage. This study develops and tests hypotheses to determine their replicability. The relationships between the climate attributes of risk-orientation and relative advantage, achievement-orientation and relative advantage, and external-orientation and radicalness have not been theorized, but will be developed and tested in this study. Climate has two positive implications for innovation. The first is the value the organization receives from the exchange of technical information, and the second is the psychological value of promoting trust in the organization (Saleh & Wang, 1993).



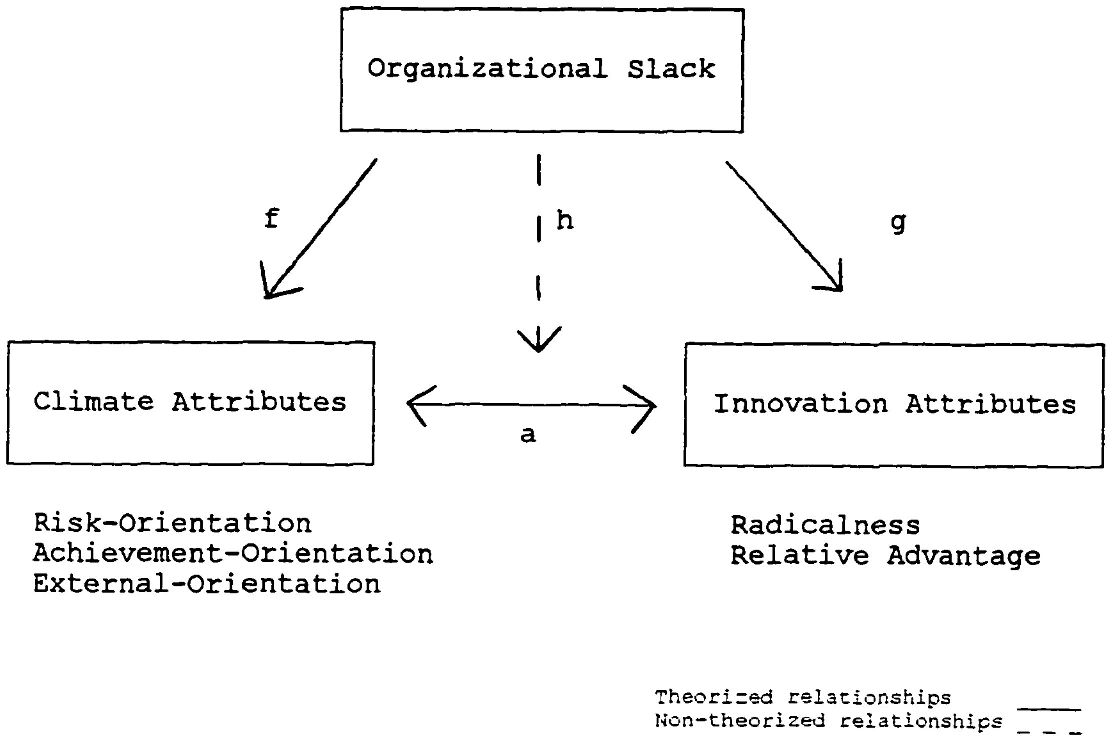
Research Model A
Relationship Between Climate and Innovation Attributes

Figure 3.1



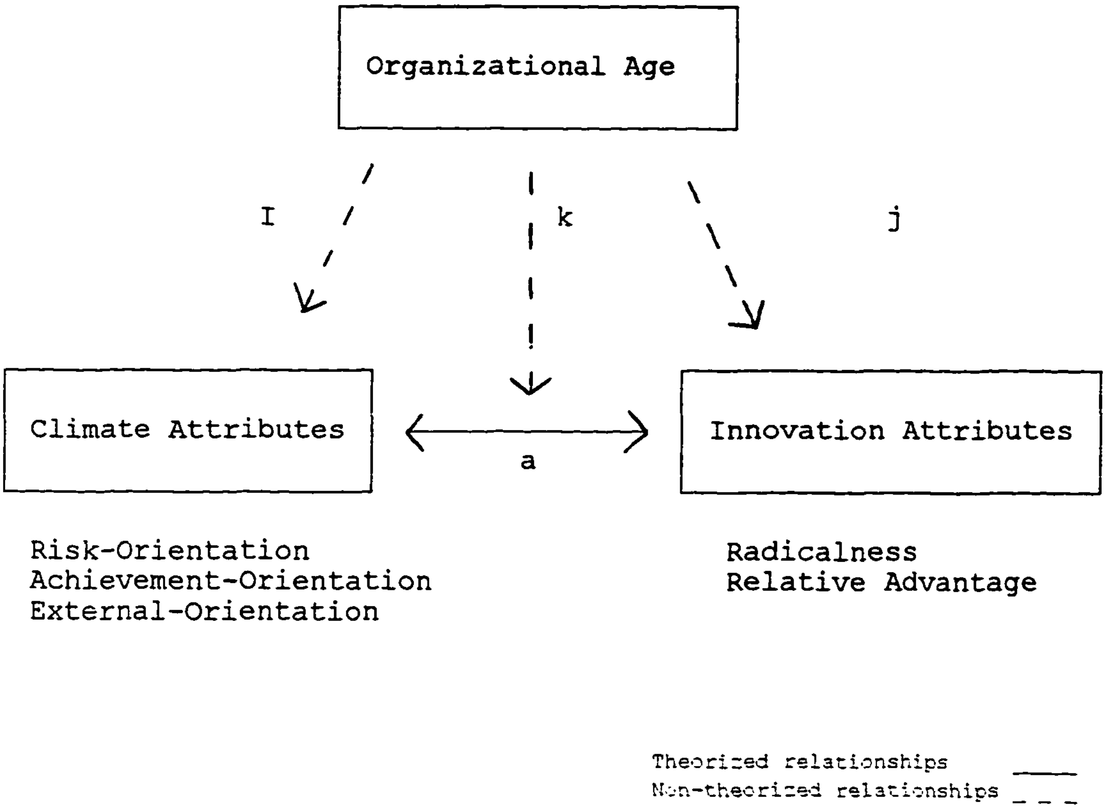
Research Model B1
Relationship of Organizational Size to Climate and Innovation Attributes

Figure 3.2



Research Model B2
Relationship of Organizational Slack to Climate and Innovation Attributes

Figure 3.3



Research Model B3
Relationship of Organizational Age to Climate and Innovation Attributes

Figure 3.4

Attributes of Climate		Attributes of Innovation: Radicalness	Attributes of Innovation: Relative Advantage
	Risk Orientation	H1a +	H1b n.s. (+)
	Achievement Orientation	H2a +	H2c +
	External Orientation	H2b n.s. (-)	H2d n.s. (+)

positive relationship	+
negative relationship	-
Not Studied in Past	n.s.
Expected direction of relationship	( )

Relationships Between Innovation Attributes and Climate Attributes Theorized in Past Literature

Figure 3.5

Trust is important in developing a climate that promotes risk taking. Employees in such anenvironment will not be afraid to take risks even though they may fail. Souder (1987) indicated that risk-promoting climates encouraged innovation and, therefore, organizational climate can be related to the radicalness of an innovation.

Top managers serve as a bridge between the organization and the technological environment (Daft, 1978; Hage & Dewar, 1973). Top administrator's exposure, status, and rank place them in a position to introduce and influence changes within the organization. Their exposure to new ideas and their influence on all organizational members can make a difference in the organization. A major function of top management is to set goals and priorities (Selznick, 1957) and to set the tone for the future of the organization. If a goal of innovation is established, that theme will penetrate all levels within the organization.

Upper level management may also have different attitudes toward innovation and risk. They can be conservative, preferring to keep the status quo, using current or time-tested methods, procedures and technology no matter what the problem. Alternatively, managers can be risk prone, actually encouraging risk-taking and the use of innovative or radical techniques to move the organization forward. The potentially disruptive and threatening characteristics of a radical innovation requires that managers with attitudes that encourage risks to support its adoption (Dewar & Dutton, 1986).

Damanpour (1991) found that managers' favorable attitude toward change leads to an organizational climate that is conducive to innovation. Managerial support for innovation is essential in the implementation stage for coordination and conflict resolution. It may also be required in the adoption stage as well. It is in the adoption stage that executives decide that regular and extensive innovation in their organization should be a vital element of their strategy.

These 'entrepreneurial' organizations usually try to obtain a competitive advantage by routinely making dramatic innovative changes and taking the inherent risks associated with those innovations. Other organizations run by more conservative managers may view innovation as costly and disruptive to production efficiency. These 'conservative' organizations may innovate only when they are seriously challenged by their competition or by shifting consumer preferences (Miller & Friesen, 1982). Miller and Friesen (1982) argue that momentum is a pervasive force in organizations; that past practices, attitudes and strategies tend to evolve in the same direction. Thus, organizations that are willing to take risks and make changes may have the propensity to be even more innovative.

The following hypotheses are proposed:

H1a: The propensity to adopt more radical innovations is positively associated with a risk-oriented organizational climate.

An innovation has greater relative advantage when it is viewed as better than the innovation (product or process) that precedes it. But the perception of "better" is a vague concept and can create problems while making an adoption decision. Organizational decision makers must, generally, rely on their perceptions of the future benefits likely to be received from the adoption of an innovation, rather than only depending on demonstrated or measurable benefits, prior to making the decision to adopt the innovation (Ramamurthy, 1990). The idea of relative advantage may also serve to legitimize the adoption of an innovation.

Whenever businesses take a greater risk in an investment, they normally expect a greater return on that investment. If an organization has a climate with greater risk-orientation, they may expect the innovation adopted to have greater relative advantage. Since much of the relative advantage, or "being better" than the previous investment, is often not amenable to calculations prior to the adoption (i.e., increase in productivity, increase in utilization, higher reliability), much of the justification for a risk-oriented climate to adopt a new innovation will be to legitimize the innovation socially and politically (Clemons, 1991).

H1b: The propensity to adopt innovations with a greater relative advantage is positively associated with a risk-oriented organizational climate.

The concept of achievement orientation is built around the notion of achievement relative to a standard of excellence (Litwin & Stringer, 1968) and may be expressed as a continuum with achievement orientation on one end and rules orientation on the other end of the continuum. Rosenthal (1963) found that performance expectations affect the behavior of individuals in an organization. His research was one of creating a climate whereby the expectations were subtly communicated to the subjects. As an example, teachers set higher standards for the students they thought were gifted. Teachers probably paid more attention to them, helped them more, and had more confidence in them. All of these things lead to increased performance by the students. The same is likely to be true for organizations. When there is an expectation for high achievement which includes the adoption of innovations, then individuals within the organization will likely meet those expectations.

H2a: The propensity to adopt more radical innovations is positively associated with an achievement-oriented organizational climate.

A study called project Sappho examined seventeen pairs of product innovations, one a success and the other a failure (Johne & Snelson, 1988). Among their conclusions about successful product innovations were: 1) successful innovating companies had a much better understanding of customers needs; and 2) successful innovating companies made more effective use of outside technology and outside advice, even though they did more work in-house. This meant that people within the organization had to take on boundary-spanning roles.

In the hospital industry, external-orientation might be important. If the hospital management or physicians do not take on the role of boundary spanner, they may be out of touch with customers' and community's needs. They may, then, tend to adopt technology that is used infrequently. The hospital may be "jumping on the technology bandwagon" just to keep up with the competition and not closely align itself with the customer/community needs. A technology not used at a minimal level of capacity can create a financial loss resulting in fewer adoptions in the future. A external-oriented organizational climate can enable better awareness of the customers' and community's need, and acquire only these innovations/equipment that will be better utilized for its customers. A hospital that does not have such a external orientation may be physician driven, adopting a radical technology to satisfy specific physicians' desires. It may also adopt the use of medical equipment/innovation that is the latest in technology, just to keep up with its competitors, and not necessarily based on customer/community need.

H2b: The propensity to adopt more incremental innovations is positively associated with a external-oriented organizational climate.

As noted earlier, the degree of relative advantage of an innovation can be expressed in terms of profitability, status, or savings. Achievement-oriented firms will be less bureaucratic and less rules-oriented, and more likely to be goal-oriented by trying to attain a certain level of excellence. Organizations with achievement-oriented climates will likely adopt innovations that result in a greater relative advantage because they do seek status and profitability.

H2c: The propensity to adopt innovations with greater relative advantage is positively associated with an achievement-oriented climate.

External-orientation suggests that the firm is oriented toward the needs of its customers and constituents, and they intergrate this orientation throughout the organization. This implies that the communication link between the adopting organization and their customers and constituents is perceived as vital to the future success of the organization. In terms of status or relationship with their customers, external-oriented firms would attempt to please their customers and therefore consider the relative advantage of an innovation (in terms of savings and quality to the customer) an important attribute for the innovations it chooses to adopt.

H2d: The propensity to adopt innovations with greater relative advantage is positively associated with an external-oriented climate.

3.2 CONTEXTUAL FACTORS

Rather than searching for a grand theory of organizations, researchers have focused their attention on exploring middle-range relationships, or those that hold within a particular context (Ginsberg & Venkatraman, 1985). This study evaluates the effects of three contextual variables on the relationship between climate attributes and innovation attributes. Research indicates that organizational size, slack, and age have an effect on innovation or climate, but almost no evidence exists about the specific way these contextual variables affect the relationship between innovation attributes and climate attributes.

Schoonhoven (1981) highlighted two interpretations of hypothesized contingency relationships. The first can be stated in a hypothesized form as: 1) the greater the value of contextual variable z, the greater the impact of variable x on variable y; and the second is: 2) given the value of variable z, there is a matched value for variable x that produces the highest value of variable y. Deviations from this relationship in either direction reduce the value of variable y. Past literature does not suggest the type of effect, either direct or moderating, that the contextual variables will have on the primary relationship of the innovation attributes and climate attributes. Therefore, the roles of contextual variables will be explored post facto.

3.2.1 Organizational Size

Numerous stories have been told of small unconventional companies that have seemingly outperformed the large traditional organizations of the past. As an example, the Macintosh computer was prototyped by a team of 20 individuals working in a small house-like facility behind a Texaco station (Guterl, 1984; Yeaple, 1992); the Xerox Memorywriter electronic typewriter prototype was developed by an independent design firm of six engineers and a secretary in 6 months with a manufacturing cost 40% below the expected cost of in-house engineers (Jacobson & Hillkirk, 1986).

Referring back to Model B1 about the relationships between organizational size and climate and innovation attributes, a logic will be presented for each of the relationships (a) through (d). Relationship (a) between climate attributes and organizational attributes has been previously identified through hypotheses development (H1a, H1b, H2a to H2d).

Relationship (b) refers to the effect of organizational size on climate attributes. There are many reasons why this phenomenon may occur. Cooper (1964) found in his interviews with innovative firms that the average level of competence of technical people in small organizations was far greater than that of large organizations. Engineers in small organizations tend to be more cost conscious with a greater sense of urgency to get a project completed. In small organizations the communication and coordination with customers, suppliers and production are more efficient (Cooper, 1964). The lack of bureaucracy or formalized structure of a large organization allows the communication to be swifter and the decision making more immediate, leading to faster introduction of the innovation (Fama and Jensen, 1983).

Relationship (c) refers to the effects of organizational size on the adoption of innovation and innovation attributes. The implication that small organizations are more efficient at innovations than large organizations is not new (Yeaple, 1992). Jewkes et al. (1958) traced the origin of 61 major twentieth-century innovations and found that twenty percent were developed by large laboratories and organizations, whereas 59% came from independent inventors. More recently, a study by Acs and Audretsch (1988) traced 2617 innovations introduced in the United States in 1982 by manufacturing companies in 35 industries known for innovations and found that small firms (less than 5 employees) have an innovation per employee ratio of 6 times that of large organizations. If large organizations are not as efficient in developing innovations, it has not been for lack of resources.

Small organizations are less rigid in planning. Large organizations may depend more heavily on formal strategic planning and may stay with a plan even in the face of changing market conditions. This also allows small organizations to be more responsive to changing markets and conditions. Small organizations can respond to changing conditions more rapidly and with greater accuracy because they have a closer link to the customers. There is less of a sense of competition between R&D and the entire organization in small firms. The intense competition that at times forms between functional areas within large organizations often transforms in small organizations into an intense competition between that small organization and its larger competitors (Cooper, 1964).

Small organizations usually have no specific budget for innovation or research and development (Avlonites, 1985). Innovations or adoption of innovations may be a more random act than in a larger organization. The randomness could also lead to more radical innovations, with larger organizations experiencing more incremental innovations.

Large organizations are slow to use product modifications and improvements to meet a competitive threat

(Utterback, 1994). There tends to be a lag between the pattern of product innovation and process innovation for assembled and nonassembled products (Utterback, 1994). Therefore, large organizations tend to adopt process innovations even slower than product innovations. Competition may not be as threatening to a large firm as a small one. For example, the loss of an account for a small business may be 20% of their net income, whereas to a large firm, it may only mean 2% of their income lost. Therefore, the relative advantage of an innovation may be more important to small organizations, and they may tend to be more customer-oriented because they have fewer layers of bureaucracy.

Relationship (d) refers to the moderating effect of organizational size on the relationship between climate attributes and innovation attributes. The past few paragraphs have presented an argument that smaller size of the organizations would foster a more favorable climate taken up for investigation (i.e., higher risk-orientation, greater achievement-orientation, and more external-orientation). As noted earlier, the direct relationship between size and innovation has however been fraught with conflicting findings in past research. Although, smaller organizations tend to be more innovative, on an average, both large as well as small organizations have been observed to display innovative behavior. Therefore, it appears logical to expect that the relationship between climate and innovation attributes would be stronger in smaller organizations.

3.2.2 Organizational Slack

The concept of organizational slack has appeared in the organizational literature as a factor that explains a firm's innovative behavior (Bourgeois, 1981; Damanpour, 1987). In their definition, Cyert and March (1963) emphasized the disparity between the resources available to the organization and the payments required to maintain the coalition. They defined organizational slack as the difference between the total resources available and the total necessary payments. In addition, slack has been defined as the difference in resources available to the organization and the combination of demands made on it (Cohen, March & Olsen, 1972) and the difference between existing resources and activated demands (March & Olsen, 1976). Organizational slack provides the organization with a kind of cushion or 'spare resources' which prevents an organization from fatal hazards in the face of a rapidly changing environment (Kuitunen, 1993).

Bourgeois (1981) has distinguished four different functions of organizational slack from previous literature:

(1) slack as an inducement for organizational actors to remain within the system, (2) as a resource for conflict resolution, (3) as a buffering mechanism in the workflow process, and (4) as a facilitator of certain types of strategic or creative behavior within organizations. This dissertation uses the fourth function of slack.

Referring back to Model B2 about the relationship between organizational slack and climate and innovation attributes, a logic will be presented for each of these relationships (f) through (h). Relationship (a) between climate attributes and innovation attributes has been previously identified through hypotheses development (H1a, H1b, H2a to H2d).

Relationship (f) refers to the effect of organizational slack on organizational climate attributes. Researchers have found that slack can play an important role in stimulating creativity and experimentation (Meyer, 1982; Nord & Tucker, 1987). According to the literature, increasing slack has been seen as a facilitator of experimentation (Kuitunen, 1993). Experimental innovative behavior, especially the development of new strategies, has been emphasized as one of the major effects of slack resources. Organizations with greater slack may be in a position to pursue innovations that are more risk-oriented. Excess resources provide funds for adoption of innovation and distributed slack is available for projects that would not necessarily be approved on a tight budget (Cyert & March, 1963). Organization with greater slack resources may not identify the urgency to adopt innovations with greater relative advantage since the cushion resources may tend to mask the necessity to achieve the advantage.

Relationship (g) refers to the effect of organizational slack on the adoption of innovation and innovation attributes. Nord and Tucker (1987) found slack to aid in the implementation of an innovation in three ways. The first is the way slack contributed to the technical and organizational preparedness through previous expenditures. The second is the way organizations could employ slack to lower performance standards, such as extending deadlines. With a greater slack, organizations are not forced to meet specific deadlines to match their competitors on innovation implementation. Finally, slack was used to acquire resources that aided in implementation, such as managerial or technical talent of a consulting firm. Organizations having more slack resources would also be able to take a more risk-oriented approach to the adoption of innovation due to the cushion of assets to lessen the blow of a failure.

Organizations do not merely innovate by adopting radical innovations, even though they have sufficient resources for such an activity. Many times it will only be necessary to adopt an innovation that currently exists to remain competitive. Slack has been associated with continuous but conservative behavior. March and Simon (1958) pointed out that an institutionalized search for innovation implies higher levels of innovative activity with a more stable trend. Therefore, organizational slack may facilitate the adoption of incremental technology in organizations.

Relationship (h) refers to the moderating effects of organizational slack on the relationship between climate attributes and innovation attributes. The direct effect of organizational slack on climate attributes may be that as slack increases, organizations may become more risk oriented, but slack may have a negative effect on achievement orientation and customer orientation since organizations view slack as discretionary. The direct effect of organizational slack on the adoption of innovation may be that as slack increases in organizations more resources are available to adopt innovations, and innovations may become more consistent and continuous, since organizations view slack as discretionary. Therefore, one might reasonably expect that organizational slack may have a positive effect on the relationship between climate and innovation attributes.

3.2.3 Organizational Age

Organizational age has appeared in the organizational literature as a factor that leads to high levels of structural inertia resulting in the inability to make changes easily. Younger organizations are believed to be hampered by a liability of newness and to have a higher mortality rate (Hannan & Freeman, 1977, 1984). Age has also been interpreted as organizations becoming conservative, traditional, and resistant to innovation (Khandwalla, 1977).

Past literature provides theories that suggest organizational age may have both a positive and a negative affect on the adoption of innovation in organizations. This study explores the direct affects of organizational age on climate attributes, innovation attributes; and the potential moderating affect on the relationship between climate attributes and innovation attributes.

Organizational age is defined as the number of years the organization has been in existence. Older organizations increase their structural inertia because organizational members take time to learn to trust and cooperate with one another, learn to coordinate (Stinchcombe, 1965), and learn organization-specific skills and routines (Nelson & Winter, 1982). Organizations develop formal structures to align themselves with their environments. These formal structures also enhance the legitimacy of the organizations. A lack of formal structure or "isomorphism" with the institutional environment is an underlying cause of the liability of newness (Stinchcombe, 1965; Hannan & Freeman, 1984; Singh, House, & Tucker, 1986) which suggests that organizational changes that enhance organizational legitimacy result in higher survival rates.

A highly integrated firm will tend to create and perpetuate an effective structure, climate, and planning process that makes it successful with technological innovations (Burns & Stalker, 1961; Souder, 1987; Souder, 1977; 1983). This degree of integration for success of innovation appears to be related to the degree of market and technological uncertainties faced by the firm, and the presence of persons able to carry out the integration (Shrivastava & Souder, 1987). Young organizations may not have the human resources, market and technological knowledge required to integrate appropriately for success.

Referring back to Model B3 about the relationship between organizational age and climate and innovation attributes, a logic will be presented for each of the relationships (I) through (k). Relationship (a), as noted previously, has been identified through hypotheses development (H1a, H1b, H2a to H2d).

Relationship (i) refers to the affect of organizational age on the organizational climate attributes. There is a common assertion that older organizations resist change more than young organizations. Starbuck (1983) suggested that old as well as young organizations resist change in their task structure, or the programs that constitute the means by which the organization achieves its goals. Starbuck (1983) believed that old organizations tend to resist change in internal social relations, while young organizations resist changes in their goals. Yet young organizations support changes in their social culture, while old organizations support changes in their goals.

Starbuck (1983) grounded these speculations on commitment by members of the organization. In young organizations, members tend to be idealistic, which may be the primary force in the formation of new organizations. There is also a great deal of commitment to the goals of the organization. Over the years, members of organizations develop a commitment to the organization itself. The survival of the organization becomes primary, and when the organization's goals or mission become inoperative, members will go in search of new goals that justify the existence of the organization. Therefore, older organizations may create a greater risk-oriented organizational climate to ensure survival of the organization. Younger organizations may tend to be more customer-oriented since they tend to be more idealistic and more adaptive to changes in needs. Young organizations may tend to be more achievement-oriented. Younger organizations are very goal oriented and need to create a climate of achievement-orientation to overcome any disadvantage compared to older organizations. At a given point in time, young organizations are less likely to have developed knowledge and skills about their particular industry or business, than older organizations. They have fewer financial resources when they first enter the competitive arena, and they have had less time to develop relationships and identity with their customers.

Khandwalla (1977) found that organizational age and size are strongly correlated. Young organizations that do survive normally grow large as they mature. Holding size constant his study found that (a) as organizations grow older they seek or find themselves in more predictable, stagnant environments; (b) as organizations get older they become more familiar with their environment and tend to view their environment as less turbulent and unpredictable than younger organizations in that same environment; (c) older organizations tend to scale down their goals; (d) older organizations tend to avoid high-risk, high-return investments in favor of moderate-risk, moderate-return investments; and (e) older organizations tend to see less need for brainstorming than younger organizations. Younger organizations may tend to adopt more radical technological innovations since they tend to be more risk-oriented, tend to have loftier goals, view their environments as more turbulent and threatening.

As organizations age they tend to increase their level of formalization (Inkson et al., 1970). Starbuck (1983) concluded that as an organization gets older, it learns more about coping with its environment as well as its internal problems of communication and coordination. Models of the stages in organizational development (Chandler, 1962; Channon, 1973; Scott, 1970) have described the progression of an organization from its early and simple stage to a mature stage of large scale with financial security and organizational complexity. Younger organizations with less formalization may develop more risk-oriented climates and adopt more radical innovations.

To summarize, hypotheses have been developed for the climate attributes: risk-orientation, achievement-orientation, and external-orientation and their relationship to the innovation attributes of radicalness and relative advantage. Past literature provides some theory and empirical support about the direct relationships of the contextual factors of organizational size, slack, and age on climate and innovation. This study seeks to understand how climate and innovation attributes are contingent on organizational size, slack, and age. Therefore, an exploratory analysis of the effects of organizational size, slack, and age will seek to validate current knowledge and develop new theory about the potential moderating effects of the contextual variables on the relationship between climate attributes and innovation attributes. The following chapter will discuss the research design for this study.

Chapter 4

Research Design

This chapter provides a discussion of the research design which was used to test the hypotheses and to explore contingencies. This chapter covers: (a) data collection, (b) sample, (c) pilot study, (d) measurement of the variables, (e) statistical methodology, and (f) validity and reliability assessments.

4.1 DATA COLLECTION

Past studies of organizational innovation have used different approaches to data collection. No one approach to research has been recognized as being superior to others in this literature. In general, the choice of research design or data collection method depends on the objectives of the research (Babbie, 1992).

One major objective in the design of this study involved surveying within the specific level of the organization where decisions are made to adopt technological innovations. Senior managers and members of committees, instituted for the purpose of determining technology adoption, were the target of the survey since it is at this level that key decisions are made about adoption of innovations in hospitals.

Bourgeois (1990) stated that a contingency approach should be used in deciding whether to use objective or perceptual measures in studying organizations. When content issues are studied, such as performance or growth, objective measures should be used because they capture developments. When researchers are interested in studying process issues such as decision-making, perceptual measures should be used because they tend to capture attitudinal/behavioral aspects important to the dimensions measured (Bourgeois, 1990). The nature of the variables involved in this study, such as organizational climate or an innovation's degree of radicalness, defied the use of a simple objective measure and could best be captured by perceptual measures.

This study used self-administered questionnaires as a basic method for data collection. They were sent through the U.S. mail, along with a letter explaining the purpose of the research and a self-addressed, stamped envelope for returning the completed questionnaires.

Initially, a letter (Appendix 1) was mailed to the CEOs of every hospital in the target sample in order to determine whether they were interested in participating in this study. A return postcard was enclosed for them to indicate either an agreement to participate or a decline. Upon agreement to participate in this study, a letter (Appendix 2) and a packet of ten questionnaires was mailed to the respondent in that hospital. The packet of questionnaires included seven climate questionnaires, a demographic questionnaire, and two different technology questionnaires.

The CEO, or the individual coordinating the data gathering, was asked to complete demographic information about the organization, and to complete the climate survey. Five out of the six remaining climate questionnaires were requested to be distributed to five individuals in senior management, or members of the technology committee, who took part in the decision-making process for the adoption of technology. Finally, the respondent to the technology questionnaires was also asked to complete a climate questionnaire. The research design required that at least three individuals respond to the climate questionnaire, so that the average would likely be representative of the climate prevailing in the decision-making committee and a reasonable representation of the organizational climate in general.

In addition, another questionnaire was developed specifically for a respondent who oversees operation of the Medical Imaging Department, and included specifics about the adoption of technology in their organization. One of the technology surveys included a list of 9 primary Medical

Imaging technology categories, such as Magnetic Resonance Imaging (MRI), and Computed Tomography, with subcategories of these technologies such as Magnet type or field strength. This survey assessed which of the 68 technologies each hospital had adopted and the year of adoption. As noted earlier, the Medical Imaging respondent was also asked to complete a climate questionnaire.

This "cluster bomb" approach to survey questionnaires presented several advantages to this research. First, contacting all hospitals within a chosen sample predetermined those hospitals that wished to participate in this study. This reduced the high cost of mailing the entire packet to organizations who would not be willing to participate in the research. It also eliminated the necessity for a large second mailing. Second, this resulted in reduced cost of printing the survey questionnaires. Finally, as noted, this research required that three out of seven potential respondents reply to the climate questionnaire. If top management commitment to the research project could be garnered, there was a greater likelihood that the other respondents in the organization would also respond.

4.2 SAMPLE

The sample of organizations for this study was derived from a list compiled by the American Hospital Association (AHA) located in Chicago, Illinois. There were over 6,500 hospitals registered with the AHA as long-term or short-term acute-care facilities. The hospitals ranged from small hospitals with only 25 beds to large hospitals with over 1,000 beds.

Another major objective of this study was to examine a geographically homogeneous sample of a targeted population in the hospital industry. A homogeneous sample was desired in order to control for other factors that may influence the adoption of technological innovations in a hospital. For instance, hospitals in different regions of the United States encounter different Certificate of Need (CON) processes and other state-specific legislative requirements, Medicare reimbursement rates, local gross incomes, or different competitive environments. For example, on the West coast, the movement toward managed care impacts the benefits employees receive from their firm and the reimbursement a hospital may receive for a procedure. Under a high level of managed care, the reimbursement would be identical if a patient were to receive a diagnostic evaluation from an MRI which is six years old, or if the MRI were state of the art faster pulse sequence technology. Therefore, these hospitals may respond differently in their approach to adopt new technology than hospitals in the Midwest, whose total managed care patient ratio is forty percent versus the seventy percent in the state of California. Hospitals on the East coast are even further behind in their movement toward managed care. There are other factors that may contaminate the results of this study in a heterogenous sample. The Certificate of Need (CON) process may or may not exist in a state. The CON process is administered by a state regulatory agency which requires hospitals to apply for the state's authority to duplicate technology in a given service area, thereby eliminating the adoption of new technology for services that are currently provided by existing technology.

The population of hospitals in the upper Midwest, specifically, Wisconsin, Minnesota, and Illinois, was chosen. The author of this research represented a major university in the state of Wisconsin, which could help to yield a higher response rate. An accompanying letter by the President of the Wisconsin Hospital Association supporting this research was also mailed to the hospitals in Wisconsin.

At the time of this study, the state of Wisconsin had 151 hospitals, Minnesota had 158 hospitals, and Illinois had 246 hospitals, for a total of 555 hospitals. The theory underlying the hypotheses suggests that they may be appropriately tested in a more homogeneous sample where the environments have similar effects on the adoption of technology. Most previous studies had been tested using homogeneous samples. The three states were also chosen because of the similarity of their environments: regulatory, demographics, and geography.

This study used statistical power analysis to determine the required sample size (Cohen, 1977, 1988). The power of a test refers to the probability that a significant effect will be detected if, in fact, a statistically significant effect exists. Stated alternatively, power refers to the ability to detect actually false null hypotheses, so as to avoid making Type II errors that means overlooking meaningful differences. Statistical power ($1-B$) is a function of effect size (r^2), significance level (α) and a sample size (n) Therefore, when a researcher estimates the effect size in percentage terms, sets the significance criteria and the statistical power, then the sample size (n) necessary to meet specifications can be calculated.

The statistical analysis methods to be used in this study include both Pearson product-moment correlations and hierarchical regression. To calculate a sufficient sample size, a conservative estimate was used for the significance level α (.05). It was first assumed that all three independent variable (risk-orientation, achievement-orientation, and external-orientation) would be significant in explaining adoption of innovation. With a power estimate of (1-*B*) = .80 and a conservative effect size of r^2 = .10 (ie., it explains 10% of the variance), the sample size was required to be at least 106 organizations. On the other hand, with an r^2 = .30, the same power estimate of (1-*B*) = .80, and a significance level of .05, the sample size was required to be at least 33 organizations (Cohen, 1988).

With six predictor variables, which include the contextual variables, a power estimate of (1-*B*) = .80 and an estimate of r^2 = .10 and .05 for the significance level, the sample size was required to be at least 127. With an r^2 = .30, a power estimate of (1-*B*) = .80, and a significance level of .05, the sample size was required to be at least 41. From these calculations the desirable sample size ranged from 33 to 106 (with three antecedent variables) and from 41 to 127 (with the inclusion of the contextual variables).

4.3 MEASUREMENT OF THE VARIABLES

Each of the variables and its measurement are described in the following sections. Many of the measures have been used in previous research, but some measures were developed specifically for use in this research.

4.3.1 Organizational Climate

The three measures of organizational climate used in this study are risk-orientation from Litwin and Stringer's (1968) Organizational Climate Questionnaire (LSOCQ), achievement-orientation from Stern's (1967) Organizational Climate Index (OCI) and external-orientation from Narver and Slater's (1991) Market Orientation Index.

Risk-orientation was one of seven dimensions in Litwin and Stringer's (1968) measure of organizational climate. Their sample included 59 MBA students and 42 managers from different companies. The risk scale consisted of five items. Three of theses five items clustered or correlated with one another, but the authors provided no information about which three items clustered together. Their mean intercorrelation in the original study was 0.29.

Most recently, Day and Bedeian (1991) and Toulson and Smith (1994) used Litwin and Stringer's (1968) questionnaire in their research on organizational climate's relationship with job performance and employee perceptions of personnel management. Both aforementioned studies referred to the Mossholder, Bedeian, Touliatos, and Barkman's (1985) factor analysis of the Litwin and Stringer (1968) measures. Mossholder et al. (1985) performed an analysis using a sample of 425 public accountants. These authors observed that all the coefficient alphas, with the exception of

Responsibility scale, were 0.70 or above (average = 0.78); no specific value of Cronbach alpha was given for the Risk scale.

In this study, each of the five risk items from Litwin and Stringer (1968) was measured along a seven-point Likert scale ranging from 1=strongly disagree to 7=strongly agree. The items for risk-orientation, as well as the other scales used in this research, appear in Appendix 3.

Achievement-orientation is one of ten dimensions in Stern's (1967) Organizational Climate Index (OCI). The OCI used a sample of high school and college students. The original average general biserial correlation for achievement-orientation was 0.68. When Payne and Pheysey (1971) administered the entire OCI survey to 120 junior/middle managers from more than 100 companies, they found a reduced number of eight scales was more appropriate to business organizations, and they called their revised instrument the Business Organizational Climate Index (BOCI). Their general biserial correlation for the eight scales was 0.70. Both the OCI and the BOCI used the mean scores of individuals to represent the larger system.

The items used in this study to measure achievement-orientation were obtained from Stern (1967) and they appear in Appendix 3. Each of these items was measured along a seven-point Likert scale ranging from 1=strongly disagree to

7=strongly agree. The mean of these scales were interpreted to represent achievement-orientation of the organizational climate.

The orientation of the organization has been viewed in several different ways. Organizations have been viewed as being achievement-oriented (Stern, 1967; Dastmalchian, 1986) and risk-oriented (Litwin & Stringer, 1968). In pilot-testing interviews with managers of several organizations in the health care industry, this researcher found that there appeared to be another aspect of an organization's orientation that managers believed to be vital to their success in adopting innovation. This additional dimension concerned external-orientation toward their customers and constituents.

Narver and Slater (1990) defined market-orientation as the organizational culture (i.e., culture and climate, Deshpande and Webster, 1989) that most effectively and efficiently creates the necessary behaviors for the creation of superior value for the buyers. They validated this measure of Market Orientation which includes customer orientation, competitor orientation, and interfunctional coordination.

Customer orientation the understanding of one's target buyers to be able to create superior value. Competitor orientation means that the organization selling understands the short-term strengths and weaknesses and long-term capabilities and strategies of current and postential competitors. Interfunctional coordination is the behavior which includes the utilization of company resources in creating superior value for target buyers (Narver & Slater, 1990). The overriding objective of market orientation for nonprofit organizations is survival by satisfying all key constituents in the long run (Kotler & Andreasen, 1987).

This present study evaluated all three behavior components of market orientation because of its direct implications on organizational climate in hospitals. The interaction between the hospital and its constituents may be a primary consideration in the adoption of technology.

The sample used in developing and validating Market Orientation included 371 respondents who worked in 140 strategic business units (SBUs) of a major western corporation. Narver and Slater (1990) randomly split the data into two samples before assessing reliability and validity. They conducted reliability analysis on the first sample and replicated those analyses on the second sample, then conducted tests for construct validity on the combined samples. The Cronbach alpha for customer orientation was 0.89, competitor orientation was .71, and interfunctional coordination was .71. The Cronbach alpha for all three behavioral components of market orientation when combined was .88, exploratory factor analysis resulted in an Eigenvalue of 7.1, with 44.8% of the variance explained. This provides strong evidence of convergent validity for all three behavior components.

More recently, Narver and Slater (1994) used their measure of Market Orientation to evaluate the competitive environment's moderator effect on the market orientation-performance relationship. Their sample consisted of 81 strategic business units (SBUs) in the forestry products industry and 36 SBUs in a diversified manufacturing corporation. The 81 forestry products company SBUs are a subset of the sample from their earlier study (Narver and Slater, 1990). The Cronbach alpha for customer-orientation subscale was 0.88, for competitor orientation was .73, and for interfunctional coordination was .77.

A modified version of market orientation (Narver & Slater, 1990) is used to address the orientation a hospital has to its "patient" population. This modified version of Narver & Slater's (1990) market orientation is designated as external-orientation in this study. Only nine of the original 21 items in the scale are used in this study. All six items for customer-orientation is used, one competitor item is used and two interfunctional coordination items are used.

Only a portion of the items from the original scale was used to maintain brevity and balance in the climate questionnaire. Keeping the questionnaire to one double-sided page would limit the time necessary for respondents to complete the questionnaire. Since there were a total of ten questionnaires mailed to each respondent hospital, it seemed prudent to make each questionnaire as brief as possible to increase the response rate. Using all 21 items of market orientation also created an imbalance in the questionnaire, with over 50 percent of the items focused on one climate attribute.

The word customer was replaced by the word patient in each item to clarify and standardize the meaning of customer. The items for the external-orientation scale appear in Appendix 3 and include items six through fourteen. Each of the items was measured along a seven-point Likert scale ranging from 1=strongly disagree to 7=strongly agree.

4.3.2 Innovation

Past research has used two measures for analysis of innovations. One measure counts the absolute number of innovations adopted in each organization. By contrast, a relative measure focuses on the percentage of innovations adopted from the total innovations available for adoption during a specific time period (Damanpour, 1987).

The hospital industry is vast and varied in the type of innovations it adopts. For example, hospitals may adopt technology in three basic areas: surgical technology, radiological technology, and cardiac care technology. Not every hospital provides a full array of cardiac care, or surgical care. Many hospitals provide only a primary or secondary level of inpatient care that requires the adoption of a basic level of technology. A tertiary care hospital, on the other hand, adopts more radical technology for procedures such as angioplasty, heart transplants and brain microsurgery. Radiological technology is necessary for patient diagnosis. Since this study evaluated the adoption of technology among various levels of hospital care, an area of technology that is common to most hospitals was required. Radiological technology was common to all hospitals. Even those hospitals that could not afford to purchase radiological technology had opportunities to share technology through the use of mobile equipment or lease arrangements.

The first method used to evaluate the adoption of Medical Imaging technology in each hospital involved formulating an aggregate score for the total number of Medical Imaging technologies that had been adopted by the hospital. Under the guidance of the researcher, the initial list of imaging technologies was developed by a firm that provides comparative information for hospitals and clinics planning to purchase medical technology.

For this research, the researcher asked a panel of five experts in the area of Medical Imaging technology to refine the initial list. Refining the initial list of imaging technologies included paring down the initial list of technologies to include only those technologies that were approved by the F.D.A. (Federal Food and Drug Administration), and including those technologies that have been adopted by most hospitals, not limiting the adoption to one category of hospital (i.e., tertiary care vs. secondary care hospital). These five experts agreed that nine technologies they identified would be a manageable list, but would need to include sub-classifications of those technologies to assist in determining the radicalness or relative advantage of those nine major technologies. Sub-classifications resulted in a list of 68 imaging technologies, which appears in Table 5.8 in Chapter 5.

These experts included a Medical Imaging Department manager with 15 years of experience, and a research physician at a major Midwestern University Medical School, who worked with equipment manufacturers to develop future Medical Imaging technology. The panel also included two physicians who were Radiology department heads at two regionally recognized hospitals, and a staff Radiologist.

Each hospital received a survey listing 68 technologies that exist in the Medical Imaging area. The Medical Imaging technologies spanned more than two decades of adoptions. The list of 68 Medical Imaging technologies reduced respondents' possible confusion about the definition of a Medical Imaging innovation and imposed structure and limits on the responses. Respondents placed a check mark next to the innovations their hospital had adopted. This measure of innovation replicated measurement methodologies of previous research (Damanpour, 1987, 1991).

Past measures lack depth in the measure of the adoption of innovation. For example, suppose one organization has an absolute number of 10 out of the initial 68, and another organization has an absolute number of four out of the 68 innovations. The latter four innovations may be more radical and profound in the industry than those of the organization that has adopted 10 innovations, which may be incremental and quite trivial in comparison. In order to address such difficulties and, hence, get a better idea of the nature of innovations adopted by the hospital, each of the 68 technologies was evaluated on radicalness and relative advantage by the panel of experts, and then a mean score was developed for each technology. Details of this rating procedure are described below.

Past studies have evaluated radical versus incremental innovations (Ettlie, Bridges & O'Keefe, 1984; Dewar & Dutton, 1986). The studies have examined innovations in a particular industry, such as footwear (Dewar & Dutton, 1986). Typically, a sample of innovations identified a priori by a panel of industry experts as radical and incremental innovations in the industry are identified. The researchers ask the organizations to identify from a predetermined list which innovation they adopted. Innovativeness scores are determined by the expert judges.

Along similar lines, the panel of experts (identified in this study as noted above) was provided with a definition of terms 'radicalness' and 'relative advantage' so the experts would be consistent and clear about the meaning of the terms. The definition for Relative Advantage was as follows:

"We define Relative Advantage of the technological innovation to include its ability to: (a) foster superior service to patients; (b) enhance productivity; (c) improve performance efficiency (in patient-care); (d) reduce costs/labor; (e) insure greater reliability and consistency in performance; and (f) enable the adoptor organization enjoy a number of indirect/intangible benefits (e.g. higher market share, improved hospital image, etc.)."

The definition for Radicalness was as follows:

"We define radicalness to include (a) the extensiveness of the knowledge/skill required to satisfactorily exploit the technologies' capabilities; (b) the degree to which the technology is a radical (rather than an incremental) departure from existing/previous practices; and (c) the degree to which the technology breaks new ground in the hospital industry."

The experts were instructed to go over the entire list of technologies and identify the technology they believed to be the least radical and assign a value of 1 to that technology. Likewise, they were asked to select the technology that they believed to be the most radical and assign a value of 7. They repeated this same approach to anchor relative advantage. Relative to those polar values, they were asked to rate the remaining technologies on the scale of 1-7 (1=least radical/ relative advantage and 7 = most radical/relative advantage). It was possible that there could be more than one technology assuming similar values (including the extremes 1 and 7) in each of the attributes of radicalness and relative advantage. They could also assign a technology with a decimal value (e.g. 4.5). The inter-rater reliability was evaluated before computing the mean expert scores for each technology on radicalness and relative advantage.

The mean expert score was then combined with the adoption of technology survey from each responding hospital. An aggregate score for radicalness for the adoption of Medical Imaging technology was then determined by multiplying those technologies that were adopted by each hospital by the mean expert scores and expressed as an aggregate value of radicalness for each hospital. For example, if a hospital adopted five Imaging technologies with three technologies receiving a mean expert score of 5.0 and the remaining two receiving a mean expert score of 4.0, their aggregate radicalness score would be 23.0. On the other hand, if a second hospital adopted seven Imaging technologies with four of these having a mean expert radicalness score of 3.0 and the remaining three having an expert score of 2.0, their aggregate radicalness score would be 18.0. As can be noted, although in the second example the hospital adopted a larger number of innovations, the degree of radicalness of these innovations is lower than in the first case. The same process was used to determine the relative advantage score of the Imaging technologies adopted in each hospital.

Innovation adoption in previous studies was usually measured by the number of innovations adopted without consideration for the radicalness or relative advantage of the innovations adopted. This measure of innovation evaluates the experts' perceptions of radicalness and relative advantage of all the innovations adopted in each hospital, so it may be compared to the radicalness and relative advantage of innovations adopted in other hospitals.

4.3.3 Organizational Size

One measure for size of the organization was the number of full-time equivalent (FTE) employees. A second measure of size was the number of beds in the hospital. The most common measure of size in the literature is number of employees. The number of employees is a good measure because it tends to correlate highly with other organizational measures (Kimberly, 1976). Child (1972) cautioned against the use of measures of revenue in service-oriented organizations since there was a low correlation with other measures.

4.3.4 Organizational Slack

The construct of organization slack has been measured by Ramamurthy (1990) as: (a) the degree of abundance or scarcity of financial resources; (b) the degree of abundance or scarcity of skilled labor resources; (c) the degree of abundance or scarcity of managerial talent; and (d) the degree to which funds have been committed already for other capital projects. This study adopted Ramamurthy's (1990) scale for slack. Each item was assessed along a seven point Likert scale where 1=strongly disagree and 7=strongly agree. The slack scale appears in Appendix 5.

4.3.5 Organizational Age

Organizational age was measured by the number of years the individual hospital had been in existence.

4.4 RELIABILITY AND VALIDITY ASSESSMENTS

The reliability of a study establishes the upper limit on validity (Babbie, 1992). The maximum possible validity of an instrument is equivalent to the square root of its reliability. Whenever possible, this study used established measures to assure reliability. Cronbach alpha's are computed for all measures including those where reliability has not been established before.

The first step in the process of determining reliability and validity was to assess "unidimensionality" of each predetermined measure/scale before proceeding to examine construct validity in the form of "discriminant validity". This process was followed by evaluating the reliability of the measures/scales.

Items included in the Climate Questionnaire focus on three dimensions of organizational climate: risk-orientation, achievement-orientation, and external-orientation. As will be detailed in Chapter 5, both sets of items, Climate and Innovation, were factor analyzed using a varimax rotation in order to assess their dimensionality or "factorial validity" (Covin, Prescott, & Slevin, 1990). As noted by Allen and Yen (1979), factorial validity is a form of construct validity. When items exhibit high loadings on a single factor, it suggests that they are empirically related and therefore can be viewed as a unidimensional attribute. The next section discusses the statistical analysis approaches selected in this research for data analysis.

4.5 STATISTICAL ANALYSIS

The hypothesized relationships between the attributes of climate and the attributes of innovation are assessed using the Pearson product-moment correlation coefficient, which indicates the strength of a linear bivariate relationship, ranging from a perfect positive (+1) to a perfect negative (-1) linear association. It is a measure of the degree to which variation in one variable is associated with variation in another variable. The strength of the relationship indicates how well the goodness of fit of a linear regression line fits the data. The square of the Pearson product-moment correlation coefficient indicates the proportion of variance in one variable explained by the other variable.

Hierarchical regression was used to explore the influence of the three contingency variables of organizational size, slack and age. Hierarchical regression is a general statistical technique through which the relationship between a dependent variable and a set of independent variables can be analyzed (Cohen & Cohen, 1983). This technique summarizes and decomposes the linear dependence of one variable on the others. The purpose of the analysis is to investigate the amount of variance in the dependent variable, attributes of innovation, accounted for by both the independent variables (climate dimensions) and contextual variables (organizational size, age, and slack).

Past literature does not specify the type of influence the contextual variables have on the relationship between the dependent and independent variables examined in this study. A hierarchical regression can test the type of effect that a moderator variable has on the independent-dependent variables' relationship. It can determine if the moderator relationship behaves as a homologizer, a pure moderator or a quasi-moderator (Arnold, 1982; McArthur & Nystrom, 1991; Sharma, Durand & Gur-Arie, 1981). Such an approach to moderator analysis is appropriate for this research project, because it is not clear a priori how the contextual variables affect the climate-innovation relationship. For example, if the contextual variable of slack behaves as a "homologizer", the magnitude of the relationship between climate and innovation attributes would differ significantly for organizations with large versus small amounts of slack. In a pure moderator, the slack interacts with climate but is not directly related to either climate or innovation attributes. In a quasi-moderator role, slack not only interacts with climate but is also directly related to innovation attributes, to climate attributes, or to both innovation and climate attributes.

4.6 PILOT STUDY

The pilot study found that the process developed to distribute the survey questionnaires to the appropriate people throughout hospital was both feasible and efficient. The level of participation by the respondents throughout a hospital was heightened by the commitment of the CEO. The hospitals in the pilot study returned at least five out of seven climate surveys when only three were required.

When this researcher communicated with some of those individuals who responded to the technology survey, they commented on the ease of completion of the technology survey. The survey simply required them to place a check mark by those technologies that their hospital had adopted. The difficulty they foresaw was recalling the date of adoption for some of the older technologies. Adoption dates were sometimes an approximation, since some the technologies had been adopted up to 20 years ago.

Time required for both completing the surveys and distributing and gathering the surveys was also evaluated.

Most of the surveys, especially the Climate Questionnaire, required less time (five minutes) to complete than the 10 minutes expected by the researcher. All pilot hospitals found the ten-day response time to the CEO's office to be adequate for responses, and yet not too long so that individuals would tend to forget or put the surveys aside. Most individuals responded and returned their surveys to the CEO's office within three days.

A few technology respondents had to contact other colleagues in the Radiology department for some assistance to be able to complete the survey in determining the adoption dates for some of the older technologies, but none of the Medical Imaging respondents suggested it was too difficult a task to accomplish.

No changes were required to be made to the initial survey questionnaires. The process used in distributing and returning the survey questionnaires, both to the CEO's office and back to the researcher's office at the University, was maintained. The following chapter will discuss the sample obtained for this study and assessment of the measures based on the study sample.

Chapter 5

Sample and Assessment of Measures

As detailed in Chapter 4, some previously reliable and validated survey instruments were adapted by this study to measure organizational climate, radicalness and relative advantage. Before these measures can be taken as representing the constructs being tested in the research hypotheses, they must be examined to assess whether they meet the criteria of reliability and validity in this sample of hospitals. Finally, the responses from the panel of experts are assessed.

5.1 SAMPLE

The initial request (Appendix 1) for participation in this research was mailed during the first week of June, 1995 to all 555 hospitals operating in Illinois, Minnesota, and Wisconsin. A total of 76 hospitals expressed an interest in participating. Each of those hospitals was mailed a letter (Appendix 2) and a packet of ten questionnaires. Three of the hospitals declined to respond to the questionnaires and returned them to the researcher, expressing time limitations as a factor in not participating. After five weeks, 63 hospitals returned completed questionnaires. A reminder letter was then sent to those hospitals who had not yet responded. Seven more hospitals responded, raising the response rate to 12.6% of the original population of Midwestern states. The sample included 70 hospitals with a distribution yielding 42 hospitals in the state of Wisconsin, 14 hospitals in the state of Minnesota, and 14 in the state of Illinois. The characteristics of the hospitals and the survey respondents are shown in Table 5.1.

The mean bed size of sample hospitals is 167.56 with a standard deviation 183.28, the mean FTE's is 557.23 with a standard deviation 596.67. The mean age for the sample hospitals is 64.91. Sixty seven respondents to the demographic survey were from the Administrative area of the hospital while only three respondents were from Clinical areas of the hospital. Hospitals in the survey sample included 7 branch hospitals, 11 subsidiary hospitals and 52 independent hospitals.

To identify whether the sample obtained provides an accurate representation of the targeted population, a check for non-response bias was conducted. The statistics for hospitals not responding to this research was obtained from the American Hospital Association Guide to the Health Care Field (AHA, 1995). This guide provides statistical data about all hospitals across the country, those that are members as well as non-members. The data for non-respondents was available on only a subset (420 for bed-size and 371 for

FTE) of the 480 non-responding hospitals since hospitals provide information to the American Hospital Association on a voluntary basis. Potential non-response bias was examined through t-tests on the demographic characteristic of hospital size through the number of beds and FTE's and a chi-square test on ownership type.

Given that the responding hospitals represented a wide range of values on the size measures, a logarithmic transformation was done to minimize the variance within the sample. The log-transformed variables of size were used in the analysis to examine non-response bias.

The sample and population of hospitals in the states of Wisconsin, Illinois, and Minnesota do not differ significantly (Table 5.2) in terms of size: number of beds, the log transformation of beds, the number of full-time equivalent employees, as well as the log transformation of FTE's. Also, the sample and population do not differ significantly (chi-square = 2.61, $p = .27$) in terms of ownership categories: government owned, not-for-profit, and for-profit hospitals.

5.2 ORGANIZATIONAL CLIMATE ATTRIBUTES

The respondents to the Organizational Climate survey were all managers or physicians who were involved in decisions to adopt medical technology. At least three individuals from each hospital responded to the climate survey, the modal hospital provided four respondents, and some hospitals submitted all seven responses to the Climate survey. The distribution of Climate questionnaire responses is shown in Table 5.3.

The first test of the climate constructs was to assess unidimensionality, before proceeding to evaluate construct validity in the form of discriminant validity. Unidimensionality was evaluated through factor analysis of each of the climate attributes. If the items for a particular attribute loaded on to one factor, then it can be concluded that one dimension is represented by those items. To ascertain construct validity in the form of discriminant validity for the various climate attributes, all of the items were factor analyzed together as one set. The unidimensionality and reliability of each climate attribute will be discussed separately, followed by the results of discriminant validity assessment.

The five items for the risk-orientation scale taken from the Litwin and Stringer (1968) modified Organizational Climate Questionnaire were factor analyzed using this research sample, which consisted of a minimum of three respondents up to a maximum of seven respondents from each hospital.

Table 5.1
Descriptive Statistics

Variables	Frequency n	pct.	Mean (s.d.)
Beds			167.56 (183.28)
FTEs			557.23 (596.67)
Organizational Age(years)			64.91 (21.47)
Organizational Position			
President	21	30.0%	
CEO	9	12.8%	
Administrator	23	32.9%	
Vice President	13	18.6%	
Department Head	4	5.7%	
Department in Hospital			
Administrative	67	95.7%	
Clinical	3	4.3%	
Ownership			
Private	18	25.7%	
Public	11	15.7%	
Not-for-Profit	41	58.6%	
Kind of Hospital			
Branch	7	10.0%	
Subsidiary	11	15.7%	
Independent	52	74.3%	
Respondents' Management Levels			
2 levels	17	24.3%	
3 levels	34	48.6%	
4 levels	11	15.7%	
5 levels	6	8.6%	
6 levels	0	0.0%	
7 levels	2	2.9%	

Table 5.2
Comparison of Respondent and Non-Respondent Hospitals

Size	Respondents Means (s.d.)	Non-Respondents Means (s.d.)	t-value	p-value
Beds	149.6286 (136.765)	170.1071 (153.084)	1.14	0.26
Beds-log	4.6892 (0.811)	4.7778 (0.873)	0.84	0.41
FTE	560.7714 (590.179)	659.1105 (828.761)	1.19	0.24
FTE-log	5.8859 (0.962)	5.884 (1.116)	0.02	0.99

Using the five original items yielded two factors rather than one. The first factor (F1) had three items (2, 3, 4 of Appendix 3), and the second factor (F2) has 2 items (1,5). The factor loadings on F1 ranged from 0.715 to 0.856, with an Eigenvalue of 2.26; the factor loadings of F2 were 0.903 and 0.622, with an Eigenvalue of 1.04. The findings in this study seem consistent with the findings in the modified Organizational Climate survey instrument (Litwin & Stringer, 1968), but one cannot determine whether the particular three items this study found to converge into the first factor here are the same three items that clustered in the Litwin and Stringer (1968) study since they did not provide specific information about the items.

Evaluating the phraseology used in all the items indicated that item 5 is prescriptive whereas the others are descriptive. Therefore, since items 1 and 5 converged into a single factor, the decision was made to use only items 2, 3, and 4 in the subsequent analyses.

When those three items were factor analyzed, they converged into one factor with an Eigenvalue of 1.91 which explained 63.5 of the variance; and had a coefficient alpha

TABLE 5.3
Distribution of Hospitals

Number of Respondents per Hospital	Frequency number	pct.
3	17	24.3%
4	24	34.3%
5	13	18.6%
6	10	14.3%
7	6	8.5%

of 0.70. Table 5.4 provides means and standard deviations for and correlations among the organizational climate dimensions.

The two items (items 20 and 21) for achievement-orientation were factor analyzed. These two items converged on one factor with an Eigenvalue of 1.72 which explained 86.1 percent of the variance, and factor scores of .93. The coefficient alpha was 0.83. The original study reported an average bi-serial correlation for achievement of 0.68 (Stern, 1967).

When the nine items for external-orientation were factor analyzed, the factor scores for the items ranged from 0.860 to 0.641. All nine items converged on one factor with an Eigenvalue of 5.627 which explained 62.5 percent of the variance. The coefficient alpha was 0.92. In two prior studies, Narver and Slater found the coefficient alphas for customer orientation to be 0.89 and 0.88 respectively (1990, 1994).

In order to assess discriminant validity, all of the 14 indicator items relating to the three climate attributes were factor analyzed together. Three factors emerged, with items 6-14 loading on the "external-orientation" factor, items 20 and 21 loading on the "achievement-orientation" factor, and items 2, 3 and 4 loading on the "risk-orientation" factor as shown in Table 5.5. There were some

Table 5.4

Descriptive Statistics and Correlations
for Organizational Climate

Variables	Mean (s.d.)	Correlations 1	2	3
1. Risk-orientation	4.83(.61)	(0.68)[a]		
2. Achieve-orientation	5.06(.69)	.46***	(0.83)	
3. External-orientation	5.11(.66)	.59***	.57***	(0.92)

[a] Coefficient alphas on diagonal.
* $p<.05$
** $p<.01$
*** $p<.001$

secondary loadings of items 4, 6 and 8, but secondary loadings on to other climate attributes can be expected since all the climate attributes are part of the organizational climate domain. Results in Table 5.5 corroborate the validity of the organizational climate measures.

5.3 MEASURES OF INNOVATION

Prior to seeking participation by the hospitals, the panel of five experts developed a list of Medical Imaging technologies and rated those technologies on both radicalness and relative advantage, using the process described in Chapter 4. These ratings were then evaluated for inter-rater reliability through correlation analysis. With one exception (Rater 2 and 3 on relative advantage), all inter-rater correlations were significant at the .05 level or better as shown in Tables 5.6 and 5.7. These results, therefore, indicate a high level of concordance across the experts, which suggest that a mean score of their experts' ratings is an appropriate measure. The list of 68 Medical Imaging technologies expert scores on radicalness and relative advantage for those technologies appear in Table 5.8.

Table 5.5

Factor Analysis to Evaluate Discriminant Validity

Item Number	Factor 1 (external-orientation)	Factor 2 (achievement-orientation)	Factor 3 (risk-orientation)
CL.7	.80460		
CL.11	.78404		
CL.12	.75870		
CL.10	.69770		
CL.13	.69033		
CL.14	.64147		
CL.9	.60936		
CL.8	.60799		
CL.6	.59659		
CL.20		.84964	
CL.21		.81603	
CL.2			.88890
CL.3			.59317
CL.4			.56861

Table 5.6

Inter-rater Correlations for Relative Advantage

Variables	Mean	s.d.	1	2	3	4	5
Rater1	4.49	1.33	___				
Rater2	4.60	1.36	.39***	___			
Rater3	4.03	1.36	.30*	.22	___		
Rater4	4.70	1.75	.39***	.30*	.61***		
Rater5	4.87	1.30	.47***	.52***	.57***	.62***	___

* p<.05
** p<.01
***p<.001

Table 5.7

Inter-rater Correlations for Radicalness

Variables	Mean	s.d.	1	2	3	4	5
Rater1	4.96	1.70	—				
Rater2	4.06	1.67	.48***	—			
Rater3	4.37	1.95	.66***	.50***	—		
Rater4	5.25	1.57	.54***	.70***	.41***	—	
Rater5	5.06	1.64	.73***	.70***	.72***	.66***	—

* $p<.05$
** $p<.01$
*** $p<.001$

Table 5.8

Mean Expert Scores for Technologies [a]

Technology	Radicalness	Relative Advantage
1. Automated Chest Unit		
a. Automated	1.80	1.80
b. Analog	3.00	1.40
c. Digital	4.60	4.00
2. C-Arm Mobile		
a. Digital Fluoroscopy	3.60	3.60
b. High Frequency Generators	3.80	3.40
c. Image Manipulation	4.20	3.60
3. Computed Tomography		
a. Second Generation	1.80	1.40
b. Third Generation	2.80	3.00
c. Fourth Generation	5.80	5.00
d. Cine CT (electron beam)	5.60	5.80
e. Spiral/Helical Technology		
1. 360/180 degree scan	6.20	5.20
2. Volumetric scanning	7.00	5.20
3. CT Angiography	6.00	6.60
f. Independent Work Stations		
1. 3-D reconstruction	6.20	6.00
2. Image manipulation/post screening	5.60	4.20
4. Magnetic Resonance Imaging		
a. Magnet		
1. Superconducting	5.80	6.60
2. Resistive	4.60	6.00
3. Permanent	4.60	6.00
b. Field Strength		
1. Ultra Low (<0.5 Tesla)	4.00	5.80
2. Lo Field (0.5 Tesla-1.5)	3.60	6.00
3. Hi Field (1.5 Tesla-2.0)	5.00	6.20
4. Experimental(>2.0 Tesla)	6.20	7.00
c. Shielding		
1. Passive	4.20	5.40
2. Dynamic	4.20	6.20
d. Coils		
1. Surface	4.80	5.40
2. Quadrative	5.40	5.80

3. Intra-cavity	4.60	6.20
4. Phased array	4.40	6.20
e. Software		
1. Gradient Pulse Sequences	4.20	5.40
2. Epi-echo planar imaging	5.00	5.40
3. Cardiac Gating	4.40	5.40
4. MAST	4.25	5.50
5. FAST	4.25	5.60
6. Respiratory Gating	4.20	5.00
7. Flow Compensation	4.20	6.20
8. Magnetic Transfer Imaging /Contrast	5.40	6.20
f. Workstation		
1. Dependent	3.00	5.80
2. Independent	4.60	5.80
5. **Mammography/ Breast Imaging**		
a. Analog	4.00	2.20
b. Digital	4.40	5.20
c. Stereo localization for biopsy	5.80	4.60
d. Core Biopsy	5.40	5.20
6. **Nuclear Medicine Gamma Camera/Computer**		
a. Detectors		
1. Single	2.40	1.40
2. Multiple (Spect)	5.00	4.00
b. Computers	5.40	3.00
c. Radiopharmaceutical	5.00	4.20
7. **PET (Positron Emission Tomography)**		
a. Detectors	6.00	6.50
b. Computers	5.60	6.25
c. Radiopharmaceutical	5.80	6.75
8. **Ultrasound**		
a. Platform		
1. Mechanical	2.20	2.40
2. Phased Array	4.20	4.20
3. Linear Array	4.40	3.20
4. Annular Array	4.20	4.00
b. Transducer		
1. Transcutaneous	3.60	3.50
2. Intra-cavity	4.40	5.50
3. Transesophogeal	4.20	4.50
4. Itravascular	5.20	6.50
5. Endoscopic	4.80	5.25
6. Transcranial	4.80	5.25

c. Doppler		
1. Continuous wave	3.40	3.60
2. Pulsed	4.60	4.80
3. Color	5.40	5.00
9. **Special Procedures Suite**		
a. Stand		
1. Single Plane	4.00	3.60
2. Bi-Plane	4.40	4.60
b. X-Ray tubes/generators	4.00	3.60
c. Image Intensifier	3.60	2.80
d. Video Chain	4.20	3.60
e. Digital Subtraction Angiography	5.00	4.80

[a] These values are rated on a 1 to 7 scale

The first method for evaluating innovation adoption of Medical Imaging technology was to formulate an aggregate score for the total number of Medical Imaging technologies that have been adopted by the hospital. This was indicated as Number of innovation adopted. This method replicates the measure used for the adoption of innovation in previous research (Damanpour, 1987). Each hospital received a survey listing the 68 Medical Imaging technologies (as shown in Appendix 4), and were asked to identify the technologies, and the approximate year of adoption, in their hospital.

The second method developed to measure innovation adoption was to determine the radicalness and relative advantage of the adopted technological innovations. To determine the radicalness of the innovations adopted by a hospital, each of the adopted technologies was multiplied by it's respective Mean Expert score for radicalness, as determined by the panel of experts. The relative advantage of the adopted technologies was determined similarly, using the Mean Expert scores for relative advantage.

The following chapter will present the results of the statistical analysis.

Chapter 6

RESULTS OF THE STUDY

This chapter provides the results from the statistical analysis discussed in Chapter 4, performed on a sample of 70 hospitals from the states of Wisconsin, Minnesota, and Illinois. The first part of this chapter discusses testing the hypotheses developed in Chapter 3. The second part of this chapter discusses the potential moderating effects of the three contextual variables on relationships between climate and innovation attributes, which were also discussed in Chapter 3.

6.1 TESTING THE HYPOTHESES

The research hypotheses developed in Chapter 3 can be broadly stated as an examination of the bivariate relationships between the climate attributes and the innovation attributes. Table 6.1 provides these correlation coefficients for the relationships between climate attributes and innovation attributes. As noted previously, this study used three methods of measuring innovation. It used the experts' scores of radicalness and relative advantage, and it included the number of innovations adopted because the latter measure typifies previous studies of innovation adoption.

Hypothesis H1a states that hospitals with a more risk-oriented organizational climate tend to adopt more radical innovations. Based on Pearson product-moment correlational analysis, this research finds a significant positive relationship between risk-oriented organizational climate as perceived by top administrators and the radicalness of the adopted innovations as judged by outside experts (r = .22, p = .062).

Hypothesis H1b states that organizations with a more risk-oriented organizational climate tend to adopt innovations with greater relative advantage. This research finds a significant positive relationship between risk-oriented organizational climate and the relative advantage of the adopted innovations (r = .23, p = .051).

Hypothesis H2a states that organizations with a more achievement-oriented organizational climate will tend to adopt more radical innovations. This research does not find a significant zero-order relationship between achievement-orientation and the radicalness of adopted innovations (r = .07, p =.555).

Hypothesis H2b states that organizations having a external-oriented climate tend to adopt more incremental innovations (less radical) rather than to adopt more radical

Table 6.1

Means, Standard Deviations, and Correlations

Variables	Mean	s.d.	Correlations 1.	2.	3.	4.	5.
1. Risk-orientation	4.96	.74					
2. Achievement-orientation	5.54	.74	.46***				
3. External-orientation	5.11	.66	.59***	.57***			
4. Radicalness	89.21	63.77	.22*	.07	.04		
5. Relative Advantage	88.44	66.50	.23*	.07	.02	.93***	
6. Number of Innovations	20.34	13.70	.23*	.06	.04	.65***	.75***

† $p<.10$
* $p<.05$
** $p<.01$
*** $p<.001$

innovations. This research does not find a significant zero-order relationship between a external-oriented organizational climate and the degree of radicalness of adopted innovations (r = .04, p = .769).

Hypothesis H2c states that organizations with a more achievement-oriented climate will tend to adopt innovations with greater relative advantage. This research does not find a significant zero-order relationship (r = .07, p = .563).

Hypothesis H2d states that organizations with a more external-oriented organizational climate will tend to adopt innovations with greater relative advantage. This study does not find a significant zero-order relationship (r = .02, p = .874).

The number of innovations adopted was also examined using correlation analysis. This study finds a significant positive relationship between risk-oriented organizational climate and the number of innovations adopted (r = .23, p = .052). This study does not find any significant zero-order relationship with the two remaining dimensions of organizational climate, external-orientation and achievement-orientation.

Table 6.2 provides results that regress each dependent variable onto the three climate attributes. A multivariate perspective is used to evaluate the hypotheses because the overall organizational climate is not a unidimensional measure. Multiple regression analysis assesses the combined effects of all the independent variables, rather than analyzing just a simple bivariate relationship. When using the radicalness scores as the dependent variable, hypothesis H1a is supported. A significant positive relationship is found between risk-orientation and the radicalness scores (beta = .31, p =.04). Hypothesis H1b is supported using the relative advantage scores as the dependent variable. A significant positive relationship is found between risk and relative advantage scores (beta = .33, p =.03). The relationship between risk-orientation and number of innovations adopted also emerges as significant (beta = .32, p = .03). Thus, the risk dimension of climate predicts all three measures of innovation even after controlling for potential effects of the other two climate attributes of external-orientation and achievement-orientation.

6.2 POTENTIAL MODERATING EFFECTS OF CONTEXTUAL VARIABLES

This study evaluates the effects of three contextual variables on the relationship between innovation attributes and climate attributes. Previous research has indicated that organizational size, slack, and age have effects on both climate and innovation attributes. However, no empirical evidence exists about the specific way that these contextual variables affect the relationship between climate and

Table 6.2

Multiple Regression of Innovation Attributes onto Climate Attributes

Dependent Variable: *Radicalness*

Predictor Variables	Betas	t	p	R^2
Risk-orientation	0.31	2.05	.04	.16
External-orientation	-0.16	-0.97	.33	
Achievement-orientation	0.01	0.09	.89	

Dependent Variable: *Relative Advantage*

Predictor Variables	Betas	t	p	R^2
Risk-orientation	0.33	2.25	.03	.17
External-orientation	-0.19	-1.20	.23	
Achievement-orientation	0.27	0.16	.85	

Dependent Variable: *Number of Innovations Adopted*

Predictor Variables	Betas	t	p	R^2
Risk-orientation	0.32	2.15	.03	.07
External-orientation	-0.48	-0.92	.36	
Achievement-orientation	-0.00	-0.01	.99	

innovation attributes. As noted in Chapter 4, the analysis used here (and outlined in Figure 6.1) to identify moderator variables was proposed by Sharma, Durand, and Gur-Arie (1981) and Arnold (1982).

In the first step, a researcher determines whether a significant interaction is present between the hypothesized moderator variable (z) and the predictor variables (x) by using the moderated regression analysis (MRA). In applying MRA, hierarchical regression is used. The following three regression equations are examined for equality of the regression coefficients (Zedeck, 1971).

Model 1: $y = a + bx + e$

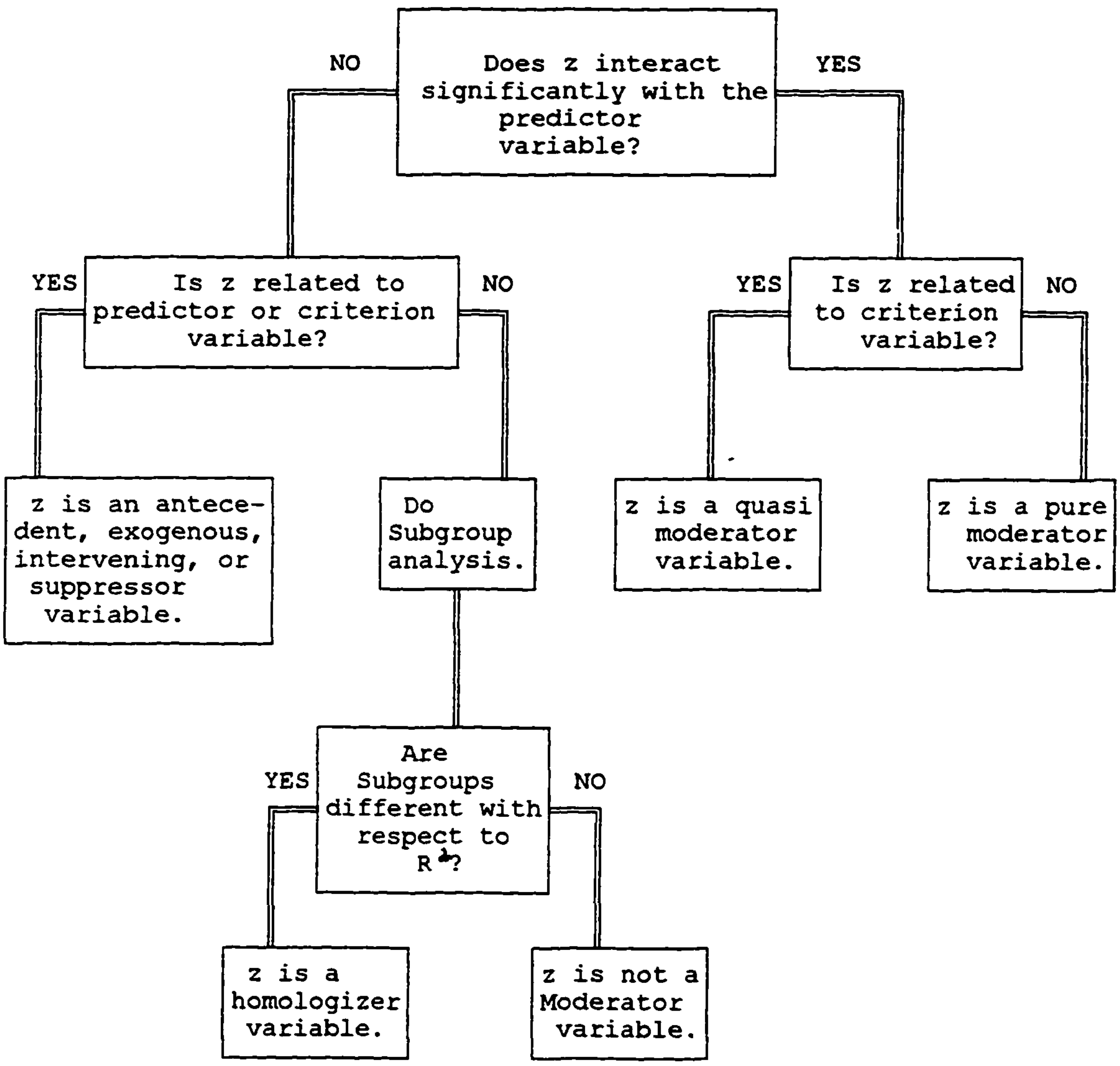
Model 2: $y = a + bx + cz + e$

Model 3: $y = a + bx + cz + dxz + e$

6.2.1 Size as a Contextual Variable

Table 6.3 provides the summary statistics for Models 1 and 2, and Model 3, for the contextual variable of organizational size. Model 1 regresses the dependent variable of innovation onto the three independent variables of risk-orientation, external-orientation, and achievement-orientation climates (reported completely in Table 6.2). Model 2 adds the contextual variable of size, while Model 3

Figure 6.1
FRAMEWORK FOR IDENTIFYING MODERATOR VARIABLES
(from Sharma et al., 1981)



adds the interaction terms of size by each of the climate attributes.

In the hierarchical regression Model 2, the inclusion of the contextual variable of size significantly increases explained variance for each of the three dependent variables; radicalness, relative advantage, and the number of innovations adopted. For example, R^2 rises from 0.06 to 0.48 for the radicalness score when size is included.

More importantly, a comparison of Model 2 and Model 3 in Table 6.3 reveals that the inclusion of the interaction terms significantly increases explained variance. For example, R^2 rises from 0.48 to 0.55 for the radicalness score when the interaction terms are included.

These results indicate that the contextual variable of hospital size interacts significantly with the predictor variables. Therefore, size operates as a moderator of some sort. To assess whether a contextual variable is a quasi-moderator or a pure moderator, it is necessary to examine whether the contextual variable is related to the criterion (dependent) variable: if correlated, then the contextual variable is a quasi-moderator variable (see Figure 6.1). All three of the Pearson product-moment correlations in Table 6.6 between size and the innovation attributes are significant at the $p < .001$ level, which means that hospital

Table 6.3

Hierarchical Regression Analysis for Size[a] As a Contextual Variable

Variables	R^2 (df)	F	ΔR^2 (df)	F for ΔR^2
RADICALNESS				
MODEL 1	0.06 (3,66)	1.53		
MODEL 2	0.48 (4,65)	14.23 (1,65)	0.42	51.28***
MODEL 3	0.55 (7,62)	10.77 (3,62)	0.07	3.27*
RELATIVE ADVANTAGE				
MODEL 1	0.08 (3,66)	1.83		
MODEL 2	0.47 (4,65)	14.23 (1,65)	0.39	47.58***
MODEL 3	0.55 (7,62)	10.68 (3,62)	0.08	3.63*
NUMBER ADOPTED				
MODEL 1	0.03 (3,66)	1.63		
MODEL 2	0.47 (4,65)	14.93 (1,65)	0.44	51.12***
MODEL 3	0.55 (7,62)	11.00 (3,62)	0.08	3.49*

[a] Size is measured by the log of beds
† $p<.10$
* $p<.05$
** $p<.01$
*** $p<.001$

size serves as a quasi-moderator of the relationship between climate and innovation attributes. A quasi-moderator affects the form of the relationship between climate attributes and innovation attributes. With a quasi-moderator, size may interact with organizational climate but may also be directly related to adoption of innovation, or to organizational climate, or to both.

6.2.2 Slack As a Contextual Variable

Table 6.4 provides the summary statistics for Models 1 and 2, and Model 3, for the contextual variable of organizational slack. Model 1 regresses the dependent variable of innovation onto the three independent variables of risk-orientation, external-orientation, and achievement-orientation climates (reported completely in Table 6.2). Model 2 adds the achievement-orientation climates (reported completely in Table 6.2). Model 2 adds the contextual variable of slack, while Model 3 adds the interaction terms of slack by each of the climate attributes.

In the hierarchical regression Model 2, the inclusion of the contextual variable of slack significantly increases explained variance for each of the three dependent variables: radicalness scores, relative advantage scores, and number of innovations adopted. For example, R^2 rises from 0.08 to 0.18 for the relative advantage score when slack is included.

Comparing Model 2 and Model 3 in Table 6.4 reveals that the inclusion of the interaction terms significantly increases explained variance. For example, R^2 rises from 0.18 to 0.27 for the relative advantage score when the interaction terms are included. These results indicate that the contextual variable of hospital slack interacts significantly with the predictor variables. Therefore, slack operates as a moderator of some sort. As noted previously, if the contextual variable is related to the criterion (dependent) variable, the contextual variable is a quasi-moderator. All three of the Pearson product-moment correlations in Table 6.6 for slack are significant at $p < .05$, which means that slack also serves as a quasi-moderator. Slack may, therefore, interact with organizational climate but also be directly related to adoption of innovation, or to organizational climate, or to both.

6.2.3 Age As a Contextual Variable

Table 6.5 provides the summary statistics for Models 1 and 2, and Model 3, for the contextual variable age of the hospitals. Model 1 regresses the dependent variable of innovation onto the three independent variables of

Table 6.4
Hierarchical Regression for Slack
As A Contextual Variable

Variables	R^2 (df)	F	ΔR^2 (df)	F for ΔR^2
RADICALNESS				
MODEL 1	0.06 (3,66)	1.53		
MODEL 2	0.18 (4,65)	3.55 (1,65)	0.12	9.06**
MODEL 3	0.26 (7,62)	3.19 (3,62)	0.08	2.39†
RELATIVE ADVANTAGE				
MODEL 1	0.08 (3,66)	1.83		
MODEL 2	0.18 (4,65)	3.67 (1,65)	0.12	8.56**
MODEL 3	0.27 (7,62)	3.23 (3,62)	0.09	2.35†
NUMBER ADOPTED				
MODEL 1	0.07 (3,66)	1.63		
MODEL 2	0.18 (4,65)	3.65 (1,65)	0.11	9.10**
MODEL 3	0.25 (7,62)	3.27 (3,62)	0.07	2.44†

† $p<.10$
* $p<.05$
** $p<.01$
*** $p<.001$

risk-orientation, external-orientation, and achievement-orientation climates (reported completely in Table 6.2). Model 2 adds the contextual variable age, while Model 3 adds the interaction terms of the age by each of the three climate attributes.

Tables 6.5 indicates that hospital age does not increase the amount of explained variance for any of the three measures of innovation adoption. A comparison of Model 2 and Model 3 in Table 6.5 reveals that the inclusion of the interaction terms of climate by age also does not significantly increase explained variance.

Referring back to Figure 6.1, if a contextual variable does not interact significantly with the predictor variable, then it is necessary to determine whether that contextual variable is related to the criterion (dependent) or predictor (independent) variable.

From Table 6.6, it can observed that correlations for age with the dependent variables are all nonsignificant: .19 for the radicalness, .18 for relative advantage, and .18 for number of innovations (Table 6.6). Correlations for age with the independent variables were also found to be nonsignificant: .04 for risk-orientation, .01 for external-orientation, and -.13 for achievement-orientation. Since age is not related to the dependent or independent

Table 6.5

Hierarchical Regression Analysis for Age
As A Contextual Variable

Variables	R^2 (df)	F	ΔR^2 (df)	F for ΔR^2
RADICALNESS				
MODEL 1	0.06 (3,66)	1.53		
MODEL 2	0.10 (4,65)	1.80 (1,65)	0.04	2.50
MODEL 3	0.16 (7,62)	1.63 (3,62)	0.06	1.36
RELATIVE ADVANTAGE				
MODEL 1	0.08 (3,66)	1.83		
MODEL 2	0.11 (4,65)	1.83 (1,65)	0.03	2.13
MODEL 3	0.15 (7,62)	1.59 (3,62)	0.04	1.13
NUMBER ADOPTED				
MODEL 1	0.07 (3,66)	1.63		
MODEL 2	0.10 (4,65)	1.75 (1,65)	0.03	2.05
MODEL 3	0.15 (7,62)	1.54 (3,62)	0.05	1.22

† $p<.10$
* $p<.05$
** $p<.01$
*** $p<.001$

Table 6.6
Pearson Correlations Between Contextual Variables and Innovation Outcomes

Variables	Correlations		
	Beds	Slack	Age
1. Radicalness	.63***	.30*	.19
2. Relative Advantage	.61***	.29*	.18
3. Number of Innovations	.63***	.30*	.18

* $p<.05$
** $p<.01$
*** $p<.001$

Table 6.7

Testing for Significance in Sub-group Analysis of Hospitals by Age

	Group 1 (Less than 64)		Group 2 (64 or Greater)		
Dependent Variable	R^2	F	R^2	F	z
Radicalness	.07	1.80	-.01	.90	0.94
Relative Advantage	.06	1.77	.00	1.03	1.44
Number of Innovations	.06	1.73	-.01	.91	0.85

variables, it is not a moderator. When a contextual variable is not related to the predictor or the criterion variables, then the sample should be split into subgroups to analyze the differential strengths of relationships, following Figure 6.1.

The total sample was split into subgroups at the median hospital age of 64 years. The median value was used because the distribution of hospitals was skewed toward older hospitals. Results of a test of significance using Fischer's z transformation of correlations for difference in predictive validity across groups appears in Table 6.7.

When significant differences result, then the contextual variable would be classified as a homologizer. However, no significant differences were found between the two age groups; hospital age is not any type of moderator.

The following chapter will interpret these research findings, indicate limitations of the study, suggest directions for future research, and offer conclusions.

Chapter 7

Discussion of Research Findings and Conclusion

This chapter offers an interpretation of the research findings presented in Chapter 6 and discusses the implications of these findings for management theory and practice. Contributions and limitations of the study are discussed, and suggestions for future research are advanced.

7.1 Discussion of Results

Main Effects

Hypothesis H1a of this study proposed that hospitals with more risk-oriented organizational climates tend to adopt more radical innovations. There is marginal support for this hypothesis through correlation analysis which finds a significant positive relationship between the degree of risk-orientation and the adoption of more radical innovations. This hypothesis was also supported through multiple regression analysis that partialled out the effects of the other two climate attributes. Moreover, risk-orientation is also significantly positively related to the historically popular measure (number of innovations adopted).

Top managers serve as a bridge between the organization and the technical environment (Daft, 1978; Hage & Dewar, 1973). Their ideas and influence on organizational members molds the decisions for the organization, setting the tone for the future of the organization. Top managers possess differing attitudes toward risk and innovation. While some top managers have conservative attitudes, using methods and technologies that have served them well in the past, others are more risk prone, actually encouraging risk-taking and the adoption of more innovative or radical techniques. The findings of this dissertation study corroborate prior empirical studies (Damanpour, 1991; Souder, 1987) which found that upper level management's favorable attitude toward risk encourages the use of innovative or radical techniques to move the organization forward.

Hypothesis H1b proposed that hospitals with more risk-oriented climates tend to adopt innovations with greater relative advantage. There is also marginal support for hypothesis H1b in this study through correlation analysis. This hypothesis is also supported through multiple regression analysis. This study finds that hospitals with greater risk-oriented organizational climates tend to adopt innovations that have greater relative advantage. Organizations that take on greater risk in their investments may expect a greater return greater benefit to the organization and its constituents. For example, if a hospital were to adopt an MRI, which is a greater financial investment, to replace a CT scan, they would expect that the MRI provide both the hospital and patients a greater benefit than the current CT scan. Investing in a new MRI would eliminate the need to send patients to other facilities to provide a sharper picture of the affected area which would result in greater revenue for the hospital. The fee for the MRI procedure would generate more income per procedure, and the patient will receive more state-of-the-art technology resulting in a better quality image for physician interpretation. The addition of the MRI also enhances the hospital's image. The addition of an MRI may, then, be translated into greater relative advantage such as improved utilization, greater productivity, or an increase in technological sophistication. These findings contribute to the adoption of innovation literature and can contribute to the justification for adopting new technological innovations.

No support was found for Hypothesis H2a stating that more achievement-oriented organizations tend to adopt more radical innovations. The theoretical background for this hypothesis suggests that when there is an expectation of high achievement, individuals will most likely meet those expectations. Rosenthal (1963) found that performance expectations affect the behavior of individuals in an organization. Therefore, hospitals with a more achievement-oriented climate may tend to behave in a manner consistent with their beliefs and attitudes towards high achievement. The assumption made in this study was that the adoption of innovations, specifically more radical innovations, may result from the achievement-oriented climate which creates an expectation for improved individual and organizational performance. This achievement-orientation would, therefore, likely translate to decisions made by top management to adopt more radical innovations for the organization.

Achievement has been viewed in a variety of ways; for example, as achieving specific business goals, or as achieving a standard of excellence relative to an industry standard, to their competition, or to the organization's own capabilities. However, achievement-orientation may not necessarily imply that a hospital reach a standard of excellence that includes the adoption or non-adoption of specific types of Medical Imaging technologies, which the theoretical development of the hypothesis suggested.

Although hospitals may be achieving their own specific goals or standards of excellence, being more achievement-oriented did not correlate with hospitals adopting more radical technology. The measures used in this study assessed achievement-orientation but did not assess whether hospitals were reaching their own goals and objectives.

The concept of external-oriented organizational climates has not been evaluated in the health care industry as it pertains to the adoption of technological innovations. Hypothesis H2b stated that the propensity to adopt incremental innovations would be positively associated with a external-oriented organizational climate. No support was found for this relationship using correlation or multiple regression analysis. This implies that more external-oriented hospitals may not be "jumping on the technology bandwagon" by adopting more radical Imaging technology simply because it is available.

Perhaps there are other more critical issues in the health care industry that lead to the adoption of more radical technologies than a hospital's external-orientation. The availability of hospital resources may be an over-riding issue for more radical technology adoption. The competitive nature of the hospitals' environment may be another critical factor to adoption of more radical innovations.

Medical equipment acquisition in hospitals may be equated to creating a portfolio of health services that addresses particular market niches (Greer, 1984; Meyer, 1985). The top-level decision makers may in fact be formulating explicit strategic decisions when they consider investment in new Imaging technology.

For example, suppose a hospital positions itself as a referral center for a tertiary care hospital. The hospital is currently using a low powered CT scan which has the ability to scan and diagnose the existence of tumors. Yet, the primary care physician and the local hospital may not provide treatment for the tumor, referring the patient to a tumor specialist practicing at a larger tertiary care hospital. An MRI provides a clearer sharper image of the tumor, thereby enabling the original primary care physician to diagnose the type of tumor. However, a decision to adopt the MRI to replace the low powered CT scan may only be considered if the hospital added physician services enabling treatment of the tumor through either surgery or chemotherapy. Therefore, though the original hospital may be external-oriented, the adoption of technology to deliver the most appropriate care to the patient would be based on the strategic decision to remain a referral center to a larger tertiary care hospital. Thus, adoption of new radical Medical Imaging technology in a hospital may be considered a strategic decision, rather than an operational decision. External-orientation may therefore have little role in the adoption of innovation in such a context.

External-oriented organizational climates may be linked with a short-term orientation that assesses the benefits for individual patients. Greer (1988) alluded to these patient decisions as the "clinical model" of decision making when ethics promotes each individual patient's welfare but rejects concerns for collective efficiency. Therefore, hospitals with a greater external-orientation may not necessarily influence the adoption of Imaging technology since such adoption may be a strategic rather than a short-term patient oriented decision.

Hypothesis H2c stated that the propensity to adopt innovations with greater relative advantage is positively associated with an achievement-oriented organizational climate. No support was found for this hypothesis using correlation or multiple regression analysis. This may occur because the measure of relative advantage used in this study is based on a comprehensive list of Imaging technologies, providing an objective evaluation of relative advantage of each technology independent of a hospital's specific circumstances. As mentioned earlier, the experts evaluating the relative advantage of each of the Imaging technologies were provided with a definition of "relative advantage" as a technology's ability to: (a) foster superior service to patients; (b) enhance productivity; (c) improve performance efficiency; (d) reduce labor costs; (e) insure greater reliability and consistency in performance; and (f) enable the adopter organization to enjoy a number of indirect/intangible benefits (for instance, higher market share or improved hospital image).

When a hospital evaluates the relative advantage of a specific technology for potential adoption, the hospital likely considers the benefits or advantage of the new technology compared to technology used previously. The evaluation of relative advantage is, then, a comparison to their own previous technology. However, the relative advantage scores used in this study are based on the panel of experts' comparison of relative advantage among the 68 Imaging technologies identified in the initial survey. Therefore, an individual hospital may perceive the relative advantage of a technology it recently adopted as greater than the previous technology, but in comparison, the relative advantage may not be large enough compared to the most recent state-of-the-art Imaging technology.

Achievement-orientation may be viewed as a competitive inclination, where individuals and the organization tend to take responsibility for solving problems, accomplishing goals, and is viewed as demanding and challenging, yet supportive. As mentioned previously, relative advantage measured by the panel of experts considering all 68 Imaging innovations, whereas, hospitals may view achievement-orientation compared to their organization's abilities and goals. The measure of relative advantage, therefore, may not coincide with a relative advantage goal that a specific hospital would expect to achieve for itself.

Hypothesis H2d states that organizations with a more external-oriented organizational climate tend to adopt innovations with greater relative advantage. No support was found for this hypothesis using correlation analysis or multiple regression analysis. As noted earlier, this study did not find any significant relationship of external-orientation with the adoption of more radical innovations or with the historically popular measure of number of innovations. These results, collectively, suggest that external-orientation does not have a significant impact on the adoption of innovation.

Perhaps hospitals that are more external-oriented do not consider the relative advantage of the innovations they adopt, since there may be other factors that outweigh customer-orientation in the adoption of technology. As stated previously, the nature of the competitive environment, which makes the adoption of Imaging technology a strategic consideration, may be the most critical issue in influencing the nature of radicalness or relative advantage of technology adopted by the hospital. For example, if a hospital is a small rural hospital, the nature of their patient admissions may be only primary or secondary care. The hospital may be involved in outpatient primary care, or inpatient secondary care where the nature of inpatient procedures may be limited to broken bones, or diagnostic procedures enabling the patient to be triaged to further specialty care. Thus, the need for adoption of technology may be limited due to the nature of care performed in the hospital.

On the other hand, larger hospitals may provide tertiary care which may include cardio-vascular and neurosurgical procedures. The hospital providing secondary care may never adopt innovations required in a hospital providing tertiary care. It is therefore likely that the adoption or non-adoption of Imaging technologies may not be dependent on how customer-oriented the hospital is, but rather on the specific level of care or strategic position of the hospital.

Finally, an external-orientation is a relatively new concept to the hospital industry. The 1980s brought about competition in the hospital industry due to the growth of managed care. Prior to the 1980s, insurers would reimburse hospitals and physicians for their services at cost, or patient care was provided on a fee-for-service basis. Managed care has brought competition to the hospital industry because health care is now negotiated between insurers and providers. HMOs or managed care organizations bring a great number of patients to the hospital through negotiated contracts. One or several patients receiving inadequate service may influence the decision to continue or eliminate the contractual relationship. This change in relationship between individual physician and patient has resulted in a greater awareness of patient or customer preferences. Historically, if one patient were lost due to dissatisfaction with services or care, the hospital may not have risked the loss entire corporate contract involving hundreds of patients. Thus, it may be that hospitals have not yet recognized the importance of the relationship between customer-orientation and the adoption of technology. This dimension of climate may become more critical in the future as competition heats up further due to the increase in managed care.

To summarize the results, two out of six hypotheses were supported in this study. Hospitals with more risk-oriented organizational climates tend to adopt innovations that are more radical and have greater relative advantage. Also, hospitals that are more risk-oriented tend to adopt more innovations, which corroborates past empirical studies (Damanpour, 1991; Souder, 1987). Neither achievement-orientation nor external-orientation exhibit a significant relationship with the radicalness of innovations, the relative advantage of innovations, or the number of innovations adopted by hospitals.

As noted earlier, the lack of support for Hypotheses H2a through H2d may be based on an incorrect application of previous theory. The hospital industry is unique in many ways; the ever-changing reimbursement methods, the change in the structure of the industry, as well as its method of decision making to adopt imaging technology. External-orientation and its affect on the adoption of technological innovations had not previously been evaluated. Achievement-orientation and its affects on the adoption of technological innovations also had not been previously evaluated.

Contextual Variables

Each of the three contextual variables studied (organizational size, slack, and age) will be discussed next.

Size was found to be a quasi-moderator in the relationship between organizational climate and the attributes of the innovations adopted. As a quasi-moderator, size not only interacts with organizational climate, it also is directly related with the adoption of innovation, and/or with organizational climate. In this study, size has no direct relationship with organizational climate: risk-orientation (r = -.07, p = .54), external-orientation (r = -.11, p = .34), and achievement-orientation (r = -.11, p = .37). No difference in organizational climate dimensions between large and small hospitals were observed with the application of t-tests. For example, no significant difference in risk-orientation is found between large and small hospitals (t = .18, p = .64). This is contrary to previous empirical studies (Mintzberg, 1979; Yeaple, 1992) which found that smaller organizations tended to be more risk-oriented, although none included hospitals in their samples.

The hospital industry is experiencing a dramatic change due to the increase in managed care and in shareholder-owned chains (Kuttner, 1996). The competitive and tumultuous nature of the industry may exert pressure on hospitals, resulting in a mind-set that encourages or requires hospital managers to take risks in order to compete effectively. If the hospital is not risk-oriented, then they may not even survive. The struggle for survival in the health care industry may require that hospitals assume a risk-oriented posture in order to weather the "health care hurricane".

The decision to adopt Medical Imaging technology in both large and small hospitals may be constrained or predetermined by the level of care and services they provide. Yet, both large and small hospitals encounter the same competitive health care environment that demands an organizational climate that is able to respond to these external pressures. These environmental pressures might explain why organizational climates do not differ substantially between large and small hospitals.

In this study, larger hospitals tended to adopt a greater number of innovations, more radical innovations, and innovations that provide greater relative advantage (Table 6.6). This is further supported by a significant difference in radicalness (t = -2.97, p = .01) and relative advantage across smaller hospitals and larger hospitals (t = -2.77, p = .01). These results are indicative of the nature of hospitals: larger hospitals provide a greater number of services and procedures that are at a more advanced level of care requiring the adoption of more radical technology, with greater relative advantage, to meet those needs.

Larger hospitals are more functionally differentiated or decentralized and are more likely to adopt innovations that are consonant with the perspectives of department managers and other professionals (Moch and Morse, 1976). Functional differentiation in larger hospitals can be viewed as an increase in the number of services provided. Larger hospitals may have psychiatric services, oncology services, cardiac surgery, and orthopaedic services, for example, which smaller hospitals are not likely to have. On the other hand, smaller hospitals, by virtue of their limited patient base and resources, tend to provide fewer services and procedures at a lower level of care and may, therefore, adopt fewer technological innovations that are less radical and have less relative advantage.

This effect of size on adoption of innovation corroborates some previous studies in the hospital industry that found that the impact of size on the adoption of the number of innovations in hospitals is substantial, but primarily indirect, operating through its effect on structural attributes (Moch, 1976). Sample populations in other studies include libraries (Damanpour, 1987) and large and small industrial manufacturers (Dastmalchian, 1986; Capon et al., 1992).

Damanpour (1996) states that the relationship between organizational size and the adoption of innovation may be weaker in service than in manufacturing organizations. He (Damanpour, 1996) suggests that a larger service organization would not maintain the same advantageous structural conditions as manufacturing organizations. An increase in service organizations' size generally results in more formalization which inhibits the service provider's flexibility in dealing with customer unpredictability.

Results may vary for manufacturing firms and hospitals because hospitals are in a fragmented industry, whereas manufacturers in many industries, such as heavy equipment, have industry leaders. Fragmented industries exist because 1) the industry may be relatively new, so an industry leader has not yet emerged, 2) there may be no economies of scale, therefore organizations tend to stay relatively small, not developing industry leaders, and 3) transportation costs may be a disincentive to expand beyond a particular geographic region. The hospital industry is relatively new in comparison to manufacturing firms. Therefore, the industry has not had the opportunity to develop industry leaders.

Hospitals provide individualized care to patients in a particular region. It is a rare occurrence that physicians, who are the service providers, travel to see patients outside a particular geographic region. By contrast, a manufacturer of heavy equipment would deliver it to a retailer anywhere in the country or perhaps in the world. The theories that may hold for manufacturing organizations may not hold for hospitals.

Most hospitals in this sample also tended to be not-for-profit (70.4%) organizations, whereas manufacturers are for-profit organizations. Not-for-profit organizations are subject to greater influence through external scrutiny by outside constituents such as regulatory institutions (Greer, 1988). The strategic decision to adopt or to not-adopt specific technology can have a significant impact on an organization's profitability and future viability against its competitors. As a not-for-profit organization, a hospital does not necessarily have to realize a profit to stay viable in its particular market. Many hospitals are the only providers of health care services in the region, so competition is not a serious threat. The hospitals that do face competition, especially in urban areas, usually reinvest any profit that is gained. Stockholders' value is not an issue for hospitals unless they are one of the relatively few for-profit hospitals. Thus, size may affect for-profit organizations differently than not-for-profit organizations due to the nature of the organizations' responsibility to its shareholders.

Hospitals' decision-making processes to adopt technological innovation differ from those in manufacturing firms (Greer, 1984). The decision to adopt technology in manufacturing organizations would usually require a break-even analysis with justification for expenses and revenues. Hospitals can make decisions on the same basis, or it may be that they acquire technology either to match their competition or because a certain physician makes it difficult for the hospital to refuse the acquisition of the technology (Greer, 1984).

In summary, organizational size may affect the adoption of innovation directly through the number of innovations adopted by virtue of the increase in the number of services provided by a larger hospital, and by the increase in radicalness and relative advantage of the technologies adopted by virtue of the advanced level of care provided.

This study also finds that organizational size affects the organizational climate-innovation attribute relationship. When size was introduced into the hierarchical regression analysis in Model 2, there was a positive significant effect on the relationship between organizational climate attributes and the innovation attributes. For example, when size was introduced into the multiple regression model, R^2 rises from 0.06 to 0.48. Referring to Model 3, given the fact that risk-orientation has a positive effect (Model 1) and organizational size has a positive effect on the adoption of more radical innovations (Model 2), these results for Model 3 suggest that larger hospitals that are more risk-oriented adopt more radical innovations than smaller hospitals.

Slack was found to be a quasi-moderator in the organizational climate-innovation relationship. As a quasi-moderator, slack may not only interact with organizational climate, but it is also directly related to the adoption of innovation and/or to organizational climate. In this study, slack does not have a direct effect on the organizational climate: risk-orientation ($\underline{r} = -.01$, $\underline{p} = .98$), external-orientation (r = .18, p = .14), and achievement-orientation (r = .08, p = .51). No difference in organizational climate dimensions between hospitals with more or less slack were observed with the application of t-tests. For example, this study did not find that organizations with more slack are more risk-oriented. These findings agree with previous empirical studies which found organizations with greater slack are not necessarily more risk-oriented (Singh, 1986; Bromiley, 1991). This is contrary to intuitive reasoning that suggests that increasing slack is viewed as a facilitator of experimentation by allowing organizations to develop a strategic orientation towards innovation (Kuitunen, 1993). Slack has been promoted as providing excess resources for the adoption of innovation (Cyert & March, 1963). Nord and Tucker (1987) found slack to aid in the implementation of innovation.

As noted previously, organizational climates may not differ significantly between smaller and larger hospitals because of intense pressure from the outside competitive and unstable environment. This reasoning may also apply to hospitals with more or less organizational slack. Withstanding the "health care hurricane" may require that organizations either build their supply of organizational resources to weather the storm or retain their level of organizational resources at a minimum while enduring the turbulence in the industry.

This study finds a significant positive relationship between slack and radicalness, relative advantage, and the number of innovations adopted. These results suggest that hospitals that have more slack tend to adopt more technological innovations, innovations that are more radical, and have more relative advantage. Smaller hospitals run on a tighter budget because they tend to provide fewer services and, perhaps, less critical services than larger hospitals. Therefore, smaller hospitals tend to generate less revenue, have fewer financial resources, fewer managerial resources, and less equipment. In summary, this study found hospitals that have more resources tend to adopt more technologies; furthermore, the technologies they adopt tend to be more radical and provide more relative advantage.

This study also finds that organizational slack affects the organizational climate-innovation attribute relationship. When slack was introduced into the hierarchical regression analysis in Model 2, there was a positive significant affect on the relationship between organizational climate attributes and the innovation attributes. For example, when slack was introduced into the regression model, R^2 rises from 0.06 to 0.18. Referring to Model 3, given the fact that risk-orientation has a positive affect (Model 1) and organizational slack has a positive affect on the adoption of more radical innovations (Model 2), the results for Model 3 suggest that hospitals with greater slack that are more risk-oriented adopt more radical innovations than hospitals with less slack.

Organizational age was not found to moderate the relationship between organizational climate and the adoption of innovations. Past literature notes a significant positive relationship between organizational age and organizational size (Khandwalla, 1977). Organizations that have been in existence for longer periods of time are usually larger in size. This was supported in this study also with a correlation between age and organizational size at 0.36 (p = .01). However, it may be interesting to note that the smallest hospital in this study's sample was also the oldest.

Organizational age has no significant direct effect on the climate of an organization since organizational climate is the shared perception of organizational members, all exposed to the same organizational structure. Organizational climate changes as organizational members change, which is not the case of organizational culture which is an enduring organizational characteristic. Therefore, it may be likely that organizational age would not have an affect on organizational climate.

As noted previously, age does not have a significant direct effect on the adoption of innovation. Past literature made assumptions about the affects of age on organizations from organizational development models. These models imply that organizations evolve through various stages as they age and grow. The primary assumption is that small organizations that survive the initial stage of development become large organizations, but that assumption may not be true in the hospital industry. Some hospitals that have been in existence for over fifty years and remain the same small rural facility. Whereas, some large urban hospitals may be relatively new in comparison.

Hospitals provide services to a limited geographical area. If this area does not have a large population, or one that is growing and developing, the size of the hospital may not change. For example, there are hospitals in northern Wisconsin that have been in existence for over 40 years. The regional population has not increased or grown and may in fact be decreasing; therefore, the model of organizational development and the affects of organizational age on organizational climate and adoption of innovations may not be applicable.

7.2 CONTRIBUTIONS OF THE STUDY

Several researchers have examined why some organizations are more likely than others to adopt a technological innovation. This study adds to this literature in several ways. A major contribution of this study is the development a more fine-grained assessment of adoption of innovations. Previous studies have measured the adoption of innovation as a dichotomy (either adopt or non-adopt). Adoption of innovation has also been measured as the number of innovations adopted in a specific period of time, from a list of possible innovations in the industry. This study used a similar measure in order to facilitate comparisons with past studies. But this study takes previous measures of innovation adoption one large step further by assessing two major attributes of technological innovations, specifically radicalness and relative advantage. Assessing the attributes of the innovations provides a clearer picture of the possible intent and outcomes of the innovation adoption, rather than adoption for the sake of adoption of technology.

The specific measure of Medical Imaging technology is also a contribution to the literature. A panel of five experts in Medical Imaging technology assisted in developing a list of 68 technologies, and then these experts evaluated the radicalness and relative advantage of each of these 68 technologies.

This fine-grained evaluation of Medical Imaging technology leads to a greater understanding of the relationship between hospitals' organizational climate and innovation attributes; and the effects of the contextual variables of organizational size, slack, and age on the innovation attributes.

For example, previous literature linked the risk-orientation of an organization with the adoption of more radical innovations (Damanpour, 1986). Much of the justification for adopting a higher risk-orientation is that the organization will receive future benefits, an advantage over the previous condition. This study finds that hospitals with a more risk-oriented climate also tend to adopt innovations with greater relative advantage, providing them with the return on investment that was anticipated.

Contributions of this study also include the rigor of the research design used to gather data from the decision makers. For each hospital, a minimum of three decision makers responded to the climate questionnaires, with the majority of the hospitals providing five or more respondents. In addition, a manager in the Medical Imaging Department responded to the Technology survey, providing information relative to those Imaging technologies adopted by the hospital. Technologies were evaluated by outside experts.

This research moves the field of innovation forward in two other ways. The theories and empirical studies that were revealed in previous literature were replicated here by studying the number of innovations adopted. More importantly, this study advances organizational studies by adding the innovation attributes as a measure of technological adoption. The positive relationship between risk-oriented organizational climates and the adoption of more radical innovation has been corroborated in this study, as is the positive relationship between risk-oriented climates and the number of innovations adopted. This study may be the first to reveal that hospitals with more risk-oriented climates also tend to adopt innovations that have greater relative advantage, which suggests that a more risk-oriented hospital tends to achieve a greater return on their investment.

The climate attributes of external-orientation and achievement-orientation did not affect the adoption of Medical Imaging technology when measured by its radicalness, relative advantage, or number of innovations adopted. This may suggest that achievement-orientation and external-orientation are not critical to developing an organizational climate that results in the adoption of innovation with greater relative advantage and more radicalness. However, this does not mean that these climate attributes are unimportant to an organization for other outcomes, but only that they do not currently drive hospitals to become more technologically advanced.

7.3 LIMITATIONS OF THE STUDY

In reviewing the study, several conditions existed that could be perceived as shortcomings. This study is limited in that the findings should not be generalized to the entire population of hospitals. In the interests of homogeneity, the original sampling frame was limited to the states of Wisconsin, Minnesota, and Illinois. As previously noted, these states have an environment that is similar due to competition, population distribution, and regulatory issues. Hospitals in other states may be experiencing different environments. For example, more California hospitals are for-profit entities which face a more competitive environment, with more managed care, and more state regulations about duplication of health care services.

Retrospectively, some of the climate measures used in this study turned out to have some limitations due to an unanticipated lack of robustness of the scales. In the process of analyzing the data through factor analysis, the scales for risk-orientation and achievement-orientation did not appear to be clean and distinctive. Previous research has not provided adequate information about the validity and reliability of the instruments. During the various data analyses, the scales used for achievement-orientation and risk-orientation had to be reduced to only two and three indicator items, respectively.

An incomplete measure of the climate attribute Market Orientation designated in this study as external-orientation was used to maintain brevity and balance in the climate questionnaire. The entire Narver & Slater (1990) scale may be used to assesses more completely the affects of customer orientation, competitor orientation and interfunctional coordination.

This study is limited to assessing the relationship of organizational climate, specifically risk-orientation, achievement-orientation, and external-orientation, and the adoption of innovation. Other organizational factors have been recognized as affecting the adoption of innovation such as organizational structure (Damanpour, 1991; Saleh & Wang, 1993). The external environment and strategic orientation have also been recognized as an influence in the adoption of innovation (Ettlie, 1983).

Other factors have previously been found to affect the adoption of technological innovation and may have a greater impact than organizational climate on the adoption of technological innovations, since the climate attributes only account for six percent of the explained variance.

The adoption of technological innovations is only one of the possible outcomes that may be important to the sample of hospitals. Other outcomes that may be considered important to hospitals is quality of care, cost-efficiency, or mortality rates. Developing a risk-oriented organizational climate may have a positive influence, a negative influence, or no influence on other outcomes that hospitals may perceive as important to their survival.

7.4 DIRECTIONS FOR FUTURE RESEARCH

This study sought to find the relationship between organizational climate and the adoption of technological innovations. The study examined three climate attributes: risk-orientation, external-orientation, and achievement-orientation. Based on the results of this study (with only risk-orientation emerging to be statistically significant), other climate attributes should be considered in future studies. For example, the organization's approach to decision making may affect the adoption of innovation. Greer (1984) suggested that three different decision systems are used in adopting technology in hospitals: medical-individualistic, fiscal-managerial, or strategic-institutional decision systems.

As noted, given that risk-orientation was found to be the only organizational climate attribute related to the adoption of innovation, further studies should develop a better measure of this climate attribute. The measure used in this study (Litwin & Stringer, 1968) had to be reduced from five items to three items after conducting analysis for factorial validity. Further development of the risk-orientation measure may provide more valuable information in future studies. Using Narver and Slater's (1990) complete Market orientation scale may provide more specific information about the three market oriented behaviors and their affects on the adoption of technological innovations.

This study evaluated only two attributes of innovation, one primary attribute (radicalness) and one secondary attribute (relative advantage). Future studies may choose to evaluate other attributes. For example, pervasiveness is a primary attribute of innovation that pertains to the degree to which the innovation affects the entire organization. This concept of pervasiveness assesses the innovation's strategic importance to the hospital.

This study evaluated the perception of top managers and physicians who are involved in the decision to adopt technology in hospitals. Future research may seek to examine the composition of this top management decision-making team to evaluate any job/ role differences, background differences, and their influences on the decision to adopt technological innovation within hospitals.

Further studies may want to segregate the sample by level of care provided in the hospital. For example, one could isolate hospitals that provide only secondary care versus tertiary care, and then examine the impact on the adoption of technology. In a recent issue, the New England Journal of Medicine addresses the resurgence of for-profit hospital chains and their impact on the delivery of care and the competitive nature of the health care industry (Kuttner, 1996). Evaluating the differences in the adoption of technology between the non-profit and for-profit hospitals would provide practitioners with a better understanding of the obstacles they are likely to face in the future.

Researchers and practitioners have argued about who are the true customers of a hospital. On one hand, the customer is the patient because they personally utilize hospital's services. Patients receive the diagnostic x-rays, they have surgical procedures performed on them, and they occupy hospital beds. Yet, some view the physician as the customer of the hospital. Physicians utilize the x-ray equipment and interpret the diagnosis, they perform the surgical procedure, and they determine who occupies the hospital beds and for how long. Further studies may want to consider this issue and explicitly identify if and how it impacts the adoption of technology in hospitals.

7.5 IMPLICATIONS FOR MANAGERIAL PRACTICE

The results of this research provide practicing managers with a better understanding of the attributes of organizational climate that may lead to the adoption of technological innovations with certain attributes, specifically, radicalness and relative advantage. Organizational climate had previously been recognized as a factor that explains the differences between organizations in their inclination to adopt technological innovations. Climate is significant because the adoption of innovation is not the result of one single organizational decision by any one individual, but involves many decision makers who reach a consensus on the future direction of the organization.

Sample hospitals that adopted radical innovations tend to be more risk-oriented. This appears to be true whether the hospitals are large tertiary care urban hospitals of 800 beds with a great deal of organizational slack, or whether the hospital is a small rural facility with only 40 beds and very little slack resources available to the hospital.

Sample hospitals that adopted innovations with greater relative advantage tend to be more risk-oriented. The adoption of technology providing greater relative advantage may benefit the organization as well its constituents. When hospitals adopt Imaging technology there is an assumption that they want to provide superior services to their patients, or to improve efficiency or reliability in the performance of the equipment. They may also seek to achieve other intangible benefits such as attracting new patients, new physicians, or achieving an image as being technologically advanced. This study found that hospitals that have a greater risk-oriented climate actually tend to achieve current benefits and future potential benefits, which is what the hospitals intended.

7.6 CONCLUSION

This study sought to identify those organizational climate attributes that are significant to the adoption of innovation as measured by the innovation's radicalness and relative advantage. Risk-orientation had a significant positive relationship with the adoption of innovations that were more radical and provided greater relative advantage. Risk-orientation also had a significant positive relationship with the total number of innovations adopted, which corroborates previous empirical research. Neither external-orientation nor achievement-orientation exhibited any significant relationships with the number of innovations adopted, with innovations' radicalness, or with the innovations' relative advantage.

The contextual variables of organizational size and slack were both found to function as quasi-moderators of the relationship between organizational climate and innovation attributes in this study. By contrast, organizational age was not found to be a moderator of the climate-innovation relationship. The contributions as well as the limitations of this study were pointed out and a number of proposals for future extensions of this research were also advanced.

Appendix 1

Cover Letter

Date, 1995

Mr. Allen Wilson, President
Global Memorial Hospital
Milwaukee, Wisconsin 53703

Dear Mr. Wilson,

Increasing environmental uncertainty and competition in the health care industry has created a clear and pressing need for innovative responses from organizations in the health care industry. Tom Peters in his book Thriving on Chaos states that organizations must poise themselves to be innovative, or they risk decline and death. The objective of this research, which is part of a Ph.D. dissertation, is to examine the effects of organizational climate on the adoption of technological innovations in the health care industry.

Participation in this study will be both interesting and useful; interesting, because it provides the opportunity to evaluate your own organization's climate, and useful, as it will enable your organization to gain a greater understanding of why certain organizations are more inclined than others to adopt technological innovations, providing a competitive edge to those organizations. If you should agree to participate in this study, you will be mailed a packet of material. Besides yourself, you will be required to distribute surveys to six other individuals in your firm. The individuals would include the Manager of Medical Imaging, yourself, and five other individuals who are salient in the decisions for your organization to adopt medical technology. Each survey should take only 10-15 minutes to complete.

Information collected from you will be treated with the utmost confidence, only aggregate results will be made available. No mention of any individual or a hospital's name will be made in any results. A copy of the results of this study will be made available to any participants upon their request.

Should you agree to participate in this study, please indicate by checking the appropriate box on the enclosed response sheet, and place it in the self addressed, pre-paid envelope. Your survey packet should arrive within two weeks of receipt of your consent to participate.

Thank you for your consideration. I look forward to receiving your response. If you should have any further questions, please write or call at (608) 277-0548.

Sincerely,

Alla L. Wilson

Appendix 2

Follow-up Letter

Date, 1995

Mr. Allen Wilson, President
Global Memorial Hospital
Milwaukee, Wisconsin 53703

Dear Mr. Wilson,

Thank you for agreeing to participate in our research study about the effects of organizational climate on the adoption of technological innovation in the health care industry. I would like to take a few moments to explain the process of survey distribution and collection.

There are two different surveys included in this packet. The blue survey is titled Innovation Questionnaire and deals with the innovations that your hospital has adopted in the area of Medical Imaging in the past two to three years. The yellow survey is titled the Climate Questionnaire and deals with the organizational climate of your hospital at the top decision-making level.

The Innovation and the Climate survey should be completed by the individual in your hospital that is the most knowledgeable about the Medical Imaging technology you have adopted in the past two to three years. It is most likely a Manager of Medical Imaging or Radiology, or a physician who heads your Radiology Department. The surveys will take approximately 15 minutes to complete and then should be returned back to your office and placed in the self-addressed, stamped, return envelope.

In addition, are enclosed six yellow Climate questionnaires. Please complete one of the Climate Questionnaire yourself, and distribute the remaining five questionnaires to individuals in your hospital that are part of the decision making process in adopting or purchasing new medical equipment. To each survey is attached directions for completing and returning the questionnaires to your office to be placed in the return envelope. The Climate questionnaires should take approximately 10 minutes to complete.

Finally, a white Demographic Questionnaire is enclosed which will take at most five minutes to complete. Either you, or a member of your management team, may complete this survey and return it in the return envelope. I realize that some of the individuals that you may distribute surveys to may not respond within a reasonable period of time. I have requested each respondent to return the surveys to your office within 10 days. In order to have your hospital's data included in this research, a minimum of three Climate Questionnaires, the Innovation Questionnaire and a Demographic Questionnaire must be returned. Your cooperation is valuable and greatly appreciated.

Thank you again for taking the time to participate in this study. If you have any further questions, please feel free to call me at (608) 277-0548.

With Great
Appreciation,

Alla L. Wilson

Appendix 3

CLIMATE QUESTIONNAIRE

The statements in this survey relate to your perception of the characteristics of your organization's climate.

How often are you involved in the decision to adopt or purchase medical imaging equipment:

__Always __Sometimes __Never

If your answer to the above question is "Never", you do not need to complete the remainder of this questionnaire, but you should still return it to the President/CEO's office.

If your answer is "Always" or "Sometimes", please circle the numeral that best indicates the extent to which you agree or disagree with the following 21 statements.

	Strongly Disagree			Neither			Strongly Agree
1. The philosophy of our management is that in the long run we get ahead by playing it slow, safe, and sure.	1	2	3	4	5	6	7
2. Our business has been built up by taking calculated risks.	1	2	3	4	5	6	7
3. Decision making here is too cautious for maximum effectiveness.	1	2	3	4	5	6	7
4. Our management is willing to take a chance on a good idea.	1	2	3	4	5	6	7
5. It is necessary to take some pretty big risks occasionally to keep ahead of the competition in the business we're in.	1	2	3	4	5	6	7
6. Our business objectives are driven primarily by patient satisfaction.	1	2	3	4	5	6	7
7. We constantly monitor our level of commitment and orientation to serving our patient needs.	1	2	3	4	5	6	7
8. Our strategy for competitive advantage is based on the understanding of our patient needs.	1	2	3	4	5	6	7
9. Our business strategies are driven by our beliefs about how we can create greater value for patients.	1	2	3	4	5	6	7

	Strongly Disagree			Neither			Strongly Agree
10. We measure patient satisfaction systematically and frequently.	1	2	3	4	5	6	7
11. We give close attention to after-service contact with our patients.	1	2	3	4	5	6	7
12. We freely communicate information about our successful and unsuccessful customer experiences across business functions.	1	2	3	4	5	6	7
13. All of our business functions (e.g., marketing, physicians, nurses, finance/accounting, etc.) are integrated in serving the needs of our target market.	1	2	3	4	5	6	7
14. All of our managers understand how everyone in our hospital can contribute to creating patient value.	1	2	3	4	5	6	7
15. All of our managers are comfortable with employees questioning formal authority and rules.	1	2	3	4	5	6	7
16. All of our managers think employees ought to concerned with efficiency above all else.	1	2	3	4	5	6	7
17. All of our managers perceive their jobs and authority to be constrained within fixed limits.	1	2	3	4	5	6	7
18. Formal rules and regulations have a very important place here.	1	2	3	4	5	6	7
19. All of our managers think employees ought to be concerned with effectiveness above all else.	1	2	3	4	5	6	7
20. Achievement of goals has a very important place here.	1	2	3	4	5	6	7
21. Being leaders in patient care is very important here.	1	2	3	4	5	6	7

Appendix 4

MEDICAL IMAGING TECHNOLOGY

Given below is a list of Medical Imaging Technologies that may be part of your hospital imaging department. Please check off only those technologies which you have in place in your hospital. Recall as accurately as possible the year in which you adopted these technologies and indicate them in the space provided.

	Check if Adopted	Year Adopted (estimate if unsure)
1. Automated Chest Unit		
a. Automated	___	___
b. Analog	___	___
c. Digital	___	___
2. C-Arm, Mobile		
a. Digital Fluoroscopy/Subtraction	___	___
b. High Frequency Generators	___	___
c. Image Manipulation	___	___
3. Computed Tomography		
a. Second Generation (rotate/translate)	___	___
b. Third Generation (rotate/rotate)	___	___
c. Fourth Generation (slip ring)	___	___
d. Cine CT (electron beam)	___	___
e. Spiral/Helical Technology		
1. 360/180 degree scan	___	___
2. Volumetric scanning	___	___
3. CT Angiography	___	___
f. Independent Workstations		
1. 3-D reconstruction	___	___
2. Image manipulation/post screening	___	___
4. Magnetic Resonance Imaging		
a. Magnet		
1. Superconducting	___	___
2. Resistive	___	___
3. Permanent	___	___

	Check if Adopted	Year Adopted (estimate if unsure)
b. Field Strength		
1. Ultra Low (<0.5 Tesla)	___	___
2. Lo Field (0.5 Tesla-1.5 Tesla)	___	___
4. Hi Field (1.5-2.0 Tesla)	___	___
5. Experimental (>2.0 Tesla)	___	___
c. Shielding		
1. Passive	___	___
2. Dynamic	___	___
d. Coils		
1. Surface	___	___
2. Quadrature	___	___
3. Intra-Cavity	___	___
4. Phased Array	___	___
e. Software		
1. Gradient Pulse Sequences	___	___
2. Epi-Echo planar imaging	___	___
3. Cardiac Gating	___	___
4. MAST	___	___
5. FAST	___	___
6. Respiratory Gating	___	___
7. Flow Compensation	___	___
8. Magnetic Transfer Imaging/ Contrast	___	___
f. Workstation (see CT)		
1. Dependent	___	___
2. Independent	___	___
5. Mammography/Breast Imaging		
a. Analog	___	___
b. Digital	___	___
c. Stereo localization for biopsy	___	___
d. Core Biopsy	___	___
6. Nuclear Medicine Gamma Camera/Computer		
a. Detectors		
1. Single	___	___
2. Multiple (Spect)	___	___

	Check if Adopted	Year Adopted (estimate if unsure)
b. Computers	___	___
c. Radiopharamceuticals	___	___
7. PET (Positron Emission Tomography)		
a. Detectors	___	___
b. Computers	___	___
c. Radiopharmaceuticals	___	___
8. Ultrasound		
a. Platform		
1. Mechanical	___	___
2. Phased Array	___	___
3. Linear Array	___	___
4. Annular Array	___	___
b. Transducer		
1. Transcutaneous	___	___
2. Intra-cavitary	___	___
3. Transesophogeal	___	___
4. Intravascular	___	___
5. Endoscopic	___	___
6. Transcranial	___	___
c. Doppler		
1. Continuous Wave	___	___
2. Pulsed	___	___
3. Color	___	___
9. Special Procedure Suite		
a. Stand		
1. Single Plane	___	___
2. Bi-Plane	___	___
b. X-Ray tubes/generators	___	___
c. Image Intensifier	___	___
d. Video Chain	___	___
e. Digital Subtraction Angiography	___	___

Appendix 5

Demographic Information

1. Name of your hospital ______________________________

2. Your position/title ______________________________

3. Your department/unit ______________________________

4. Years of service in the organization ________________

5. Your age _____

6. Are you male ____ *or female* ___?

7. What is the nature of your organization ownership?
Private ___ *Public* ___ *Not-for-Profit* ___

8. Is this organization a branch ___
subsidiary ___ *headquarters* ___

9. How long has your organization been in existence? ______

10. How many levels of hierarchy do you have in your organization (excluding non-supervisory personnel)? ______

11. How many full-time equivalent people are employed here (including non-supervisory personnel)? ______

12. How many beds does your hospital have? ____________

13. What was your organization's gross revenue last year?
*$*______________

14. Briefly explain your position in your market segment.

15. Briefly explain your market segment.

Please circle the extent to which you agree or disagree with the following statements.

	Strongly Disagree			Neither			Strongly Agree
1. There is generally no scarcity of financial resources for capital projects.	1	2	3	4	5	6	7
2. There is usually abundant availability of required labor skills within our organization.	1	2	3	4	5	6	7
3. There is usually no shortage of managerial talent to effectively run our organization.	1	2	3	4	5	6	7
4. The amount of funds already committed for capital projects is a large portion of the available financial resources.	1	2	3	4	5	6	7

Your time and effort on completing this questionnaire are greatly appreciated. Your responses will be of great help to the completion of this study. This research will provide the knowledge of types of organizational climates that may lead to the adoption of technological innovations.

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