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A critical success factors study of management information systems downsizing: From management information systems managers' perspectives

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A CRITICAL SUCCESS FACTORS STUDY OF MANAGEMENT INFORMATION SYSTEMS DOWNSIZING - FROM MANAGEMENT INFORMATION SYSTEMS MANAGERS' PERSPECTIVES

By

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Many organizations are downsizing their management information systems (MIS). MIS downsizing refers to moving computer applications to smaller computing platforms. MIS downsizing also implies that computing resources are being redistributed and matched with their respective utilizations.

The major objective of this study was to extract and test critical MIS success factors derived from previous research in order to empirically determine critical success factors (CSF) for MIS downsizing success. CSF were considered in this research from the perspective of MIS managers. The identified CSF might be used to provide MIS managers a means to communicate between users and the MIS department, a guideline for MIS resource management, and an evaluation criterion for system planning and control. The

research model was based on Rockart's classic 1982 study of CSF as modified by Martin's 1982 study and more recent literature. The research model categorized the prospected CSF into six areas: user appreciation, communication between users and the MIS department, the support services of the MIS department, commitment and support from top management and users, organizational effectiveness, and appropriate software application.

Questionnaires were mailed to MIS managers from selected U. S. companies. MIS managers were randomly selected from a purchased database. Data was examined for validity and reliability. Statistical tests included descriptive analysis, Chi-Square goodness-of-fit, canonical correlation analysis, factor analysis, and regression.

Seven CSF for MIS downsizing success were identified: communications between users and the MIS department, the managerial objectives of MIS/DP operations, the commitment and support of MIS downsizing, the MIS department's service function, user participation, appropriate applications, and user satisfaction. There were two factors in MIS downsizing success, user-oriented improvements and system effectiveness. The seven CSF were statistically significant for MIS downsizing success and supported the original research model.

The prediction model selected three CSF for predicting user-oriented improvements in MIS downsizing. They are:

management objectives of MIS/DP operation, user participation, and the MIS department's service function.

The expected contribution from this study is to identify and provide knowledge on CSF for MIS downsizing. This study also provided a basic knowledge for further research on CSF and MIS downsizing. MIS managers may also benefit from the results and may be able to utilize the CSF for planning purposes. This research, like any other research, is subject to several limitations. However, the findings are clear and are significantly supported by statistical analysis. Still additional research is needed for better understanding and confirmation.

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CHAPTER I

INTRODUCTION

Chapter I presents an overview of MIS downsizing, some definitions of terminology, and a summary of the problem, objectives and purposes of this study. This chapter also briefly describes the research model, research hypotheses, research methodology, significance of the research and the organization of the chapters.

Overview

Due to newly developing technologies, the capacities of personal computers (PCs), workstations, and mid-range computers are increasing while prices of these computers are decreasing. The development of smaller, faster, and cheaper microcomputers and workstations connected by local area networks (LAN) or arranged in client/server architectures (client/server computing is one alternative MIS downsizing approach -- some computers operate as functional servers, while some computers serve as end-user clients) has made some firms realize that the smaller systems can possibly do some jobs more effectively and more economically than the larger systems or mainframes. The phenomenon that the price of a unit of processing power on

a chip is reduced by half about every 18 months (Zachary and Yoder 1993) appears to be an important factor in impelling the operation of management information systems (MIS) to be replaced by smaller systems. Organizations considering this downsizing or outsourcing (outsourcing means using outside vendors' computer resources to perform jobs or services) of their MIS may be able to realize this potential cost-effectiveness.

Downsizing MIS can be regarded as moving applications from a mainframe-based environment to a PC-processor-based environment, i.e. PCs, workstations, or LAN (Turban 1993). However, there are many variants such as moving from mainframes to a mini computer environment and a combination of such modifications. Many organizations appear to consider the possibility of downsizing their systems to achieve dramatic savings in cost along with other potential benefits such as improved responsiveness, more control, increased flexibility and better-integrated management information systems (MIS) (Bloom 1992; Hoffman 1992; Turban 1993).

As the growth in utilization of mainframes has slowed considerably, the choice of replacement technology appears to be converging toward PCs, workstations, client/server and networks (Francis 1992). A number of factors are forcing organizations into downsizing or redistributing their MIS: reaction to business conditions, economic

pressures, international competition, user migration with MIS applications, cost-saving demands, new information technologies utilization, and requirements for flexible information systems (Rainer et al. 1992). Downsizing also can be an alternative approach for any organization whose MIS is either unable to productively serve users or is too expensive to maintain (Turban 1993).

In 1988, Theodore Klein, president and founder of the Boston Systems Group, estimated 20% to 25% of the Fortune 1,000 companies would be downsizing their information systems in 1989, and 40% to 50% of those companies would be downsizing their systems in 1990. He also assumed that the downsizing process would be completed in the mid-1990s, when almost all of the top corporations in the nation would have at least a portion of their information systems downsized (Alexander 1988/1989).

As an update, in 1990, the Business Research Group surveyed Fortune 1,000 companies. Approximately three fourths of the respondent MIS and end-user executives replied that they had implemented or would implement a client/server system within 18 months (Ehrenreich 1992). In 1991, Datamation magazine, together with Cowen & Co., a New York-based international brokerage firm, jointly surveyed U. S. MIS managers. They found that the downsizing trend was confirmed in their sample of mostly smaller U. S. firms. In 1992, from their similar survey,

they found that the rate of downsizing has accelerated at large corporations. They also found that 60% of survey respondents plan to target PCs and workstations for their longer term application development (Francis 1992).

This study is based on the assumption that organizations of all sizes will downsize their information systems resources. This fact can be observed from a survey conducted in the UniForum trade show during the Spring of 1993; almost two thirds of the surveyed information system executives said their organizations had plans to downsize their computer resources in 1993.

Definitions of Terminology

Downsizing is the term adopted in this study to describe what is variously known as rightsizing, outsourcing and client/server computing. The reason and the definition are given below.

Downsizing

The term downsizing has been given several different meanings. According to many researchers, the most accepted definition is "bringing applications down to smaller platforms" (Korzeniowski 1991; Turban 1993). This means moving information systems applications which were executed on a mainframe or on a minicomputer and redesigning them to function on PCs, workstations, or networks (Alexander 1988/1989; Korzeniowski 1991; Turban 1993). A broader

definition of downsizing is a "method of cost cutting, by reducing human resources while keeping the same quality of work" (Frye 1991). Because of the diverse definitions for downsizing, and because downsizing an MIS usually results in cutting MIS staff (Horwitt 1990; Buckler 1992; Duè 1992; Tarr and Juliano 1992), MIS staff downsizing will be considered as one result of MIS downsizing.

It should be noted that downsizing does not mean that mainframes are to be completely replaced. In many downsizing cases, mainframe computers are not replaced but reoriented as servers in a network environment. Also, some of the organizations keep their mainframes as a centralized network switch or as a data repository (LaPlante 1990; Francis 1991; Ehrenreich 1992).

Rightsizing

Redistributed computing resources or rightsizing is defined by one expert as relieving overloading problems by redistributing an organization's MIS workload so that each computer handles only the work it is simply designed for (Ehrenrich, 1992, Rosen 1992); e. g., a mainframe computer can be assigned to be the central processing unit, one PC can be assigned to control the printer, and other PCs can be assigned as terminals on a network system. In other words, applications can be relocated to the most appropriate computer platform, maximizing computer system efficiency and saving costs.

Rightsizing or redistributed computing includes distributed processing, local area networks (LAN), wide area networks (WAN), and client/server computing and is usually combined with a downsized MIS environment. In this study, the term "downsizing" includes rightsizing or redistributed computing.

Outsourcing

According to many experts, outsourcing is defined as the use of outside vendors to perform jobs or services that would normally be done by the organization's MIS department (Gates 1992; Robins 1992; Wexler 1992). Outsourcing is used when the internal MIS department can not perform all the required tasks due to a deficiency in experienced or capable personnel, a scarcity of computer resources, or a lack of capacity. Outsourcing can also be motivated by providing lower costs than in-house work. Thus, outsourcing can improve productivity by better utilization of scarce capital finances on technical and computer resources. Outsourcing also allows the organization to focus on its major business or functional tasks such as transportation or manufacturing.

An organization can also outsource its ordinary and routine task to let its MIS and other managers concentrate on strategic planning and decision making (Schmerken, 1991). MIS departments can also outsource their telecommunications networks, using advanced technology or

equipment and taking advantage of volume discounts. Outsourcing is also helpful when the organization expands its business to new areas. For example, the new branch can focus on management training, marketing strategies, or operations but outsource its routine accounting entries to a local vendor. In this study, outsourcing is viewed as one of the downsizing options, because outsourcing redesigns and redistributes MIS resources.

Client/Server Computing

Client/server computing is a network-based systems architecture in which data bases are stored on powerful file servers and processed via applications running on distributed client computers (Frye 1991; Inglesby 1992). The client computers are usually PCs and workstations. The server computers may be mainframes, supercomputers, PCs or workstations that only have a particular function such as handling data bases. Client and server devices, mass storage devices, and printers are integrated by networking; users can then share multiple applications and network resources. The location of data and applications is immaterial to the user so long as the access time is rapid and the information is accurate (Inglesby 1992). Thus, client/server computing can also be viewed as one approach to MIS downsizing in this study. Further research of this topic, however, is beyond the scope of this research.

Summary of the Problem

A major problem with today's MIS downsizing is that little is known about factors that contribute to or detract from its success. Popular literature chronicles isolated stories, but few generalizable success factors are available. In the past few years, based on Klein (1990), Buckler (1992), Dué (1992), Turban (1993), and others, organizations have tended to downsize their MIS by themselves. Robert Hylas et al. argue that not all systems are ideal candidates for MIS downsizing. Selection of the wrong system or the wrong business functional area for downsizing can result not only in systems failure but can also cause tension between MIS departments and user departments (Hylas, Gordon, and Dinetz 1989; Hoffman 1992).

Many MIS professionals who have shared their experience with the downsizing process conclude that it is difficult to estimate the hidden cost as well as the MIS staff's attitude toward downsizing (Hoffman 1992). Further, when an organization considers downsizing, few development packages are available and the security of downsized MIS becomes a major concern as do recovery and backup (Hoffman 1992, Radding 1992). Several MIS professionals also argue that downsizing carries opportunities (e.g., hardware cost saving) as well as risk -- e.g., costly conversion, re-engineering difficulty, etc. (Alexander 1989 and Turban 1993). Thus, identifying

critical success factors (CSF) for MIS downsizing can help minimize risks associated with the failure of MIS downsizing and help promote the success of MIS downsizing. Therefore, the identification of CSF for MIS downsizing is the main purpose of this study.

Objectives of this Study

The purpose of this study is, first, to identify possible critical success factors from the academic literature and from the published experience of MIS managers. The CSF which are identified should help those interested in downsizing as well as help MIS managers in implementing strategies to ensure more successful MIS downsizing. Successful MIS downsizing has the potential to improve the productivity of an organization and may increase the organization's ability to respond and adapt to a rapidly changing and intensely competitive environment (Rowley and Smiley 1991).

CSF are the factors that constitute the critical or fundamental components of the system (Rockart, 1979). They are the key areas where "things must go right" (Rockart 1979). In other words, if these components fail, the system fails. During a period of MIS downsizing, MIS managers, to achieve a successful system conversion, should recognize and identify these crucial components. Thus, identifying CSF can help MIS executives and others develop organizational strategies, tactical plans, and operational

plans that facilitate organizational effectiveness (Rockart 1979 & 1982).

The second objective of this research is to study actual MIS downsizing practices and provide a possible empirical foundation to extend existing knowledge of MIS downsizing success. Empirical studies on the MIS downsizing success or rightsizing phenomena have not been found. Only case briefings on downsizing have appeared in the popular literature. Previous empirical literature has studied measures for MIS success but none for MIS downsizing success. Some examples of the MIS success measures are: user information satisfaction (Ives, Olson and Baroudi 1983), system utilization, decision effectiveness, organizational performance (Ives, Hamilton, and Davis 1980) and critical success factors for information needs (Rockart 1979). Many of the above-mentioned measures have weak points. For example, the measurement of system usage should be based on the actual, not the required usage (Ives et al. 1983; DeLone 1988). The measurement of user information satisfaction has problems related to reliability and validity (Zmud 1979; Ives et al. 1983; Galletta et al. 1989). Decision effectiveness and organizational performance measures have the problem of too many other uncontrollable and unmeasurable factors (DeLone 1988). In contrast, CSF are flexible and can be tailored to different applications

(Boynton and Zmud 1984). According to Boynton et al. and Zahedi's studies, the reliability measures present no problem if the CSF method is applied correctly (Boynton and Zmud 1984; Zahedi 1987). Consequently, this study applies a CSF approach to identify CSF of MIS downsizing.

The third objective of the study is to develop a model which might predict MIS downsizing success by utilization of CSF. The CSF approach, to help executives define their significant information needs, was first suggested by Rockart (1979). Later, scholars extended this concept to predict the risks or the critical factors of MIS implementation success (Lyytinen 1987). Other more extended studies examined the CSF of individual differences (Ferguson 1982; Martin 1982), end-user computing (Ives and Olson 1984; Rivard and Huff 1988), user-group attributes (Miller and Doyle 1987; Magal et al. 1988), organizational and user environment (Lucas 1981; Ives and Olson 1984; Montazemi 1988), organizational characteristics (Yaverbaum 1988), and prior computer experience (Lucas 1981). Based on these studies, it appears that the CSF approach could help MIS managers in analyzing, predicting, and communicating the content of MIS and its interactions with MIS environments more accurately.

Research Model

The research model of this study is based on the CSF study of Rockart (1982), modified according to the study of

Martin (1982) and others such as DeLone (1988), Miller et al. (1987), and Bergeron et al., (1993). Figure 1-1 is a diagram summarizing the research model.

The variables in this model can be categorized into the following six areas that might determine the CSF for MIS downsizing success: organizational effectiveness, support from top management, commitment and support from users, services of the MIS department, user appreciation, communication between the MIS department and users, and appropriate software applications. Also, in this model, there are eight variables to measure MIS downsizing success (improved MIS performance) based on MIS managers' perspectives.

As this research assesses the evolution of MIS downsizing, prior experiences with MIS downsizing provides a useful starting point. Therefore, criterion were collected and analyzed; and the seemingly appropriate downsizing MIS applications in the literature were obtained. The variables were extracted from related CSF studies and examined by this study. These processes will be further explained in Chapter II. Chapter III will provide a detailed description of the hypotheses. A brief discussion of hypotheses follows.

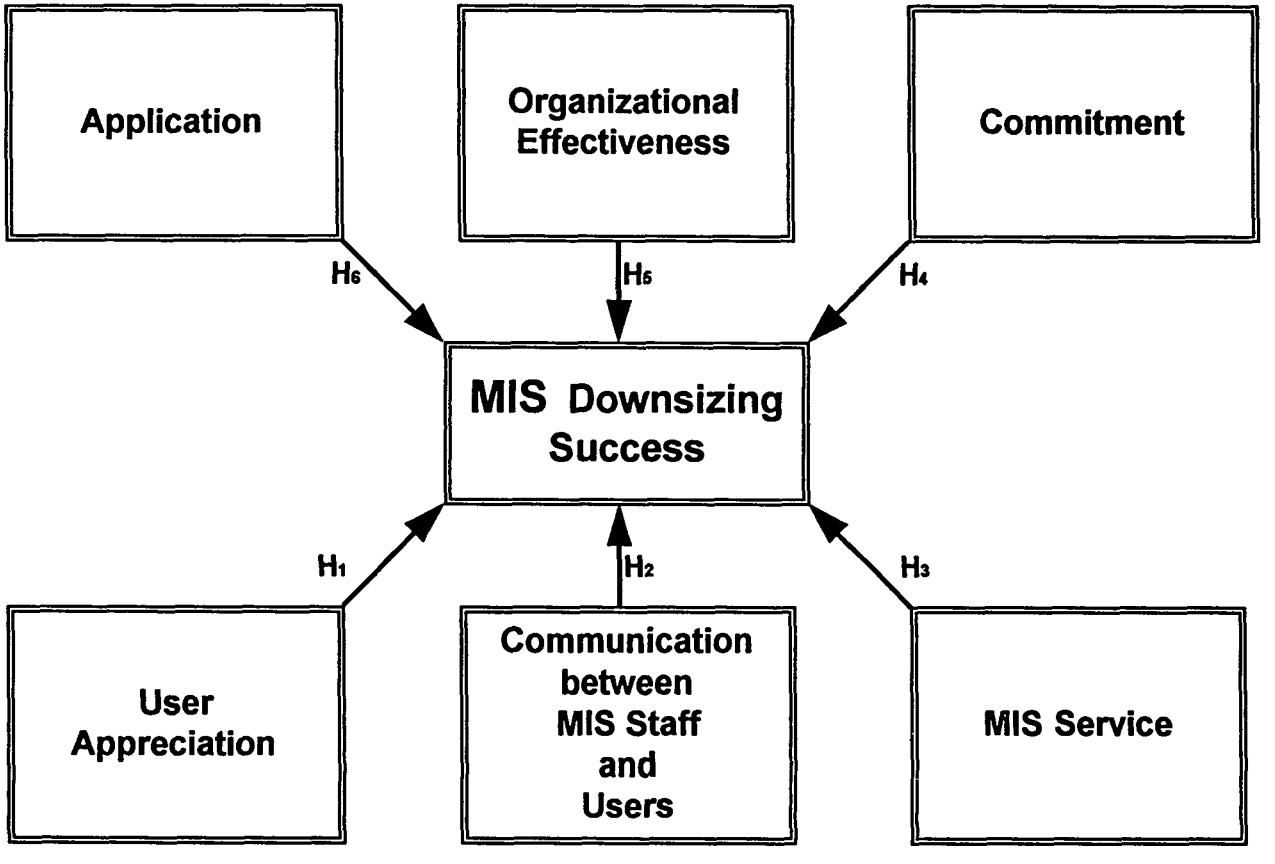


FIGURE 1-1. A CONCEPTUAL RESEARCH MODEL

Research Hypotheses

This study tested six sets of hypotheses. The first set of hypotheses implies a positive relationship between a variable called user appreciation and MIS downsizing success. User appreciation includes user involvement or user participation, user satisfaction, and user's favorable attitude toward MIS downsizing.

H_1: User appreciation is related to MIS downsizing success.

H_{1a}: Users involvement in the process of information systems downsizing is related to MIS downsizing success.

H_{1b}: Users' attitude toward MIS downsizing is related to MIS downsizing success.

The second set of hypotheses implies the importance of communication and alliance between users and the MIS department. The coordination function of an MIS department will affect users' attitudes and their participation in MIS downsizing. Oftentimes, an MIS department controls MIS resources, sets up policies and standards, collects users' responses, and provides support to users. Through communication and coordination, an MIS department can provide and support appropriate facilities to users.

H_2: Communication between users and the MIS department is related to MIS downsizing success.

H_{2a}: Facilitation to users is related to MIS managers' perception of MIS downsizing success.

The third hypothesis suggests an MIS department should support users' needs. An effective MIS department should provide required hardware and software applications to users. An MIS department also should have a competent staff that supports services and consulting. Finally, an MIS department should provide training courses to users for updating MIS knowledge and skills applicable to downsizing.

H_3: The support services of an MIS department are related to MIS downsizing success.

The fourth hypothesis proposes that the executive's support and the commitment from users will impact MIS downsizing success. Users who actively participate in the MIS downsizing planning process will understand the MIS downsizing concepts better and will be more likely to support MIS downsizing. Their commitment and support for MIS downsizing will impact the success of MIS downsizing.

H_4: Commitment and support from top management and users are related to MIS downsizing success.

The fifth hypothesis suggests that MIS downsizing should assist overall organizational effectiveness. As MIS downsizing supports organizational objectives and priorities, organizational performance and managerial

decision making will be improved. Management control and management of change should be improved also.

H_5: Organizational effectiveness is related to MIS downsizing success.

The sixth set of hypotheses is related to the study of the effect of appropriate software applications for MIS downsizing. Applications should meet business requirements and be easy to use, maintain and update. Appropriate applications should meet the criteria of quality, efficiency and adequacy.

H_6: Appropriate software application is related to MIS downsizing success.

H_{6a}: The quality of applications is related to MIS downsizing success.

H_{6b}: The efficiency of applications is related to MIS downsizing success.

H_{6c}: The adequacy of applications is related to MIS downsizing success.

Research Methodology

This research methodology section briefly discusses the sample subjects, research instrument, and data analysis. A more detailed discussion can be found in chapter III.

Sample Subjects

This study employed a mail survey for 1,000 randomly selected management information systems managers from various U. S. companies. MIS managers were chosen as the subjects because of MIS managers' professional qualifications, their professional interest in management information systems, and their knowledge concerning the distribution of MIS resources. Moreover, several empirical studies have found a positive relationship between MIS success and MIS managers' perceptions.

Research Instrument

The questionnaire is designed in four parts. The first part of the questionnaire contains four questions and is designed to identify the MIS downsizing trend. The second section is composed of eight variables measuring MIS downsizing performance based on MIS managers' perceived evaluation. These items are based on, or obtained from, the literature. Table 2-3 in Chapter II explains where the research items are identified and obtained in the literature. The third part of the questionnaire is designed to identify MIS activities that influence MIS downsizing performance. Table 2-3 of Chapter II also explains how these variables were identified in the literature. The fourth part of the questionnaire contains environmental and demographic data on the subject's

organization and the position of MIS managers in the management structure.

Data Analysis

Data Analysis is divided into five parts: (1) test of non-response bias and descriptive statistics on variables; (2) test of reliability and validity of the instrument; (3) identification of expected composite critical success factors; (4) test of the relationships between CSF and MIS downsizing success; and (5) development of a predictive model for MIS downsizing success.

The questionnaire was tested for non-response bias. Cronbach's coefficient alpha was used to check internal consistency and as an overall reliability measure. Both construct and content validity were measured to insure that the questionnaire met the validity requirements. Factor analysis was used for checking construct validity and identifying critical success factors. Canonical correlation analysis was used to test the relationship between the identified CSF and MIS downsizing success.

Significance of the Research

The results of this study may provide a contribution to both academic research and MIS management for CSF studies and for MIS downsizing. Identified CSF could help focus future research on questions that significantly impact decisions regarding MIS downsizing. It is also

believed that the expected findings may help extend the existing knowledge on MIS downsizing research. Based on the expected findings, the risk or dark side of MIS downsizing -- e. g., hidden conversion cost; data corruption caused by inconsistencies between mainframe and the server database, etc. -- may also be identified in further studies.

MIS managers could be expected to utilize the identified CSF for their downsizing planning. The expected findings could help guide MIS downsizing followers to more properly adopt successful MIS downsizing strategies. The expected CSF could also be used by MIS managers, both as an evaluation criteria for system planning and control and as a facilitator of communication between MIS departments and their users. With better utilization and better understanding concerning the downsized MIS, the organization might be better able to achieve cost savings and efficiency in its new systems. Thus, the benefits of successful downsizing could improve the corporate utilization of information systems resources and assist in achieving a competitive advantage for the organization.

Organization of the Dissertation

The remainder of the dissertation is organized as follows:

Chapter II presents a review of the literature relevant to the downsizing research of this proposal.

Specific areas of literature review include various CSF studies and downsizing studies in related areas; both academic/conceptual literature and empirical studies are reviewed. The last part of Chapter II states the general propositions from which the hypotheses are derived. Specific hypotheses are stated and justified.

Chapter III describes the research model. A research design and methodology is presented, subjects for the study are identified and the validation of data collection instruments, as well as the procedures used to collect data, are discussed.

Chapter IV reports the results of the data analysis. First, the plan for descriptive statistics concerning the respondent MIS managers and items for presentation, analysis and interpretation is given. Then, the statistical techniques used to obtain the quantitative results are discussed. Next, the qualitative data is also analyzed and discussed.

Finally, Chapter V presents the research findings, the contributions and limitations of the research, a summary of the study and suggestions of possible topics for future research.

CHAPTER II

LITERATURE REVIEW AND HYPOTHESES

Few empirical studies have been directed toward critical success factors (CSF) involved in management information systems (MIS) downsizing or rightsizing. This study reviews the related topics in CSF literature -- for example, CSF studies on system success, or CSF studies on information centers, as fundamental for MIS downsizing success. The conceptual framework of this research includes literature of seven types. The first type consists of an overview of studies on the development of, comments related to, and the reliability of CSF. The second type reviews applied CSF empirical studies for measuring performance and system success. The third type outlines CSF studies on information needs for executives. The fourth type reviews studies on the application of CSF for user involvement and system success. The fifth outlines CSF empirical studies that measure the performance of information centers (IC). The sixth outlines the studies and popular literature that relate to MIS downsizing success. The seventh part extracts some advice for MIS

downsizing. These literature synopses are followed by a discussion of the development of the hypotheses.

The literature reviewed in this study is based on the concept that successfully managed MIS downsizing depends on MIS management and the interactions among MIS resources (MIS staff, hardware, and application software) and users. The concept should be relevant, because "the success of the information system depends on the social structures and interactions that prevail during and after the development process" (Lyytinen 1987). Further, in order to evaluate the successfulness of MIS downsizing, the MIS components that are critical to performance should be identified, and the measurement of MIS effectiveness and performance of these components should be attained (Zahedi 1987).

This study also reviews the literature related to MIS managers' (also MIS executives') perceptions of MIS success. Several studies have examined the relationship between CSF of IS managers and CSF of MIS success. They assert that if a section of a proposed system being considered is very important to the manager, this section usually performs better than others. Miller and Doyle (1987) examined and confirmed this relationship in their study of the financial service sector. Raghunathan et al. (1989) also reported that all the identified performance measures were significantly related to the CSF of MIS managers. If this relationship holds true, the MIS

managers' perception of importance could indicate areas critical to information systems performance. These above mentioned concepts dominate the selection of literature to be reviewed.

Development, Comments, and Reliability of CSF

Rockart (1979) originated the CSF approach and has popularized helping executives identify their information needs. Rockart's CSF approach was based on that of D. Ronald Daniel, who was apparently the first to discuss the concept of "success factors" in the management literature (Rockart 1979). Rockart defined critical success factors as "the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization. They are the few key areas where 'things must go right' for the business to flourish." He argued that managers need appropriate information for their management functions and that performance in each area should be measured continually. It follows that information should be made available as necessary for managers' performance.

Davis (1979, 1980) criticized the use of CSF because CSF rely on managers' responses which may be incorrect, incomplete, or insufficient caused by the constraints of human behavior. According to Davis, these constraints are "bounded rationality, human ability to evaluate probabilities and to identify causality, and the biasing

effect of availability of data." Thus, in his view, the CSF method will elicit the information that executives feel they need, not the information executives actually need. In other words, managers might unintentionally invent, overlook or fail to mention CSF. Davis (1980) recommended further research on the use of explicit models and implicit models to elicit information requirements. Several researchers, have responded to Davis' comments and suggested ways to minimize the weakness (Munro 1983; Boynton and Zmud 1984). A brief discussion follows.

Munro and Wheeler (1980) presented a general approach for identifying CSF within the context of corporate planning. They analyzed the process of determining information requirements for organizational control purposes by interviewing senior middle level managers in a training seminar. Those processes are: "understand business unit objectives; identify CSF, and identify the performance measures and standards for each CSF; identify data required to measure performance; and identify decisions and information required to implement the plan." From these processes, they concluded that the CSF method and the performance measures and standards for each CSF can help management information systems by providing required management information. They also indicated that identifying CSF within the context of organization planning

processes could overcome the potential difficulties noted by Davis.

In response to Davis's comments, Munro (1983) compared the results obtained from Rockart's CSF study (1982) and Martin's CSF study (1982). Munro also examined both authors' articles in detail and compared both articles' citations, descriptions, and their interviews with senior IS managers. He commented that results from these two studies are interrelated and quite similar. He also concluded that the results from CSF methods are reasonable and the CSF approach is a reliable technique. His study did mention that the CSF approach cannot be completely free from the bias of an interviewer's interests and perceptions, unless the interviewers are skillful (Munro 1983).

In their 1984 study, Boynton and Zmud concluded that any weakness as identified by Davis which may occur by using the CSF method can be largely overcome by careful application of the technique. They conducted two case studies; one is a study of a financial services firm and the other, a study of a state university. From their experience, guidelines for effective application of CSF are succeeded:

1. CSF are an excellent tool for information resource planning. The CSF method seems particularly useful for organizations

considering a more aggressive information technology posture.

2. The use of a prototype is recommended as a means of product development.
3. The individual managing the CSF effort should have a thorough understanding of the organization or should be literate in the organization's principal area of business.
4. It is useful to identify and cultivate a senior-level manager to champion the project.

Their study employs the CSF method has many strengths; the reliability of the CSF method can be achieved in a structured design process; in MIS planning, Davis' criticisms can be overcome by interviewing managers across a diagonal slice of an organization.

This study employs the idea from Munro, Wheeler, Boyton and Zmud's findings that a CSF approach is a reliable and reasonable technique. Further, a structured questionnaire extracted from a literature search might provide a better measure (content and construct validity) as suggested by Churchill (1979). And a multi-item measures method could provide a "careful" measure as suggested by Boyton and Zmud. The multi-item measures could also provide benefits because "the reliability tends to increase and measurement error decreases" (Churchill, 1979). The mail survey would reach IS managers of

different levels in an organization, and thus, could overcome some weaknesses that Davis was concerned about (Boyton and Zmud, 1984; Emory and Cooper, 1991). Moreover, there are several CSF empirical studies using mail surveys -- e. g., Miller and Doyle (1987); Rivard and Huff (1988); Raghunathan et al. (1989) and Bergeron et al. (1993), and their results have provided creditable contributions. The author, therefore, concludes that a mail survey can be a proper method for the CSF study of MIS downsizing success.

Benbasat (1984) summarized that the CSF approach could be considered in the same classification as information based on a management by objectives approach. He indicated that the critical success factors approach could be a system analysis tool for eliciting executive's information requirements at the management control level. CSF could be a means of supporting system planning and could grant successful competitive performance for the organization. Since he did not explicitly criticize the CSF method, his support of the CSF approach is warranted.

Zahedi (1987) suggested and developed reliability as the measure of information system success based on CSF. He attempted to provide a theoretical framework for measuring information system success. His research used the data of Rockart's 1982 study to identify and build a hierarchial configuration of the observed CSF of the MIS. The study also used the data from Martin's 1982 study to verify the

construction of the MIS configuration that was derived from Rockart's data. Zahedi's verification indicated that the developed CSF configuration could be applied to other sample data with some minor modification. Based on the derived CSF configuration, Zahedi generated a reliability measure for information systems. This reliability measure is defined as "the probability that the system works successfully in achieving its objectives under a given set of environmental conditions." Zahedi also presented numerical examples and demonstrated how reliability measures can be utilized in evaluating IS projects in cost/benefit analysis. Based on the strengths of the CSF research approach mentioned above and methods for dealing with critical comments, there appears to be some confidence and support for obtaining critical success factors for MIS downsizing.

During the past decade, more extensive studies have attempted to overcome the weakness attributed to CSF and have broadened the concept to several different areas. These application could be: 1. Utilize CSF as the board of directors' strategic guidelines (Ferguson and Dickinson 1982); 2. Apply CSF for information requirements and corporate planning (Munro and Wheeler 1980; Boynton and Zmud 1984); 3. Apply CSF in the management decision process (Rockart and Crescenzi 1984); 4. Apply CSF in crisis communications (Dilenschneider and Hyde 1985);

5. Apply CSF in MIS planning (Shank, Boynton, and Zmud 1985); 6. Apply CSF for information satisfaction in the small business environment (Dickinson, Ferguson, and Sircar 1984; DeLone 1988; Montazemi 1988); 7. Apply CSF for financial services (Miller and Doyle 1987); and 8. Apply CSF for information centers or IS organizations performance (Wetherbe and Leitheiser 1985; Magal and Carr 1988; Raghunathan, Gupta, and Sundararaghavan 1989; Bergeron, Rivard, and DeSerre 1990). So, based on these previous studies, this study attempts to provide empirical research results suitable for applying and identifying CSF for MIS downsizing success.

Measuring Performance and Effectiveness

To evaluate an information system's success, one should measure systems performance and effectiveness. Hamilton and Chervany (1981a) reported the need for performance measures for MIS. They claimed that "Evaluating system effectiveness in meaningful terms has been the most difficult aspect of the MIS implementation process." Their study (Hamilton and Chervany, 1981b) described and compared the effects of evaluator viewpoints on system effectiveness on resources-oriented perspectives (or efficiency) and influences-oriented perspectives (or effectiveness). Some of their evaluation items -- for example, MIS personnel productivity, computer performance, service, and users' attitude -- are identical to the

components of CSF from Rockart (1982), Martin (1982), and later CSF studies, briefly reviewed later. Some of Hamilton and Chervany's evaluation items -- e. g., productivity, service, users' attitude, and computer performance -- are included in the research instrument.

Zmud (1979) suggested that organizational factors, MIS usage, top management's support, decision performance, personal and interpersonal characteristics, users' attitude, MIS staff characteristics and MIS policies influence the success of system implementation. Zmud also suggested that research should examine system usage, user satisfaction, and user performance for MIS success. These factors which are a part of Zmud and other reviewed studies are included in the research instrument. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide the cross referencing of the literature and the research instrument.

Ginzberg (1981) attempted to track and manipulate the controllable variables by developing tools for the system designer and users. Ginzberg suggested that there are two management approaches that can increase the effectiveness of the system development process. One approach is to identify those variables that are both especially important to the success of system development and controllable by the user or the system designer. The other approach is to manage the development process of the system designer and user by utilizing development tools and procedures.

Ginzberg conducted a field study in a large U. S. bank and concluded that "the degree of realism of user's pre-implementation expectations was positively correlated with a range of project success measures, both attitudinal and behavioral."

According to Rockart and Flannery's definition of end-users (Rockart and Flannery 1983), an MIS manager could serve as a system designer and a user as well. Following Ginzberg's suggestion, this study also attempts to examine the MIS manager's view of the importance of MIS downsizing success. As a result, the MIS manager will be chosen as the research subject of this study.

Yaverbaum (1988) applied the "Job Diagnostic Survey" (developed by Greg Oldham and J. Richard Hackman in 1980) on 84 end-users to investigate motivation and satisfaction in a computer environment. Yaverbaum's results indicate that task factors, organizational factors (management support, management activity, and training program), and user factors (cognitive differences, user characteristics: attitude, age, past training, education, job experience, and user participation) affecting user satisfaction, are crucial to the success of information systems. Since her results support Zmud's 1979 study, this study includes organizational factors, task factors and user factors in the research instrument.

Information Requirements

Rockart's 1982 classic study identified the CSF from nine MIS executives. These CSF differ from company to company, but can be summarized as a set of four generic CSF: service (operations and development), communication between users and IS staff, IS human resources, and repositioning the MIS function. Rockart also explained that the fourth generic CSF, repositioning the IS function, contains four basic elements: "technical, organizational, psychological, and MIS managerial."

From these four generic CSF, Rockart discussed related items as the key ingredients for success. These items are confirmed and supported by similar items examined in later studies by Martin (1982), and Magal and Carr (1988). Therefore, Rockart's four generic CSF are included in the research instrument of this study.

Martin's study (1982) reported the results from interviewing 15 chief MIS or data processing (DP) executives of sizable business or governmental organizations. His report identified seven general CSF of MIS/DP organizations:

1. System development
2. Data processing operations
3. Human resources development
4. Management control of the MIS/DP organization
5. Relationships with the management of the parent organization
6. Support of the objectives and priorities of the parent organization
7. Management of change (Martin 1982)

As mentioned above, Munro (1983) compared Rockart's and Martin's studies and concluded that their results correspond closely to each other. Munro's discussion further confirms Rockart's and Martin's studies which are important for this study. Consequently, these seven CSF are of high priority for this study.

Ferguson and Dickinson (1982) suggested that CSF have particular significance for boards of directors. They claimed that by identifying and monitoring CSF through its own analysis, the board can direct the activities of the chief executive officers. They suggested seven CSF for directors :

1. The need to improve productivity
2. The need to make better use of resources
3. The need to improve the product or the product line
4. The need to strengthen and develop management
5. The need to be more attractive to lenders and investors
6. The need to increase the value added
7. The need to become less vulnerable to inflation (Ferguson and Dickinson 1982)

These first four CSF, also recognized in other reviewed studies, will be included in the research instrument of this study. Table 2-3 and Table 3-2 provide the cross reference of this literature and the research instrument.

User Involvement and System Success

Some studies indicate that the end user has become crucial to the success or failure of a system. Ives and

Olson (1984) reviewed 22 studies and reported that eight studies found a positive relationship between user involvement and system success; seven studies produced mixed results. They concluded that further research should be based on a strong conceptual foundation built on the knowledge from previous research. From Ives and Olson's findings, this study is based on the assumption that there is a positive relationship between user involvement and information system downsizing success, and this proposition is thoroughly examined in the study .

Rivard and Huff (1984) studied ten of the 100 largest Canadian business firms having more than two to three years' experience with services promoted to assist user-developed applications (UDA). Their research utilized two sources: one, in-depth interviews with DP executives and other DP professionals responsible for providing end-user support services; and two, the secondary data from an MIS profile questionnaire, internal documents and direct observation. Their findings suggested that users are satisfied with the UDA services made available to them via MIS departments. They also concluded that the evaluation of tangible benefits associated with the UDA services is a critical issue for MIS managers. As a result, this study is based on the assumption that services supported by the MIS department increase users' facilitation and thus increase MIS downsizing success.

Rivard and Huff in a 1988 follow-up study reported critical success factors for end-user computing via a two-phase study based on their 1984 study. Of 1,074 subjects surveyed, 272 end users answered the questionnaire, giving a 25 percent response rate. The following factors of success were found: quality of MIS support, user satisfaction with support from MIS, user satisfaction with environmental set up, perception of user friendliness of software tools, and users' attitudes. Each of these factors is positively correlated with end-user computing success. This study is based on the assumption that there are positive relationships of MIS downsizing success with users' attitude, MIS support, and appropriate applications.

A survey-based field study (questionnaire-based) of thirty Australian firms that implemented custom-built information systems was conducted by Tait and Vessey (1988). In all, they surveyed 59 systems and obtained complete responses for 42 systems, a response rate of 71 percent. They examined the role of user involvement in system design as well as factors affecting the application of user involvement on system development success. They concluded that the availability of adequate resources for system development is an important factor for the success of system development; the association between users' attitudes and system success is small and positive; and system complexity has a negative effect on system success.

This study, therefore, includes user involvement in the research instrument and will examine the relationship between users' attitude and MIS downsizing success.

In order to find potential factors for end-user computing (EUC) success, Bergeron, Rivard and Raymond (1993) reviewed 67 studies and judged 30 questionnaire items from these articles. Then they sent 1,830 questionnaires both to the MIS managers and to their immediate superiors of 180 Canadian organizations. A return of 263 questionnaires represents a response rate of 14.3% for individuals and 19.7% for organizations. Through a principal components factor analysis with varimax rotation, the 30 success variables that were investigated can be merged into five factors. Overall factor loading ranged from 0.42 to 0.73. Cronbach's alpha for each factor ranged from 0.50 to 0.79. Percent of variance explained ranged from 5.0 percent to 23.4 percent. According to Bergeron et al. (1993), these five success factors, listed in the order of decreasing importance, are:

1. Organizational effectiveness, regrouping criteria related to improvements in decision making and overall performance in the enterprise;

2. User appreciation, which focusses on improvements in the access to and use of information by individuals;

3. Efficiency of applications, with criteria relating to improved productivity, cost and time savings brought about by end-user applications;

4. Quality of applications, which reflects technical design criteria for databases, outputs and processing of end-user applications;

5. Adequacy of applications, which reflects the conflict between individual aims in terms of user or departmental autonomy, and organizational concerns in terms of the relevance and competitive implications of end-user computing for the enterprise. (Bergeron, Rivard and Raymond 1993)

Table 2-1 lists the items in the research instrument of Bergeron et al. The order is rearranged according to the order of importance of the resulting analyzed factor. The researchers concluded that this certain order remained the same no matter which stage of EUC growth obtained. They also judged three composite factors: organizational effectiveness, quality of applications and efficiency of applications as more important as an EUC matures within the organization. This study will adopt most of these variables in the research instrument for identifying CSF of MIS downsizing success. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of the literature and the research instrument.

Performance of Information Centers

Magal and Carr (1988) investigated the existence and nature of CSF for an information center and examined the effects of age, size, and hardware options on the CSF applicable to information centers. Twenty-six CSF were identified from three studies, "Wetherbe and Leitheiser

(1985), Sumner (1985), and Brancheau, Vogel and Wetherbe (1985)." The questionnaire was sent to 1,450 information center managers who were randomly selected from the subscription list of Information Center magazine. From the collected data, the three most important variables were determined: competent staff, communication with the users, and top management support.

Five composite CSF were identified from a principal components factor analysis. The relative importance of the five composite CSF was found to be the same regardless of the age of an information center, its size, or the hardware options it supported. These five CSF are: commitment to the information center concept, quality of information center support services, facilitation of end-user computing, role clarity and coordination of end-user computing. The research instrument for MIS downsizing success includes a modified version of these variables. This study is based on the assumption that the supporting role of end user computing in an information center (Sprague and McNurlin 1986) is related to this study's proposition that an MIS department's support has a positive relationship with MIS downsizing success. Therefore, this study borrows the CSF studies of Magal and Carr to examine the relationship of MIS department's support and MIS downsizing success.

In another study, Magal, Carr, and Watson (1988) proposed a stage theory for the evolution of information centers (IC). They sent questionnaires to 1,490 randomly selected subscribers to Information Center magazine. They proposed a stage hypothesis for an information center and examined 26 relevant CSF. (The four stages for information centers are initiation, expansion, formalization, and maturity). Table 2-2 lists these 26 CSF. From the 311 usable responses, a response rate of 21 percent, they found that their proposition was supported from their survey; the stages of information center growth had statistically significant impact on the composite CSF. They also found the importance of these composite CSF tended to change among themselves but was relatively constant individually across the information center stages. They suggested that it is important for information center managers to understand the CSF at various stages.

They utilized a principal components factor analysis for the 26 individual CSF with varimax (orthogonal) rotation. Their study identified five composite CSF: 1. Commitment to the information center concept; 2. Quality of information center's support services; 3. Facilitation of end-user computing; 4. Role clarity; and 5. Coordination of end-user computing. Most of the variables in their research instrument will be investigated in this study for identifying CSF for MIS downsizing success. This

study chooses items from their research that are suitable for examining the proposed six categories for MIS downsizing success. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of the literature and variables that will be examined in this study.

Miller and Doyle (1987) investigated 21 South African financial service companies for measuring the effectiveness of computer-based information systems. They sent out an 80-item questionnaire to manager users and DP managers in these 21 companies. From 276 responses, a principal components factor analysis using varimax rotation was applied. The reliability coefficient of the overall instrument was 0.88. The outcome of the factor analysis supported the construct validity of their instrument. The factor loading for each variable ranged from 0.80 to 0.46. Total variance accounted for 62% of the factors in the performance set, and for 55% of the factors in the importance set.

From the results of factor analysis, seven composite factors were found: Characteristics of conventional systems; Strategic management issues; User involvement; Responsiveness to new systems needs; end user computing; IS staff quality; and Reliability of service. The researchers indicated that factors related to IS effectiveness can be mapped well onto the four CSF determined by Rockart (1982).

They also suggested that IS effectiveness is a function of the relationship between perceived importance and performance on particular information systems attributes. Therefore, if MIS managers administer the MIS function according to the CSF, they should be able to improve MIS performance and effectiveness; that is the implicit finding from Miller and Doyle for this study. Further, their study confirms the use of MIS mangers as the research subject in this study. Their variables with high factor loadings were chosen in this research instrument for identifying CSF for MIS downsizing success. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of the variables from Miller and Doyle's literature and the variables for examining MIS downsizing success.

Raghunathan, Gupta, and Sundararaghavan (1989) conducted a survey from a sample of randomly selected 1,000 IS executives from "The facts on the file: Directory of Major Public Corporations" by Stanley Greenfield, which contains various US organizations' addresses. From 205 responses of 1,000 surveyed, or a 20.5% response rate, 199 of the responses were usable. Cronbach's alpha of each CSF, which was above 0.64, supported the reliability of the CSF. Their six CSF were: human resource development; relationship with and support of the objectives of parent organization; management control of the MIS/DP

organization; data processing operations; performance; and system development. Because the findings of their study indicated the four Rockart's CSF (Operations and development; Communications between users and IS staff; Human resources and Repositioning the MIS function) as well as the six CSF from Martin's study (Data processing operations, System development, Human resources, Relationships with the management of the parent organization, Support of the objectives of the parent organizations, and Management control of the MIS/DP organization), most of their measurement items were included in the research instrument of this study.

Their main purpose was to relate CSF of MIS managers to the performance of MIS organizations. They concluded that all the performance measures identified in their study were significantly related to the CSF of MIS managers.

> Relations with and support of the objectives of the parent organization is most significantly related to performance, whereas DP operations is least significantly related to performance. ... Improved user job performance is most significantly related to CSF, whereas widespread use of IS is least related to CSF. (Raghunathan et al. 1989).

Their study upholds the selection of MIS managers as the research subject for this study. Moreover, their questionnaire is a good reference for this study to assemble variables for evaluating MIS downsizing success and identifying the critical success factors. Table 2-3 of

Chapter II and Table 3-2 of Chapter III provide a cross reference of the literature and the selected variables.

IS Downsizing Cases and Articles

In a non-empirically based article for practitioners, Klein (1991) indicated that downsizing decisions should be based on an application-by-application basis, not on a political basis (such as gaining control over an information system). According to Klein, the measure of proper applications for IS downsizing should consist of these criteria: IS strategy; involvement of senior executives and line management; response time; database size and access requirement; technical background of users and IS staffs; how many users will be involved; user satisfaction; development costs; competitive benefits; responsiveness to change and deployment flexibility.

Klein also suggested that executives should evaluate these downsizing criteria factors with what he calls "strategic IS principles." Thus, an organization with a consistent, effective IS downsizing implementing strategy could gradually and successfully distribute applications and gain experience of downsizing at minimal risk.

It is clear that many of Klein's criteria correspond to the CSF identified by empirical studies which were reviewed above. Therefore, this study chose several of Kelein's criteria, as discussed above, for the research

instrument as well as for study as potential success factors for MIS downsizing.

According to Bloom (1992) and Turban (1993), there are several possible options to downsizing an IS. These options depend on the user's need and organizational objectives relative to the degree of off-host technologies adapted. General options such as replacing the mainframe by mid-range or PC-based LAN, or replacing the mid-range by PC-based LAN, are self explanatory. Other options are:

1. Wallpaper approach -- merely changing system's appearance without changing its structure; or modifying the system so that PC programs can control mainframe-based applications.
2. Modified wallpaper approach -- automatically executing PC-based software, to strengthen mainframe functionality.
3. Mainframe download and display approach -- the mainframe periodically downloads a data file or summary information to the PC or local-area network (LAN) server.
4. The dynamic download and display approach -- download specific required information rather than entire files.
5. Mainframe read/server write approach -- data is input from mainframe to the server-based

applications. Data is stored on a platform other than the mainframe.

6. The server-only approach -- all data and stored procedures are on the server and the applications are stored on PCs. It requires a company to have an LAN infrastructure to assure company-wide access to applications and data.
7. The multiplatform database approach -- it enables applications to read, manipulate and update databases on both mainframe and the server.

From these options, it can be concluded that most of the approaches appeared to involve redistributing the MIS function from the mainframe, with PCs or an LAN added to the system. From these approaches, this study can conclude that MIS downsizing does not necessarily imply the complete replacement of mainframes for an MIS downsizing.

Turban and Bloom also indicated that each of these options has advantages and disadvantages. An organization must conduct a cost-benefit analysis to choose the right approach. According to Bloom and Turban, the advantages of MIS downsizing are:

1. Speed development time (faster turnaround)
2. Fast response
3. Increase Productivity

4. Easy-to-use PC tools
5. Reduction in labor
6. Reduction of mainframe CPU cycles
7. Reduction in operation costs
8. Reduction in maintenance cost
9. Reduction of mainframe data storage and CPU costs
10. Reduction in hardware costs.

The disadvantages of MIS downsizing, according to Bloom, are:

1. Increase IS staff's burden
2. Need additional design, development and conversion time
3. Need re-engineering code
4. Data corruption caused by inconsistencies between mainframe and the server database
5. Hidden costs.

According to Turban, the downsizing potential costs are:

1. Software conversion costs
2. Purchasing cost of new equipment
3. Training costs
4. Consultants' fees
5. Sunken costs of discontinued equipment
6. Termination of employees cost
7. Security cost (usually high in LAN environments)
8. Loss of standardization and control
9. Too much reliance on packaged solutions
10. Conversion cost (Turban 1993)

This study takes the claimed downsizing advantages, disadvantages and potential costs as the guidelines for

selecting variables in the research instrument. Many of the items are included in the research instrument. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of Bloom's and Turban's normative variables in the research instrument.

Richard Duè (1992) in a report indicated that there are direct costs and indirect costs associated with the hidden cost of downsizing. Organizations should carefully evaluate these costs to determine whether any benefits would be obtained from downsizing. According to Duè, direct costs associated with MIS downsizing are:

1. Hardware and software acquisition cost
2. Severance costs from laid-off employees
3. Penalty for termination of equipment leases
4. Penalty for termination of maintenance contracts
5. Training and retraining cost for downsized IS environment
6. Cost of new security, disaster planning, and recovery plans
7. Asset write-offs

Duè claimed the indirect costs of MIS downsizing are:

1. Loss of control of the IS function;
2. Downsizing inappropriate applications;
3. Decisions based on erroneous or incomplete data;
4. Loss of systems development capability.

Duè (1992) also stated that the organization should carefully evaluate such political reasons for IS downsizing as allowing user departments physically to control their own data thus taking it and applications from the IS department. He further recommended the concept of internal franchising of data processing by an MIS department.

> Franchising is a process that sets common organizational goals and ensures development and operational standards while harnessing powerful entrepreneurial drives within the organization. (Duè, 1992).

Moreover, Duè suggested that the development and operation of franchising systems offers another approach to accomplish a reliable MIS downsizing with minimal problems and costs. From Duè's statement, this study observed another approach to MIS downsizing -- franchising. This observation affirms that MIS downsizing has many approaches; thus franchising is considered beyond the scope of this research. However, this study uses some of Duè's suggested downsizing cost items as reference for selecting variables for the research instrument. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of the variables and the literature.

Rowley and Smiley (1991) in a case study report suggested that the MIS department should provide timely and high quality assistance to its users and its senior managers. Users are demanding responsive, affordable applications that they can access on their personal

computers. Rowley and Smiley studied the IS department of BellSouth Enterprises Inc., and argued that their findings are generalizable or applicable to any computerized information system. They discussed three principles for IS downsizing that will improve an MIS department's proper managing of its resources and better support the users. Their three principles for MIS downsizing are briefly stated as:

1. A focus on line management decision making; a line manager's specific needs must be identified and conformed to in the design of MIS.
2. A definition of the roles and shared responsibilities for the MIS resources.
3. A restructuring of the MIS department into an investment center.

Thus, the new MIS department should be able to support its users with the information necessary to achieve a competitive advantage.

This study confirmed from Rowley and Smiley's concept of the role of the MIS department in a downsizing environment that an MIS department should be able to communicate with its user departments and provide the requested supports and manage the MIS resources accordingly. This study modified the three principles (from above) and included them in the research instrument. Table 2-3 of Chapter II and Table 3-2 of Chapter III

provide a cross reference to the literature and to the variables included in the research instrument.

Ehrenreich (1992) described three basic approaches to MIS downsizing:

1. Low-end applications such as PC-LAN can be "upsized" or "upgraded" to more powerful systems and servers;
2. High-end mainframe and supermini-computer applications can be "downsized" or redistributed through a networked MIS;
3. Client-server computing, a network-based system in which data are stored and processed on powerful file servers and accessed via applications running on distributed client computers -- typically PCs and workstations.

Ehrenreich stated that MIS downsizing benefits are:

1. Time savings
2. Faster response to queries and jobs
3. Applications run more quickly and efficiently
4. Users can share information in multivendor computing environments
5. Users can take advantage of multitasking capabilities

Ehrenreich's downsizing benefits are included in the research instrument of this study for CSF for MIS downsizing success. Table 2-3 of Chapter II and Table 3-2

of Chapter III provide a cross reference of the literature and the research instrument.

Ehrenreich (1992) also suggested that client-server computing will reduce design-to-implementation time or time-to-market of new services, network options, and maintenance systems. His rationale was that client-server computing can expedite software development in the long run; downsizing allows an organization to move resources where they can be performed most effectively, improving response time and customer service as well; and downsizing can facilitate the use of new network-based multimedia technologies also. He concluded very positively that:

> "through client-server computing, users have access to more applications and network resources than before; each computer performs only the specialized tasks it was designed for thereby maximizing computer system efficiency. In the long run, backlogs on mainframes and supercomputers are reduced." (Ehrenreich 1992).

Therefore, this study includes in the questionnaire time savings with system development; cost savings in operation, maintenance and IS resources management; overall productivity; as well as applications are quicker and more efficient than prior systems.

Advice for MIS Downsizing

Hylas, Gordon and Dinetz (1989) gave some advice from their consulting experience: it is not necessary to replace mainframe systems completely. "Downsizing of selected business systems and 'corporate computing' permit

mainframe data centers to concentrate on those items it needs to handle." They described several firms' successful approach to MIS downsizing such as American International Group, and John Hancock Insurance Co. They also advised that:

1. A good candidate for downsizing is the application of a single department or user group;
2. User departments should participate in downsizing projects;
3. Strong senior management involvement is needed to sponsor downsizing;
4. Business professionals should be trained to develop and maintain their own downsized systems;
5. Active and continued support of the MIS department is essential.

Hylas et al. indicated that problems could occur during MIS downsizing if no senior executive was specially assigned to develop and maintain the downsized MIS. For example, systems would not be documented but developed arbitrarily, users would not be properly trained, etc. Their suggested factors are included in the research instrument for identifying CSF for MIS downsizing success -- e. g., user involvement, user commitment, appropriate application and MIS department's service.

In another article, Klein (1990) advised that an effective MIS downsizing should avoid the five biggest downsizing errors:

1. No management commitment -- To ensure IS downsizing success, a firm should obtain the express commitment of both corporate and line management.
2. Inadequate understanding of existing information technology infrastructure -- IS managers should evaluate the organization goals, strategies and tactics as well as the distribution of information technology and the applications within the organization.
3. An inappropriate organizational structure and resources -- Successful downsizing should be able to integrate new hardware, software, development strategies, users and supporting IS staffs.
4. Trying too much too quickly -- IS managers should not attempt to implement an immediate and large-scale downsizing effort. It is better to start a small experimental project of realistic size.
5. No controlling framework or infrastructure -- IS managers should determine a controlling framework for the new downsized systems. Since the technology and the people are more distributed,

coordination and correlation should be more noticeable.

This study concludes that if these errors can be avoided during the MIS downsizing process, successful MIS downsizing can be ensured. Thus, this study rewords these sentences positively and includes them in the research instrument for identifying MIS downsizing success; for instance, "no management commitment" is changed to "users' commitment", "inadequate understanding of existing information technology infrastructure" is changed to "provide training to users", "no controlling framework" is changed to "control procedures", etc.

Tom Dagenais (1991) recommended some critical issues for MIS downsizing success as follows:

1. Define the downsizing objectives and select the key and appropriate applications for downsizing.
2. Make sure that the required software is available for the downsized hardware platform or can be developed within a reasonable time at an acceptable cost.
3. Clearly define the constraints on the nature of the application, system availability, developers, consultants and management. Define standards as well.
4. Carefully inspect cost-effective analysis; be sure to include all costs and benefits.

5. Select available hardware platform to assure adequate response time and system requirement.
6. Ensure that the users and IS staffs understand the downsized hardware and software applications.
7. Deal with downsizing issues with System Development Life Cycle concepts.

This study selects several of these issues and includes them in the research instrument to identify the CSF for MIS downsizing success -- e. g., appropriate applications, cost-effectiveness of applications, etc. Table 2-3 of Chapter II and Table 3-2 of Chapter III provide a cross reference of the literature and the variables of the research instrument.

Alan Radding (1992) examined more than ten U. S. firms that have MIS downsized and found these firms face different downsizing problems. He summarized and discussed these problems in three issues:

1. People issues
   - .IS staffs and users may resist downsizing.
   - .IS staffs need new IS knowledge and skills.
   - .Poor alignment with corporate direction.
2. Application development issues
   - .There are few development packages available for IS downsizing or client/server.
   - .Lack of integrated tools forces use of many different products.

.The process of replacing mainframe applications and reports is long and painstaking.

.Building graphical user interfaces (GUIs) is slower than mainframe applications.

3. Administration, integration, and networking issues

.Security, recovery and backup technologies of PCs or LANs are less mature than mainframes.

.It is hard to coordinate multiple vendors and applications.

.It is much harder to isolate the failures on PC nodes. Certain LANs are too slow for downsized environment.

Radding's case studies indicated that during the MIS downsizing process, these three issues should be carefully designed; otherwise, MIS downsizing might not be a success. His summary has a strong implication for MIS downsizing followers and reflects that a successful MIS downsizing has to overcome these issues. This study attempts to reword these issues and includes them in the research instrument; e. g., "provide training to IS staffs and users" is used from his components of "people issues." Table 2-3 of this chapter and Table 3-2 of Chapter III provide a cross reference of the variables and the literature.

Howard Fosdick (1992) suggested three approaches to avoid the pitfalls of downsizing:

1. Research and maintain compatibility issues carefully,
2. Handle organizational issues up front,
3. Understand the business problem the application is supposed to solve.

Having utilized Forsdick's, Klein's, Radding's and other experts' experience and advice, this study's research instrument should contain all the important variables that are recognized by them and the previous CSF studies. This study will perform an empirical study on these variables for identifying CSF for MIS downsizing success. For identification of variables to be included in the research, Table 2-3 summarizes all of the variables identified in the literature and categorizes the variables according to the proposed type of CSF for MIS downsizing success. Refer to Table 2-3 for cross referencing of variables to previous research.

Development of Hypotheses from the Literature

Hypotheses for this study can be grouped according to the expected critical success factors for IS downsizing success. The ten hypotheses to be tested in this study are numbered for identification.

User Appreciation

User appreciation is a proxy of a group of factors about user involvement and positive users' attitudes toward

IS downsizing. User appreciation measures the relationship between users' behavior and IS downsizing success. This research proposes a positive relationship between user appreciation and MIS downsizing success:

H_1: User appreciation is related to MIS downsizing success.

Several previous studies have reached varying conclusions. A study by Ives and Olson (1984) reviewed 22 related studies. Only eight studies claimed a positive relationship between user involvement and system success, seven studies claimed a negative relationship, and the other seven studies claimed mixed results. Of the seven studies that investigated the relationship between user involvement and user's attitude toward the system, only one study reported significant results with user involvement and users' attitude. Since the Ives and Olson's study was done nine years ago, some changes may have occurred; certainly, other studies as reviewed in Chapter II presented different results (see the summarized Table 2-3). This research proposes to re-examine the relationship of these two variables (user involvement and users' attitude) and MIS downsizing success.

Two hypotheses related to user appreciation of MIS downsizing will be examined. This study is based on the assumption that there is a positive relationship between user involvement in the system conversion process

(downsizing or rightsizing) and system success, and assumes a positive relationship between users' attitude toward MIS and MIS downsizing success.

According to Olson and Ives (1981), user involvement is defined as "participation in the development by a member or members of the target user group." Olson and Ives (1984) classify the extent of user involvement as follows:

1. No involvement. Users are unwilling or not invited to participate.

2. Symbolic involvement. User input is requested but ignored.

3. Involvement by advice. Advice is solicited through interviews or questionnaires.

4. Involvement by weak control. Users have "sign-off" responsibility at each stage of the system development process.

5. Involvement by doing. A user is a design team member, or is the official "liaison" with the information systems development group.

6. Involvement by strong control. Users may pay directly for new development out of their own budgets, or the user's overall organizational performance evaluation depends on the outcome of the development effort. (Olson and Ives, 1981).

Ginzberg (1981) suggested that gaining management and user commitment to the project and gaining user commitment to any changes necessitated by the new system will increase the probability of successful implementation of MIS. Ives and Olson (1984) also suggested that user involvement affects system success. Therefore, it is expected that the

extent of user involvement and success on MIS downsizing are positively related as follows:

H_{1a}: User involvement in the process of MIS downsizing is related to MIS downsizing success.

Davis and Olson (1985) argued that:

> Implementation of information systems is a process of organizational changes; ... Implementation refers to the ongoing process of preparing the organization for the new system and introducing it in such a way as to assure its successful use (Davis and Olson 1985).

Lucas (1981) suggested that human factors affect the successful implementation of a new IS more obviously than do organizational factors. If users do not realize that the organization is going to implement MIS downsizing, and their attitudes toward MIS downsizing are unfavorable, then it is likely that they will not accept the downsized MIS. Thus, the risk of MIS downsizing failure will be increased. Users may even resist the changes involved in MIS downsizing. User resistance could be a serious problem during the MIS downsizing process. This study hypothesizes a positive relationship between users' attitude toward MIS and MIS downsizing success.

H_{1b}: Users' attitude toward MIS downsizing is related to MIS downsizing success.

Communication and Facilitation

Before an organization can move to a change - following organizational change theory - according to Kurt Lewin's three-stage model of system change, there will be unfreezing, change and refreeze stages (Lewin, 1947; Davis, 1985; Tait and Vessey 1988). During this "unfreezing" stage, the receptivity of the organization to a possible change should be increased; otherwise, the change stage can not possibly be reached. According to Ginzberg (1981), user participation in system design and implementation will aid in accomplishing unfreezing, and is a method to increase the receptivity to change. Before downsizing, the MIS department could help users obtain knowledge and skills for the new MIS. Such user awareness should increase user receptivity.

Before or during the process of downsizing, the MIS department could provide training courses, provide hardware and software for users to learn and use, help to set the standards for hardware and software, improve communication and assist users in communication and allied efforts. Thus users could have less fear and their attitude toward downsizing could be favorable (Rainer et al. 1992). In the environment of MIS downsizing, coordination of end-users computing is more crucial and complex than in the classical environment of mainframe computing. Therefore, this study hypothesizes a positive relationship of MIS downsizing

success and the importance of communication between users and the MIS department.

H_2: Communication between end-user and the MIS department is related to MIS downsizing success.

The coordination functions of MIS departments often cause conflict. The MIS department can set up control procedures to ensure standards and policies, or control costs for systems development. However, the MIS department can also provide training courses or qualified services to users to promote end-user computing or outsourcing. Through the function of coordination and communication, users can understand the limitations of MIS services and support; the MIS department can be made aware of users' needs and provide the required facilitation to users during MIS downsizing. As an example, the MIS department can acquire the software packages for PCs or workstations or set up a client/server network environment. Consequently, this research examines the relationship between the facilitation of end-users and MIS managers' perception of MIS downsizing success.

H_{2a}: Facilitation to users is related to MIS managers' perception of MIS downsizing success.

MIS Department Services

The basic function of an MIS department is to manage MIS resources and to coordinate and facilitate computer functioning for users. An effective MIS department provides sufficient and necessary hardware devices, supports applicable and efficient software, and has a competent MIS staff that supports certain services. Services such as technical support, trouble shooting, consulting and training are critical MIS department functions (Rockart 1982; Ferguson and Dickinson 1982; Ives and Olson 1984). In their study, Magal and Carr (1988) found an MIS staff's under-standing of the users' business and problems plus standardized hardware and software to be important factors for the quality of MIS support services. This study proposes a positive relationship between MIS downsizing success and the support services of the MIS department.

H_3: The support services of an MIS department are related to MIS downsizing success.

Commitment and Support

The success or failure of any business effort is often determined by the amount of top management's support (Rockart 1982, Ives et al. 1984). MIS managers actively participate in the organization's planning process with senior managers, and top managers help MIS management and

line management to overcome the problem of understanding top management's objectives, thus facilitating good communications among management levels. MIS managers who participate in the planning process also promote communication or a favorable relationship with top management. Thus, managers would perceive the changing business objectives and help the MIS department to achieve the new business objectives. Top management would acknowledge the importance of MIS downsizing and generate an appreciation of MIS management issues. Top management can better understand the idea or the problems of MIS management during the process of MIS downsizing, and would have a better image of the MIS downsizing phenomenon.

The business units also have to be aware of the MIS downsizing phenomenon and inform MIS management about their objectives (Bergeron et al. 1993, Ives and Olson 1984). As unit or line management understands more about the MIS downsizing concept, they are willing to cooperate. MIS management also should be prepared to propose a strategic plan of MIS downsizing to top and line management. This strategic plan should include the reasons for the change, its importance to the organization, the impacts likely to result from it and the procedure for evaluating it. Ginzberg (1981) indicated that such criteria are important in determining a user's response to an MIS change from the strategic plan studied and proposed by the MIS manager.

Thus, top and line management would commit to and support MIS management's objectives and offer cooperation for successful MIS downsizing. This study examines this positive relationship.

H_4: Commitment and support from top management and users are related to MIS downsizing success.

Organizational Effectiveness

Any management task should be designed to achieve the organization's objectives; similarly, MIS downsizing should be designed to achieve an organization's objectives. If MIS downsizing can improve an organization's effectiveness by upgraded but cheaper CPU capacity, then MIS downsizing may be a success. MIS should provide a supporting environment for line managers and top managers for their decision making (Munro et al. 1980, Klein 1991). During the environment of change, MIS support may ease the tedious maintenance of documents and help to derive specifications for hardware and software, thus improving the quality of managers' decision making and easing the management of change. This help should be provided by MIS. This study examines the above relationship between MIS downsizing and organizational effectiveness:

H_5: Organizational effectiveness is related to MIS downsizing success.

Software Applications

Hylas et al. (1989) indicated not all systems applications are appropriate for downsizing. Selection of the wrong business functional area or the wrong application can result in system failure. Lack of MIS downsizing experience may cause an MIS manager to choose an inappropriate application; an incompetent MIS staff may have difficulty recoding or developing software for MIS downsizing; or a deficiency of software packages for MIS downsizing can cause rigidity and difficulty for MIS downsizing (Hoffman 1992).

Most software that supports PCs, workstations, or LANs is general purpose software, or tailor-made commercial software. When downsizing, obtaining or developing the suitable software for MIS downsizing is quite a challenge. Fosdick (1992) indicates that when applications are moving from the mainframe to the desktop, compatibility should be maintained. To ensure software compatibility, the software should be compared by MIS management in detail by review of syntax, software features, semantics and external behavior. Thus, the MIS department can ensure and provide qualified software to its users after MIS downsizing. This research hypothesizes the relationship between the software applications and MIS downsizing success.

H_6: Appropriate software application is related to MIS downsizing success.

Applications should be acquired to solve business problems, not create problems. Many older applications often employ unique, antiquated and somewhat incompatible mainframe software coupled with an expensive price tag. Many current application development environments are designed specifically for cross-platform use and the prices are more affordable. Certain four generation languages (4GLs), application generators and expert system shells make downsizing a lower-risk and provide cost savings along with a higher payoff. It follows then that this study not only examines the relationship between the importance of the quality of applications and MIS downsizing success, but also examines the relationship between the efficiency of applications and MIS downsizing.

H_{6a}: The quality of applications is related to MIS downsizing success.

H_{6b}: The efficiency of applications is related to MIS downsizing success.

When downsizing, if one chooses a complicated application involving significant amounts of data manipulation as a candidate for downsizing, this could be an inadequate approach for a successful MIS downsizing. The reason for inadequacy is that large volumes of data and complicated applications contain the possibility that the database may be accessed by several related applications and the complicated application may be composed of

sophisticated coding techniques; as a result this can cause difficulties for conversion and a downsized MIS. The candidate application for MIS downsizing should be simple, familiar, and based on an application's basic merits, not on its politics (Klein 1991). Organizations should carefully evaluate potential applications for MIS downsizing. Accordingly, this study examines the relationship of the importance of the adequacy of applications and MIS downsizing success.

H_{6c}: The adequacy of applications is related to MIS downsizing success.

The above hypotheses were chosen from the literature and the relevant literature was classified above. The next chapter develops a research model and considers research methodology.

TABLE 2-1

ITEMS FROM AN INSTRUMENT USED TO MEASURE SUCCESS CRITERIA

1. Organizational Effectiveness .Increase in the quality of decision-making .Improvement in the decision-making quality .Improvement in organizational performance .Improvement in organizational effectiveness .Attainment of organizational objectives
2. User Appreciation .Quicker access to information .Easier access to information .User satisfaction .Increase in the quality of information .Increase in the use of existing information systems .Better communication capacity .Increase in data processing capacity .Efficient use of tools by the users
3. Quality of Application .No data redundancy .No duplication of applications .Quality of information .Quality of user database .Error free applications
4. Efficiency of Application .More work accomplishment by users .Time savings .Reduction in users' work effort .Cost-benefits of applications .Low cost applications .Cost-effectiveness of EUC as compared to other possibilities .Savings in the development of applications by users .Effective execution of tasks
5. Adequacy of Applications .User autonomy .Balance between local autonomy of applications and their integration to organizational systems .Competitive advantage .Information systems applied to major organizational problems

Source: Bergeron, Rivard, and Raymond "Assessment of End-User Computing from an Organizational Perspective," Information Resources Management Journal, (Winter 1993) : 14-25.

TABLE 2-2

CSF VARIABLES FOR INFORMATION CENTERS

1. Control procedures to ensure standards, policies, etc. are adhered to.
2. A competent staff
3. Support software packages
4. End-user training
5. Monitor and coordinate end-user applications development
6. Top management support
7. Response to applications requests
8. Promote information center services [*]
9. Communication with users
10. Cost effective solutions
11. Atmosphere for users
12. System performance
13. Understanding of users' business and problems
14. Organizational acceptance of IC concept [*]
15. Manage end-user expectations
16. Provide services to distributed sites
17. Define information center mission [*]
18. Users' understanding of data processing [*]
19. Reliability of applications developed
20. Commitment of end users to the IC concept [*]
21. Career paths for information center staff [*]
22. Priority criteria for work
23. Charge back criterion
24. Standardized hardware and software
25. Training for information center staff [*]
26. Liaison function with end-user departments

Note: An [*] indicates that this item is to be included with modification in this study.

Source: Magal, Carr, and Watson "Critical Success Factors for Information Center Managers," MIS Quarterly, (September 1988): 413-425.

TABLE 2-3

CLASSIFICATION OF FACTORS FROM LITERATURE

A. Information or system performance effectiveness

- System availability and timely response (1,2,4,5,6,9,10,11,12,13,14,17,20,22,25)
- Time saving of new system development (1,2,3,5,6,13,14,17,20,21,22,24)
- Cost saving in operation and maintenance (1,2,22)
- Cost-effectiveness of IS resource management (2,5,13,14,22,24)
- Flexibility of system (1,10,11,14)
- Relevance and quality of output (1,6,14,17,21)
- Understanding & reply to user's priority (4,12,13,14,17,19,24)
- Increase overall productivity (2,5,6,17,22)
- Run applications more quickly and efficiently (1,5,14)
- System security, backup and privacy (11, 13,13,17)

B. Organizational Effectiveness (23,25)

- Attainment of organizational objectives (1,3,8,11,15)
- Improvement in organizational effectiveness (1,6,11,17)
- Improvement in organizational performance (1,6,11,15)
- Improvement in the decision-making quality (1,15,17,25)
- Increase in the quality of decision making (1,6)
- Management of change (6,10,11,13,24)

C. User Appreciation

1. User satisfaction (1,6,11,17,25)
    - User confidence in system (10,12,14)
    - Easier and quicker access to system (1,2,5,14,18,22)
    - Improved user productivity (1,2,17,18,20,22)
    - User's control over IS services (1,5,14,18)

2. User's positive attitude toward IS (7,8,18,21,23)
    - Increase in the use of existing information systems(1,18,25)
    - Users develop their own applications (1,12,25)
    - Efficient use of tools by the users (1,2,11,14,18,22)

3. User involvement (6,7,10,11,17,21,23)
    - Users' understanding of system (3,7,10,11,12,14,15,16,18,19,21)
    - User participate in IS design (7,9,10,14,17,18,21,23)

D. IS department's service

- A Competent staff (3,8,11,12,14,19,21,24)
- Set up and ensure the control of standards, policies (3,8,11,12,14,15,17,19,24)
- Control system development and maintenance costs (3,11,17)
- Effective management of IS resources (3,4,5,6,10,12,13,14,17,19,21,24)

TABLE 2-3 (continued)

. Provide reliable and qualified IS services (8,9,12,14,18,19,20,23,24,25)

E. Communication between IS department and users (1,4,9,10,12,14,16,19,20,21,25)

. Communication of IS services with users (19,20)
. Provide training to IS staff and users (3,9,10,12,14,16,21,23)
. Respond to user's request of IS support (13,19,20)
. Supply and support required software packages (3,4,12,13)

F. Commitment to the IS concept

. Commitment of users to the IS concept (12,19,23,24)
. Organizational acceptance of IS concept (10,11,12,13,14)
. Support from top management (9,10,11,12,13,14,16,17,19,23,24,25)
. Strategic IS planning (1,3,11,14,17)

G. Application Issues

1. Quality of Application (1,10,17,23,25.)

. Quality of information output (1,8,10)
. Quality of user database and applications (1,8,11)
. Reliability of applications (1,3,10,12,17,21)

2. Efficiency of Application

. Cost-effectiveness of application and systems (1,3,8,10,12,14,17)
. Reduce data processing and maintenance cycle (1,2,11,22)
. Reduction in users' work effort (1,9,11,17)

3. Adequacy of Applications

. Balance between local autonomy of applications and their integration to organizational systems (1)
. Competitive advantage of software applications (1,11,19)
. Appropriate application (3,5,9,11)
. Applications respond to users' needs (1,11,14,15)

H. Problems of downsizing

1. People issues

. IS staff and users' resistance to downsizing (16)
. Increase IS staff burden (2,16,22)

2. Application development issues

. IS implementation risk (11,16)
. Need for re-engineering code (2,4,16,22)
. Data corruption caused by inconsistencies between mainframe and the server database (2,4,16,22)
. Need additional design, development and conversion time (2,4,16,22)
. Loss of system development capability (4,16)

TABLE 2-3 (continued)

3. IS management issues

- Security, recovery and backup technologies of PCs or LANs are less mature than mainframes (16)
- Coordination of multiple vendors and applications is difficult (16)
- To isolate PC nodes failures is much harder (16)

4. Cost issues

- Penalty for termination of equipment leases and/or maintenance contract (4)
- Hidden costs (2,3,4,16,22)
- Severance costs from laid-off employees (4)
- Decision based on erroneous or incomplete data (4)

I. Selected references of literature review

1. Bergeron, Rivard, and Raymond (1993)
2. Bloom (1992)
3. Dagenais (1991)
4. Duè (1992)
5. Ehrenreich (1992)
6. Ferguson and Dickinson (1982)
7. Ginzberg (1981)
8. Hamilton and Chervany (1981)
9. Hylas, Gordon, and Dinetz (1989)
10. Ives and Olson (1984)
11. Klein (1990, 1991)
12. Magal and Carr (1988); Magal, Carr, and Watson (1988)
13. Martin (1982)
14. Miller and Doyle (1987)
15. Munro and Wheeler (1980)
16. Radding (1992)
17. Raghunathan, Gupta, and Sundararaghavan (1989)
18. Rivard and Huff (1984, 1988)
19. Rockart (1979, 1982)
20. Rowley and Smiley (1991)
21. Tait and Vessey (1988)
22. Turban (1993)
23. Yaverbaum (1988)
24. Zahedi (1987)
25. Zmud (1979)

CHAPTER III

RESEARCH METHODOLOGY

This chapter describes the model, methods and procedures used in this study. The first section discusses the research model; the second describes the selection of the research subjects; the third explains the construction and testing of the research instrument; and the fourth defines methods to be used in data analysis.

Research Model

The components of Table 2-3 from the previous chapter, which summarized the variables from the literature, constituted this research model. As mentioned in the previous section, variables included in the model are drawn heavily from the previous CSF studies of Rockart (1982), Martin (1982), Magal et al. (1988), Bergeron et al. (1993), and from popular literature. The popular literature is represented by case briefings, case discussions, or recommendations from professional IS consultants or executives who have practical experience with MIS downsizing.

The research model, as shown in Figure 3-1, models the proposed relationships among the six success factors and

MIS downsizing success. The six proposed success factors are: 1. User appreciation; 2. Organizational effectiveness; 3. Efficiency, quality and adequacy of applications; 4. Commitment and support from top management and users; 5. Communication and facilitation between users and the MIS department; and 6. The support services supplied by the MIS department. The proposal of this study is that these six factors will be related to the success of MIS downsizing as defined by MIS managers.

Research Subject

This study used MIS managers from business organizations as its subjects. The reason for selecting these survey subjects was that the system success measures have in past studies been significantly related to the perceived CSF of MIS managers. The studies from Miller and Doyle (1987) and from Raghunathan, Gupta, and Sundararaghavan (1989) both cited some other case studies and/or empirical studies that uphold this relationship. Miller and Doyle and Raghunathan et al. also have examined and supported this concept in their studies. Therefore, if an MIS manager administers the MIS function corresponding to his/her CSF, he/she can improve MIS performance and effectiveness. Thus, this research attempted to extract CSF for MIS downsizing from an MIS manager's perspective.

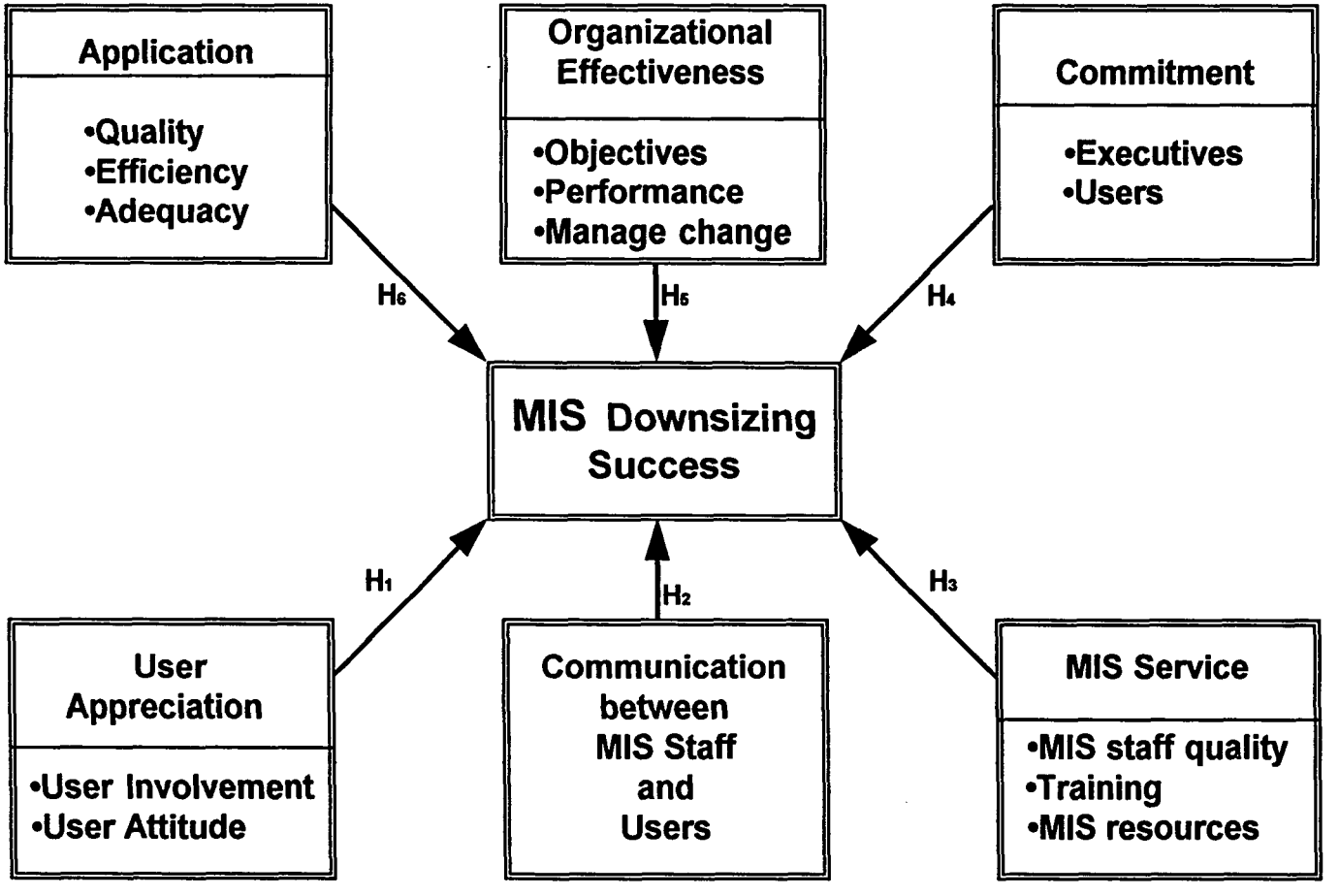


FIGURE 3-1. RESEARCH MODEL AND HYPOTHESIS

The sample subjects were information systems managers randomly selected from a "BIG BUSINESS" database file of the Data Processing Index from the PCS Mailing List Company. "BIG BUSINESS" has been defined by the PCS Mailing Company as the largest companies in the United States, with sales greater than $1 million or employing more than 10 people. The PCS Mailing List Company has 34 indexes and other sections of databases. For example, there is an Accounting Index, Business Index, Banking Index along with some others. Under each index, there are different selections as well. For example, under the Data Processing Index, there are subscriber databases for more than 40 computer-related magazines, such as PC Magazine, Computerworld, and others. Questionnaires will be sent to 1,000 information systems managers who have been randomly selected from a nationally representative population of 22,879 MIS managers by the PCS Mailing List Company.

Survey Instrument

This study used a survey-based field study of MIS managers to investigate the hypotheses. The mail survey was selected to facilitate collection of the required data, sampling cost, time frame, and the required sampling size. To enhance the cooperation of MIS managers, the instrument was designed to be answered in 10 minutes or less. A cover letter with instructions explained that individual responses would remain anonymous, that the survey was part

of a research study for identifying the critical success factors for MIS downsizing, and that a copy of the results from the survey would be sent to the respondents upon their request.

Questionnaire Design

The questionnaire design was based on the research model described above which employed four factors from Rockart (1982), seven factors from Martin (1982), and selected detailed items examined by Bergeron et al. (1993), Magal et al. (1988) and others. The relationships of these factors are shown in Table 3-1.

This research used six major factors which have been discussed as the most important criteria from different dimensions of the literature. Table 2-3 of Chapter II, Classification of Factors from the Literature, provided brief, categorized variables for system performance, six groups of expected CSF of MIS downsizing success, and the source of the relevant literature. Based on Table 2-3, this study acquired the proposed variables for the questionnaire. The questionnaire had four sections. Appendix A presents a set of questions that was used in the questionnaire to measure the CSF of MIS downsizing success. Table 3-2 shows the relationship between the questionnaire and the literature in Table 2-3.

The first section of the questionnaire comprised four questions to identify what MIS downsizing process was to be adopted by the organization, approximately what percent of their computer operations were run on the mainframe computers, what the future trend of MIS downsizing was projected to be, and the primary hardware platforms after MIS downsizing.

The second section was composed of eight items to measure the performance resulting from MIS downsizing from the MIS managers' perspective. This set of questions, which corresponded to section A of Table 2-3, employed a 7-point Likert-type scale for the measurement. To validate the construct measurement of these eight questions, a single question regarding the overall performance measurement of MIS downsizing was included in section 4, number 10.

The third section of the questionnaire contained 35 items measuring six potential success factors for MIS downsizing. These questions used a 7-point Likert-type scale for measurement. Each potential CSF had a general question for the purpose of validating the construct. Components of the questions are described below.

1. Questions one through five measured organizational effectiveness. These five questions were obtained from section B of Table 2-3. Question five is a general question for validating the construct.

2. Questions six through eight and question fifteen measured users' satisfaction with MIS downsizing. Question fifteen is the general question for users' appreciation. These four questions were obtained from section C.1 of Table 2-3.

3. Questions nine through 11 measured the importance of users' attitudes. These questions were obtained from section C.2 of Table 2-3.

4. Questions 12 through 14 measured the importance of users' involvement in MIS downsizing. This set of questions was obtained from section C.3 of Table 2-3.

5. Questions 16 through 19 measured the importance of the MIS department's service to users. This set of questions was obtained from section D of Table 2-3.

6. Questions 20 through 23 measured the importance of communication between users and the MIS department. This set of questions was obtained from section E of Table 2-3.

7. Questions 24 through 27 measured the importance of commitment and support from top managers and from line and function managers. This set of questions was obtained from section F of Table 2-3.

8. Questions 28 through 30 measured the importance of the quality of applications. These three questions were derived from section G.1 of Table 2-3.

9. Questions 31 and 32 measured the importance of the efficiency of applications. This set of questions was obtained from section G.2 of Table 2-3.
10. Questions 33 through 35 measured the importance of the adequacy of applications. These three questions were obtained from section G.3 of Table 2-3.

The fourth section of the questionnaire contained two groups of questions: four questions concerning demographic information of the respondents' organizations and one personal question about MIS managers. The set of four questions about organization characteristics measured the number of employees, annual sales, how long the organization has used the computer, and the type of organization. Question number two was about MIS managers' positions in the organization. Question number five measured the overall performance of MIS after downsizing. Question number seven is simply an option for the respondents to accept the reward of a summary of the survey's results. The last question requests respondents to add comments.

The third section of the mailed questionnaire was randomly reordered from the designed questionnaire. The reason for arranging the questions in random order was to avoid a systematic error.

Questionnaire Testing

The research instrument must meet the requirements of accuracy and validity (Churchill 1979). Several procedures were adopted to ensure and verify these criteria.

Nonresponse Bias

Mailed questionnaire surveys often have problems of nonresponse bias (Emory and Cooper 1991). In order to overcome and minimize this problem, several steps were taken: 1. The length of the questionnaire was limited to one side of a legal size paper; 2. The promise of anonymity to respondents was made in the cover letter; 3. The cover letter was personalized; 4. A return, postage paid envelope for the convenience of the respondent was enclosed; and 5. An incentive was provided by offering a summary of the survey's results to the respondent upon request.

Questions number one, three, and six in the third section of the questionnaire -- organization type, number of employees and annual sales -- were used to test nonresponse bias. The descriptive statistics (mean, variance, and standard deviation) of these three questions of the two groups (respondents' group and the obtained sample group) was compared and tested. Chi-square was used to test the differences between groups. If the differences are not significant, the inference is that data obtained from the respondents is not significantly different from

the whole sample; thus, there is no significant response bias. However, if the differences are significant, which is true in this study, there is a response bias. The results from Chi-square testing are reported in Chapter IV.

Reliability

A research instrument can be evaluated by three criteria: reliability, validity and practicality (Allen and Yeh 1979; Emory and Cooper 1991). Reliability refers to the stability or consistency of the measuring instrument; it reflects the accuracy of the measuring instrument. A measure is reliable to the extent that it provides consistent outcomes. Churchill (1979) suggested that reliability can reflect the validity of the measure and that the coefficient alpha should be the first measure to be calculated. This study calculated Cronbach's coefficient alpha for the reliability test. Cronbach's α is a formula for determining the reliability based on internal consistency; it has the most utility for multi-item scales at the interval level of measurement (Emory and Cooper 1991). Nunnally (1978) suggested that reliability of .50 and .60 should suffice and that reliability beyond .80 is wasteful, while Churchill (1979) suggested the cutting-off point of 0.70. This study took 0.60 as the cutting point. Any measurement items or factors found to be lower than 0.60 were eliminated from the data analysis, but no items were eliminated for this reason.

Content Validity

Validity refers to the extent to which an instrument evaluates what it is intended to measure. Two types of validity were tested in this study: content validity and construct validity. Content validity refers to the appropriateness or "representativeness" of the content. Content validity provides a careful and systematic examination of the instrument (Emory and Cooper 1991). This study made a thorough and extensive search or review of literature to explore and include all possible items in the measure; requested several MIS managers' opinions about how well the instrument met the standards; carefully defined the question involved; and selected the items to be scaled and the scales to be used which all determine the content validity (Emory and Cooper 1991). To safeguard the content validity, this study reviewed the related CSF and MIS downsizing studies, defined the question cautiously, and summarized these factors as in Table 2-3 of Chapter II. This study requested several MIS managers' opinions and revised the instrument.

Construct Validity

Construct validity refers to the extent to which an instrument measures a theoretical construct; that is, it evaluates the theory which the construct is based on, as well as the measuring instrument used (Emory and Cooper

1991). Two common methods of evaluating construct validation are: (1) examining of the correlations between total scores and item score, and (2) conducting a factor analysis. The first method assumes the total score is valid, and if the item scores correlate with the total score, then this implies the whole construct is valid. The second method, factor analysis, is considered one of the most powerful approaches to examine construct validity because factor analysis provides for examination of the underlying structure of the overall measure (Ives, Olson, and Baroudi 1983). This study used factor analysis for validity tests.

Practicality

The third criterion for examining a measurement instrument is practicality which refers to economic factors, convenience of execution, and interpretability of data and the results (Emory and Cooper 1991). This study considered the trade-off among research variables, budget, ease of management, and estimated which research instrument best accommodated the objectives of this study.

Data Analysis

Descriptive statistics on demographic variables and variables of interest were computed first. Several multivariate statistical techniques were used in data analysis: factor analysis, canonical analysis and

regression analysis. Chapter IV presents this detailed information. This study used the Statistical Package for the Social Sciences (SPSS) release 4.0 for data analysis.

Factor Analysis

Factor analysis is a multivariate statistical technique "whose primary purpose is data reduction and summarization" (Hair, Anderson, and Tatham 1987). Factor analysis can be used to identify a relatively small number of factors from a larger set of variables. The new composite factors can be used to represent relationships among sets of variables with a minimum loss of information (Hair, Anderson, and Tatham 1987). The main purpose of factor analysis is data reduction and summarization According to Hair et al., factor analysis can perform four functions:

1. To identify underlying constructs or factors that explain the correlations among a set of variables. The original set of variables can be reduced to a small set which accounts for most variance of the initial set.
2. To summarize a large number of variables with a small number of derived variables. Factor analysis can search data for qualitative and quantitative contrast.
3. To test a hypothesis about the structure of the variables.

4. To determine the number of dimensions required to represent a new set of variables for subsequent regression, correlation or discriminant analysis.

There are several techniques for factor extraction of the general factor analysis model. The most used two are the principal components analysis model (or components analysis model) and the common factor analysis model. The principal components model is used when the objective is to summarize most of the original information in a minimum number of factors for prediction purposes. A common factor analysis model is used primarily to identify underlying factors or dimensions not easily recognized.

This study selected the principal components model. Once the model had been selected, the factor was rotated. The purpose of rotation is to achieve a simple structure. This means each factor would have nonzero loading for only some (preferably one) of the variables, thus permitting the factors to be differentiated from each other. If several factors have high loadings on the same variables, it is difficult to ascertain how the factors differ. There are two options for factor rotation: orthogonal and oblique. In orthogonal, the factors are extracted so that the factor axes are maintained at 90 degrees. Thus, each factor is independent and orthogonal from all other factors. The correlation between factors is arbitrarily determined to be zero. In oblique, the axes of factor rotation are not

maintained at 90 degrees. The extracted factors are correlated; the underlying factors must be similarly correlated (Hair et al. 1987). This study chose the orthogonal factor rotation method, VARIMAX, because the VARIMAX rotation method supported by SPSS provides a better matrix construct (where each variable loads on to as few factors as possible) (Emory and Cooper 1991).

Canonical Correlation Analysis

The canonical analysis approach was adopted to reflect the interrelationships among sets of composite criterion variate. This research also adopted canonical correlation analysis for measuring the relationships between the predictor and criterion sets of variables.

Canonical correlation analysis is a multivariate model which measures the overall relationship between the canonical variate of the two sets of multiple variables. One set of multiple variables is the predictor (independent) variable and the other set is the criterion (dependent) variable (Hair, Anderson, and Tatham 1987). Canonical correlation can be viewed as an extension of multiple regression, but is different in two aspects. The first difference is that canonical correlation predicts multiple dependent variables from multiple independent variables, while multiple regression predicts a single dependent variable from a set of multiple independent variables. The second difference is that canonical

correlation can deal with metric or nonmetric data, while multiple regression only deals with metric data. Canonical correlation analysis can perform the following objectives:

1. Determine whether two sets of variables are independent of one another or, conversely, determine the magnitude of the relationships that may exist between the two sets.

2. Derive a set of weights for each set of criterion and predictor variables such that the linear combinations themselves are maximally correlated.

3. Derive additional linear functions that maximize the remaining correlation, subject to being independent of the preceding set of linear compounds.

4. Explain the nature of whatever relationships exist between the sets of criterion and predictor variables, generally by measuring the relative contribution of each variable to the canonical functions that are extracted (Hair, Anderson, and Tatham 1987).

This study attempted to find the relationships between the expected CSF and MIS downsizing success. Another objective of this study was to explore a model for prediction of MIS downsizing success. Canonical correlation analysis was used in achieving these two purposes.

Multiple Regression Analysis

Multiple regression analysis is a statistical tool for analyzing the relationship between a single dependent variable and several independent (predictor) variables. The objective of multiple regression is to obtain a functional equation from the known independent variables in

order to predict the dependent variable (Hair, Anderson, and Tatham 1987). A regression model also can measure the strength of the relationship among variables from multiple regression. According to Hair et al., multiple regression can achieve four purposes:

1. Determine the appropriateness of using the regression procedure in analyzing a problem.
2. Examine the statistical significance of the attempted prediction.
3. Examine the strength of the association between the single dependent variable and the one or more independent variables.
4. "Predict the values of one variable (dependent variable) from the values of others (independent variables or predictor variables)" (Hair, Anderson, and Tatham 1987); with the assumption "that each additional predictor variable gives more information and therefore a better prediction about the criterion variable" (Hair, Anderson, and Tatham 1987).

This study utilized the multiple regression model for the above four purposes as well as for the exploration of a model of prediction for MIS downsizing success. Chapter IV presents the regression results.

Data Analysis Procedures

In order to achieve the objectives of this study, five statistical steps and procedures were used. Figure 3-2

shows the data analysis procedures. The first step was to calculate descriptive statistics; the second step was to examine the nonresponse bias; the third step was to check the reliability and validity; the fourth step was to test the hypotheses; the fifth step was to develop a prediction model.

To Calculate Descriptive Statistics

A descriptive measure on demographic variables and interested variables was computed. A descriptive measure can provide the information of mean, standard deviation, and the distribution of the collected data.

To Examine for Nonresponse Bias

A Chi-square goodness-of-fit test was used to measure the presence of nonresponse bias in the sample data by comparing the difference between two groups (respondents and the whole mailed sample). Chi-square tests whether a significant difference exists between two groups (Emory and Cooper 1991). The comparison between the mailed group and the respondent group was based on the demographic characteristics of employee size, industry type and annual sales. If there is insufficient evidence for nonresponse bias, the data may represent the whole sample, and the results of the finding can be inferred for the whole population. If there is response bias, the result can only be inferred for the respondent group.

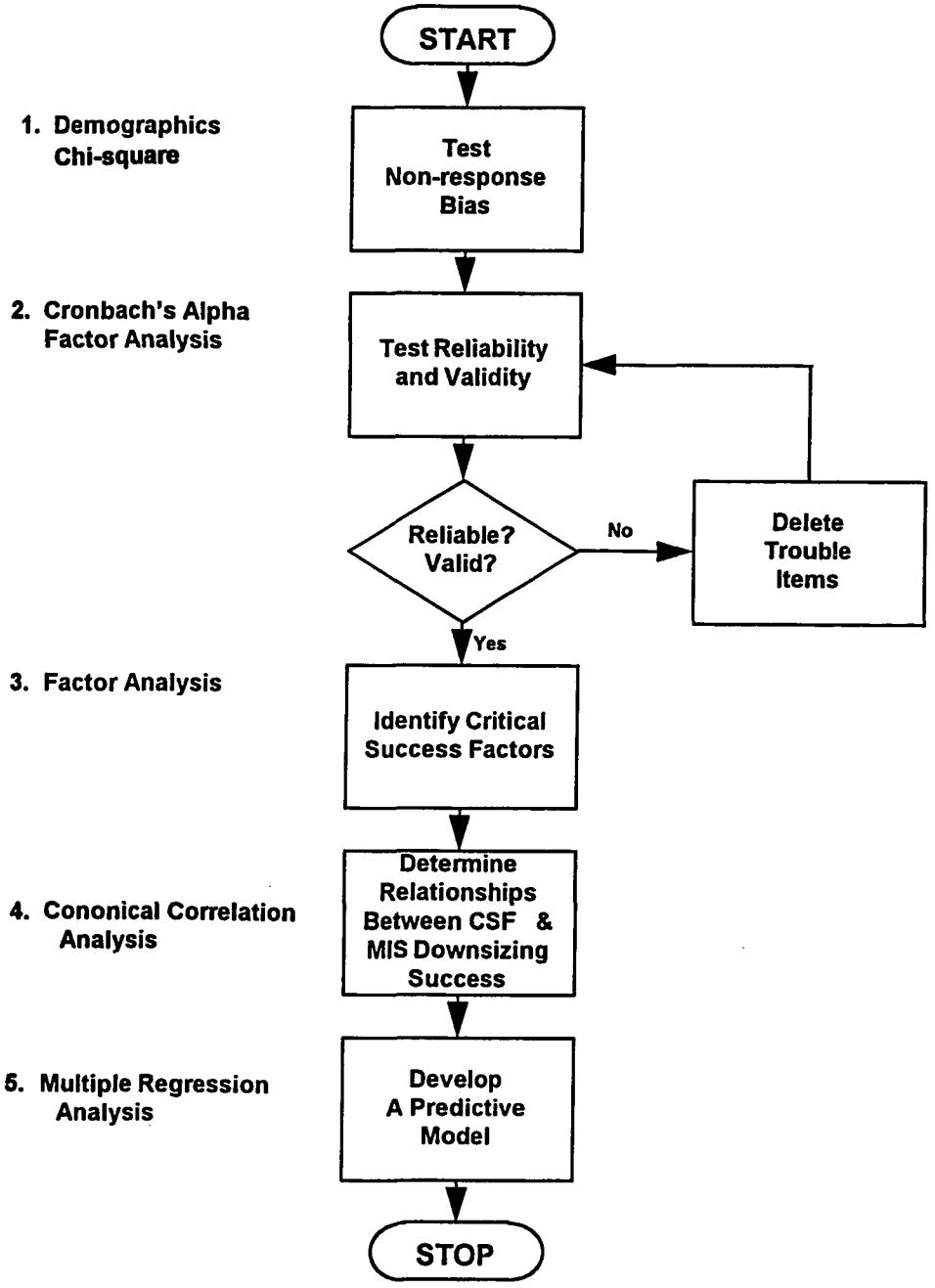


FIGURE 3-2. DATA ANALYSIS PROCEDURES

To Check Reliability and Validity

The applicability of the instrument should be evaluated. Cronbach's coefficient alpha was used to test the internal consistency, or the stability of relevant dimensions and overall measures of the instrument. If alpha is below 0.60, the item should be omitted from further data analysis. However, since this study found all of the alpha are higher than .60, no items were eliminated. The alphas for the proposed hypothesis sets were computed first. Then, the alphas from the extracted factor were checked again and determined that the calculation did provide a consistent result. The results from factor analysis can reveal which instrument items are homogenous or reflect the same underlying dimensions of the construct.

Two validity tests were performed in this study: content validity and construct validity. Content validity examines the sampling adequacy of the instrument. This requirement was fulfilled by (1) a complete and extensive inspection of the literature for all possible items to be included in the measurement, and (2) a pre-test: MIS professors, MIS students, and several MIS managers were asked to criticize the description and clarity of the questionnaire. The modification of the questionnaire then was based on these experts' opinions.

Construct validity deals with the theoretical construct of the instrument. This study performed a factor analysis for the following purposes:

1. To assess construct validity, that is to determine the set of CSF by choosing a particular factor loading pattern, thus achieving content validity and construct validity.
2. To eliminate the unnecessary items from the instrument. By checking the factor loading, and utilizing factor extraction and rotation options, unnecessary variable can be eliminated. The identified CSF could serve as the predictor variables of the prediction model.

To Test the Hypotheses and Identify the CSF

Canonical correlation analysis was used to identify and test the hypotheses of the relationships between MIS downsizing success and the MIS downsizing activities. Table 3-3 shows the statistical procedure of hypotheses testing. Two types of compound factors were derived from factor analysis. One type was a compsite factor from the dependent variables, the MIS downsizing success factor. Predictors, another type of composite factors, are the expected critical success factors. The degree of linear relationship between the CSF and the success factor can be determined. Each hypothesis was tested for the

significance of relationship. A p-value was calculated for the observed significance level by F-statistic. This study used 0.05 as the significance level for hypothesis testing.

To Develop a Prediction Model

The regression model identifies the contribution of each factor and the relationship between MIS downsizing success and the expected CSF. The regression model also can predict the strength of the relationship among the variables.

This study then constructed a prediction model based on the findings from these multivariate analysis methods. This study assumed this prediction model should have the proposed critical success factors for MIS downsizing success and serve as an evaluation guide for MIS downsizing success. The following chapter, Chapter IV, presents the details and the findings from these statistical analyses.

TABLE 3-1

THE RELATIONSHIP OF CSF STUDIES

Rockart's CSF	Martin's CSF	CSF of this Research
-Service (Operations and Development)	-Data Processing Operations -System Development	-Application (Quality) (Efficiency) (Adequacy)
-Communications between Users and IS Staff	-Relationships with the Management of the Parent Organization	-Communication -User Appreciation (User Involvement) (User Attitude)
-Human Resources	-Human Resources Development	-Service (MIS Staff Quality) (MIS Resources) (Training)
-Repositioning the IS Function (Technical) (Organizational) (Psychological) (IS Managerial)	-Support of the Objectives and Priorities of the Parent Organization -Management of Change (Technological) -Management Control of the MIS/DP Organization	-Commitment and Support (Executives) (Managers) -Organizational Effectiveness (Objectives) (Performance) (Managerial)

TABLE 3-2

DESCRIPTION OF QUESTIONNAIRE DESIGN

Questionnaire		Source	Measure Variables		Measurement Scale
Section	Item Number	Table 3			
2nd	1 to 8	Section A	MIS Downsizing Performance		7-point Likert-type
3rd	1 to 5	Section B	Organizational Effectiveness		7-point Likert-type
	6 to 8 & 15	Section C.1	User Appreciation	User Satisfaction	
	9 to 11	Section C.2		User Attitude	
	12 to 14	Section C.3		User Involvement	
	16 to 19	Section D	MIS Department's Service		
	20 to 23	Section E	Communication Between MIS Department and Users		
	24 to 27	Section F	Commitment to the MIS Concept		
	28 to 30	Section G.1	Appropriate Applications	Quality of Application	
	31 to 32	Section G.2		Efficiency of Application	
	33 to 35	Section G.3		Adequacy of Application	
4th	1 to 6		Organization's and MIS Manager's Demographic Data		scale
1st	1 to 4		Organizations' Downsizing Status		

TABLE 3-3

STATISTICAL PROCEDURE

Hypotheses	Dependent Variable, Y Scale (Item#)	Independent Variable, X Scale -- 7-point Likert type Item#-Section 3	Statistical Procedure
H_1: User appreciation H_{1a}: User involvement H_{1b}: User attitude	MIS downsizing performance Scale -- 7-point Likert-type (Item #: Section 2, item# 1 to 8)	User Appreciation (Item# 6 to 15) User Involvement (Item# 12 to 14) User Attitude (Item# 9 to 11)	Canonical Correlation Analysis
H_2: Communication between end-users and the MIS department H_{2a}: Facilitation to users		Communication (Item# 20 to 23) Facilitation (Item# 21 to 22)	
H_3: The support services of MIS department		Support Services (Item# 16 to 19)	
H_4: Commitment and support from top management and users		Commitment and Support (Item# 24 to 27)	
H_5: Organizational Effectiveness		(Item# 1 to 5)	
H_6: Applications H_{6a}: Quality of Applications H_{6b}: Efficiency of Applications H_{6c}: Adequacy of Applications		Applications (Item# 28 to 35) Quality (Item# 28 to 30) Efficiency (Item# 31 to 32) Adequacy (Item# 33 to 35)	

CHAPTER IV

DATA ANALYSIS

Chapter IV presents the results of the data analysis for this study. There are six sections in this chapter. The first section discusses the response rate. The second section describes the descriptive statistics for the respondents. The third section reports the results of the evaluation of nonresponse bias between the whole sample group and the respondent group. The fourth section discusses the results of preliminary reliability and validity tests for all items and the posterior reliability of the extracted factors. The fifth section presents the testing of the hypotheses and the results. Finally, the components of a predictive model based on the research are discussed in the sixth section.

Response Rate

The research instrument was a questionnaire that contained four sections (See Appendix A) with a total of 54 questions. As mentioned in Chapter III, the research subjects were management information systems (MIS) managers from various U. S. Companies. The MIS managers were

randomly selected from a data file which was purchased from the PCS Mailing Company.

The questionnaire was first mailed to 1,000 MIS managers in U. S. business firms on January 22, 1994. A follow up letter and a second copy of the questionnaire were mailed to all of these MIS mangers on March 1, 1994. As of the cut off date of April 10, 1994, 106 returns were received because of "undeliverable", "no forwarding address", "no longer works here", or the like. The results are based on the assumption that 894 questionnaires reached the sample subjects. From the 894 questionnaires, 170 were returned for an initial response rate of 19.02 percent. From the 170 returned questionnaires, only 128 answered enough questions to represent a complete response, yielding a usable response rate of 14.32 percent.

Descriptive Statistics

The downsizing trend and primary hardware platforms are discussed first. Then the mean values and the standard deviations of the eight MIS downsizing success items and of the 35 MIS downsizing activities are reported. Finally, the demographics of the organizations and the MIS managers are described in the last section.

The Downsizing Trend and Hardware Platforms

The first section of the questionnaire related to the MIS downsizing trend. Figure 4-1 provides the percentage

of all computer applications that were operated on mainframe computers for 1991, 1994 and 1996 (predicted). The figure shows that during 1991, about 77 percent of the respondents ran 61 percent or more of their computer applications on mainframe computers. By early 1994, the percentage of the respondents who ran 61 percent or more of their computer applications on mainframes had dropped to 53.2 percent. The respondent MIS managers also estimated that in 1996 only 36.5 percent will run 61 percent or more applications on mainframes. Consequently, Figure 4-1 shows an observable downsizing trend with the decreasing percentages of mainframe computer operations over the three years.

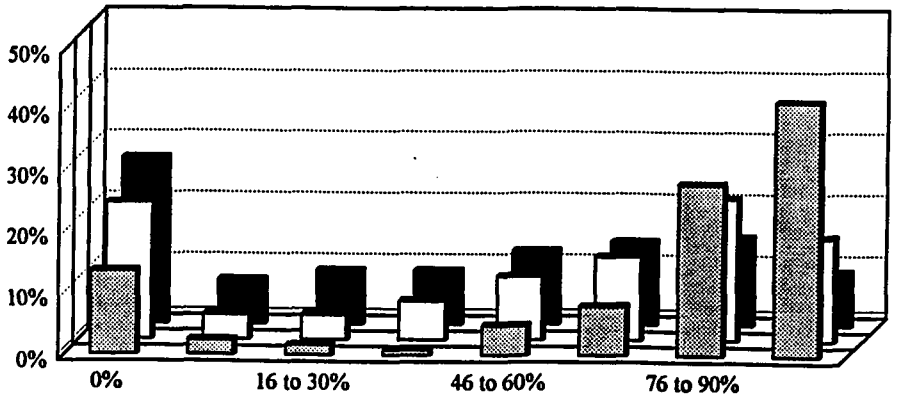


FIGURE 4-1. PERCENTAGE OF APPLICATIONS OPERATED ON MAINFRAME COMPUTERS

Figure 4-2 shows the primary hardware platforms that respondents indicated will be used after MIS downsizing. The figure shows that 31.3 percent of the respondents will use PC networks. The second most used hardware platform is Unix multiusers, 18.8 percent. The third most used hardware platform is "other", a combination of PCs, workstations, PC-networks and/or Unix multiusers, 16.4 percent. Only 12.5 percent will still use mainframes as their primary hardware platform.

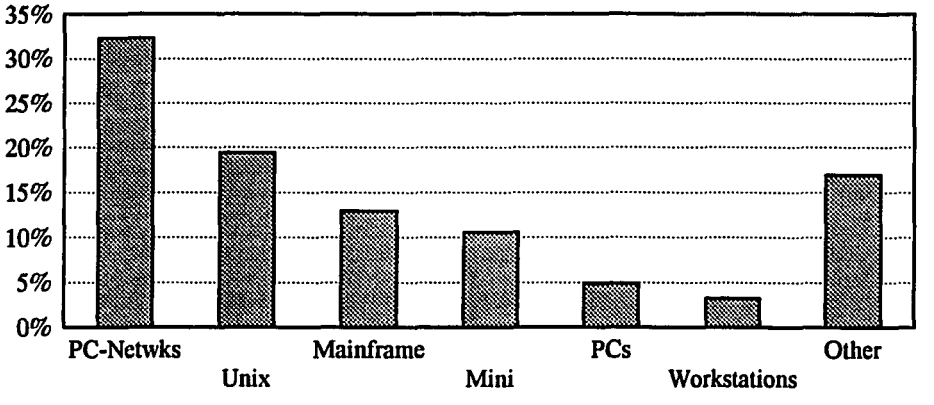


FIGURE 4-2. PRIMARY HARDWARE PLATFORMS AFTER MIS DOWNSIZING

MIS Downsizing Success Items

In the second section of the questionnaire, eight items are used to measure the improvements in systems performance after MIS downsizing. The measurements of MIS downsizing success are made on a scale of 1 (strongly disagree) to 7 (strongly agree). Table 4-1 shows the means

and standard deviations of the eight items that measure the improvements in systems performance. The eight items are improvement in: "system availability and timely response (Y1)", "time savings in new system development (Y2)", "cost savings in operation, maintenance, and IS resource management (Y3)", "system flexibility (Y4)", "relevance and quality of information outputed for users (Y5)", "response to users' priority (Y6)", "overall productivity of users (Y7)", and "speed and efficiency of applications (Y8)." The mean values ranged from 4.825 to 5.563 on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree). The standard deviation ranged from 1.086 to 1.716. "System flexibility (Y4)" has the highest mean value of 5.563. "Users' productivity (Y7)" has the second high mean value of 5.405. "Cost savings (Y3)" has the lowest mean value of 4.825, but has the highest standard deviation of 1.71.

MIS Downsizing Activities

The third section of the questionnaire was composed of 35 questions to measure the importance of MIS downsizing activities for MIS downsizing success (MIS downsizing activities). These questions also have a measurement scale of 1 (Strongly Disagree) to 7 (Strongly agree).

Table 4-2 describes the means and standard deviations of the importance rating of 35 MIS downsizing activities for MIS downsizing success from the subjects' (MIS mangers) perspective. As discussed in Chapter III, these 35 items

are expected to be categorized into six groups: user appreciation, communication between users and the MIS department, support services of the MIS department, commitment from top management and users, organizational effectiveness, and appropriate applications. The mean values for the 35 items ranged from 4.484 to 5.883 on a scale of 1 (Strongly Disagree) to 7 (Strongly Agree). The standard deviation ranged from 1.064 to 1.468. "Provide reliable and qualified IS services (X19)" has the highest mean value of 5.883. "Permit control over IS services by users (X8)" has the lowest mean value of 4.484.

TABLE 4-1

DESCRIPTIVE STATISTICS OF THE EIGHT MIS DOWNSIZING SUCCESS ITEMS

Item Code	MIS Downsizing Success Items	mean*	Std. Dev.
Y1	System availability and timely response	5.016	1.639
Y2	Time saving in system development	4.937	1.361
Y3	Cost savings	4.825	1.716
Y4	System flexibility	5.563	1.149
Y5	Relevance and Quality of output	5.270	1.311
Y6	Response to users' priority	5.317	1.086
Y7	Users' productivity	5.405	1.126
Y8	Speed and efficiency of applications	5.254	1.314

Note:* On a scale of 1 (Strongly Disagree) to 7 (Strongly Agree)

TABLE 4-2

DESCRIPTIVE STATISTICS FOR MIS DOWNSIZING ACTIVITIES

Item	Variables -- MIS Downsizing Activities for MIS Downsizing Success	Mean*	Std Dev
X1	Attain organizational objectives	5.539	1.136
X2	Improve organizational effectiveness & performance	5.641	1.202
X3	Increase the quality of decision making	5.484	1.236
X4	Facilitate the management of change	5.367	1.242
X5	Improve general organizational effectiveness	5.461	1.163
X6	Improve users' confidence in the system	5.406	1.173
X7	Improve access to the system	5.461	1.190
X8	Permit control over IS services by users	4.484	1.458
X9	Increase the use of downsized IS	5.125	1.286
X10	Ease the use of PC tools for users	5.211	1.188
X11	Generate users' positive attitudes toward IS downsizing	5.133	1.090
X12	Generate users' understanding of the downsized system	5.156	1.264
X13	Generate users' participation in the IS downsizing design	4.992	1.283
X14	Involve users in downsized IS	5.023	1.400
X15	Generate user satisfaction with the downsized IS	5.367	1.064
X16	Provide competent IS staffs	5.313	1.468
X17	Provide a basis for control of standards, policies, etc.	5.313	1.435
X18	Manage IS resources effectively	5.453	1.339
X19	Provide reliable and qualified IS services	5.883	1.175
X20	Communicate with users about IS procedures and services	5.219	1.261
X21	Provide training to IS staff and users	5.563	1.169
X22	Respond to user's request for IS support	5.484	1.204
X23	Communicate with users	5.672	1.178
X24	Promote acceptance of the IS downsizing concept to the whole firm	4.961	1.276
X25	Promote support of top management for the IS downsizing concept	5.359	1.260
X26	Design a strategic IS downsizing plan	5.281	1.322
X27	Promote users' commitment and support for the IS downsizing concept	5.141	1.228
X28	Promote high quality information output	5.742	1.165
X29	Promote high quality user database and applications	5.367	1.229
X30	Promote high quality applications for the downsized IS	5.555	1.183
X31	Reduce the data processing and maintenance cycle	5.258	1.287
X32	Improve the efficiency of applications for users	5.571	1.202
X33	Promote applications that make the converting process easier	5.008	1.207
X34	Operate applications that provide competitive advantage for the firm	5.695	1.126
X35	Implement appropriate applications for downsizing	5.414	1.112

Note: * The measurement scale is from 1 (Strongly Disagree) to 7 (Strongly Agree)

Demographics for MIS Managers and Organizations

The fourth section of the questionnaire was composed of one question related to MIS managers' positions and four demographic questions about the organization. Figure 4-3 shows the respondent MIS managers' positions in the management structure of the organization. Most of the respondent MIS managers (38.3 percent) are from upper-middle-level management. Next, respondent MIS managers are from upper level management (27.3 percent) while middle level management respondents represented 16.4 percent. The least represented MIS managers are low level management (seven percent).

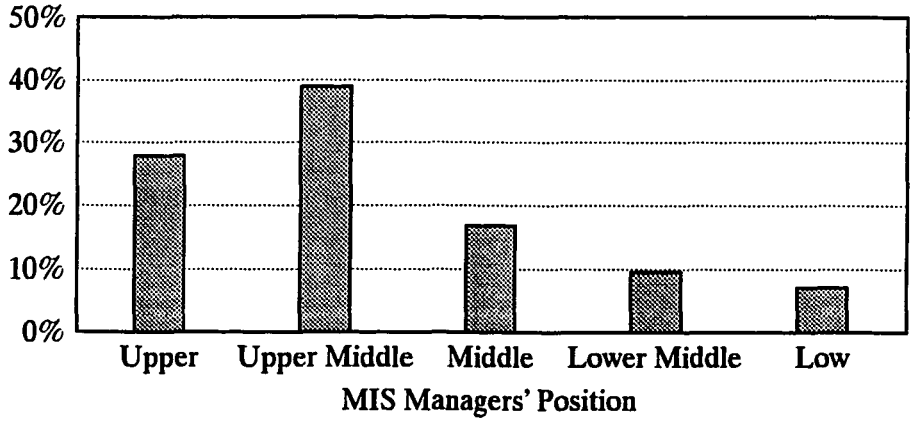
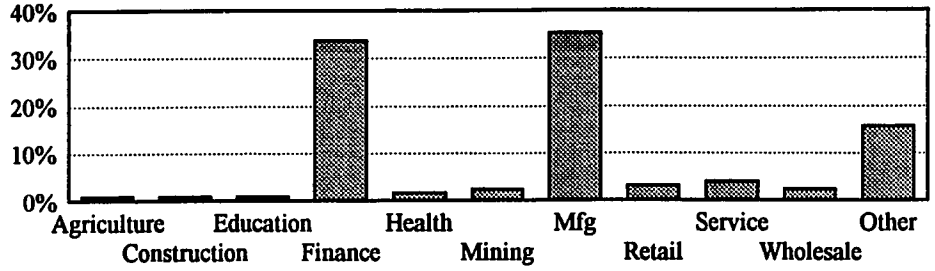
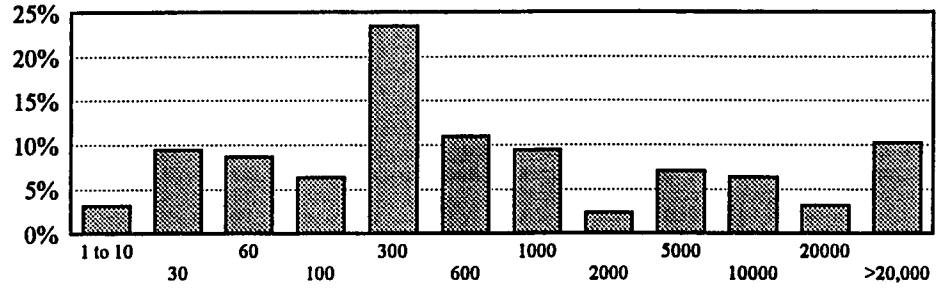


FIGURE 4-3. MIS MANGERS' POSITIONS IN THE MANAGEMENT STRUCTURE

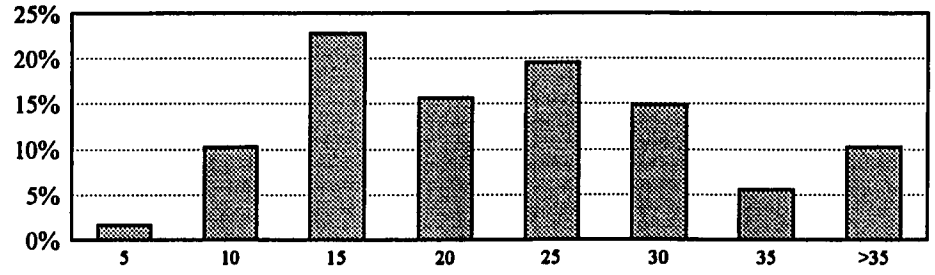
Figure 4-4 shows four items of demographic data from the respondents' organizations. Figure 4-4a shows that the majority class of organizations are manufacturing (35.2 percent) and finance (33.6 percent). Figure 4-4b shows the number of the organizations' employees. Most of the firms have 101 to 300 employees (23.4 percent) and 10.2 percent of the firms have more than 20,000 employees. Figure 4-4c shows how long the responding organizations have used computers. Most of the organizations have used computers from ten to fifteen years (22.7 percent). Among the respondent firms, 10.2 percent have used computers more than 35 years. Only 1.6 percent of the firms have used computers less than five years. Figure 4-4d shows the annual sales. Most of the firms have annual sales of more than $6,000,000 (23.4 percent) and 10.9 percent of the firms did not respond to this question. So, Figure 4-4 shows the respondent organizations are large manufacturing and finance firms with a large number of employees, high annual sales, and that have used computers for more than 10 years.



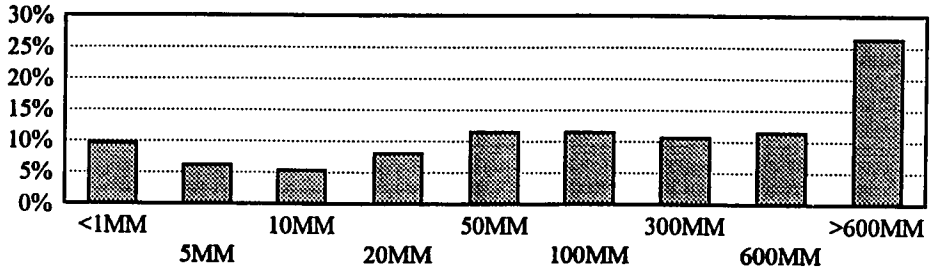
4-4a. Organization Type



4-4b. Number of Employees



4-4c. Years of Using Computers



4-4d. Annual Sales (MM=$1,000,000)

FIGURE 4-4. DEMOGRAPHICS FROM RESPONDENT'S ORGANIZATIONS

Figure 4-5 shows that most of the MIS managers (35.9 percent) evaluated the overall performance of their MIS after downsizing as being from 75% to 90% successful. The measurement scale for this item is in 15% increments. Figure 4-5 also shows that 65.7 percent of the MIS managers evaluated the overall performance of their MIS after downsizing as over 75% successful. Less than 12.6 percent of the MIS managers rated their overall performance below 60% successful. It appears that the majority of the respondent managers considered the overall performance of MIS after downsizing to be quite successful.

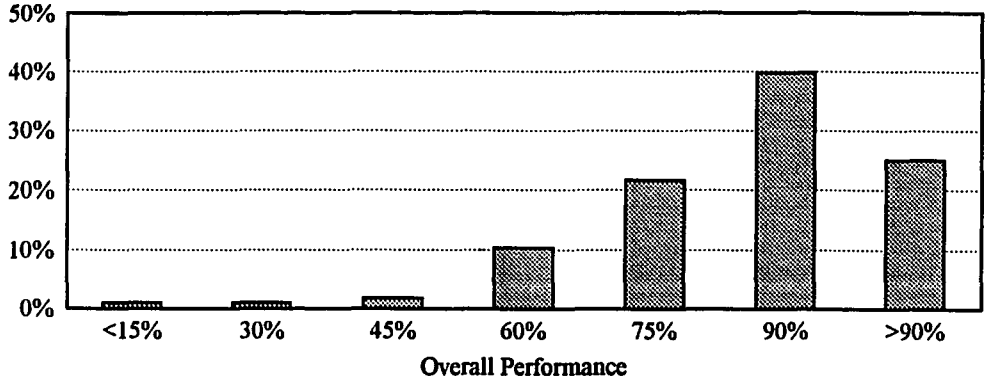
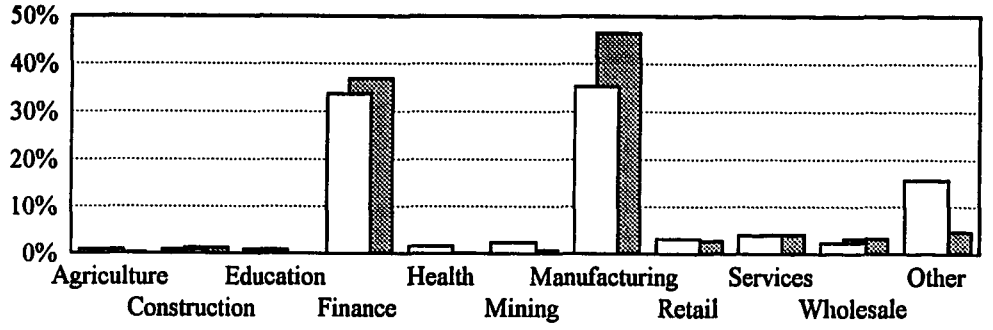


FIGURE 4-5. SUCCESSFULNESS OF OVERALL PERFORMANCE OF MIS AFTER DOWNSIZING

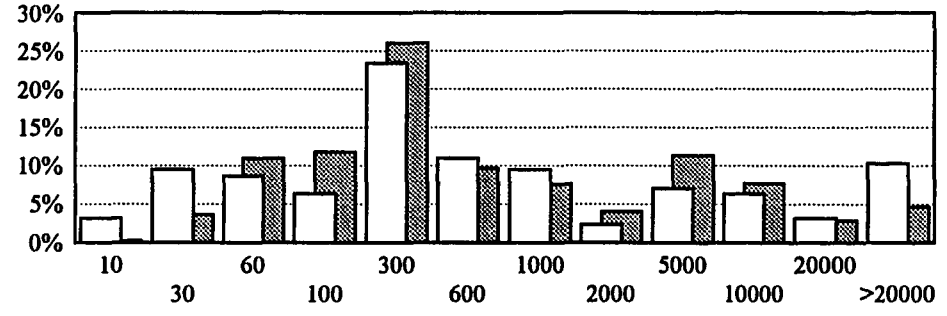
Nonresponse Bias Test

Nonresponse bias was calculated by comparing results obtained from the respondents to the entire sample with regard to three variables: (1) type of business, (2) employee size, and (3) annual sales. When designing the questionnaire, the three variables were chosen for non-response bias analysis because of their availability. Figure 4-6 presents the distribution of the three variables from the entire sample and from the respondents.

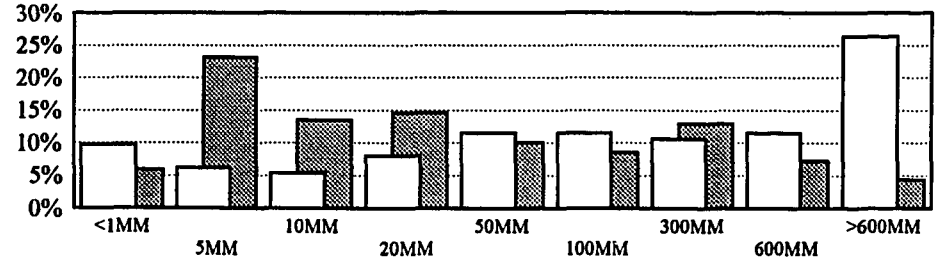
Figure 4-6a indicates that 46.4 percent of the entire sample of 1,000 firms are in manufacturing, 36.8 percent are in finance, 4.6 percent in other (such as utility and transportation, etc.) and other types of business. Figure 4-6b indicates that 26 percent of the entire group of 1,000 firms have number of employees of 101 to 300 employees, 11.7 percent of the firms have 61 to 100 employees, and only 4.6 percent of the firms have more than 20,000 employees. Figure 4-6c shows that 23.1 percent of the entire sample of 1,000 firms have annual sales from $1,000,000 to $5,000,000, 14.5 percent of the firms have annual sales from $10,000,000 to $20,000,000, 13.4 percent of the firms have annual sales from $5,000,000 to $10,000,000, and only 4.3 percent of the firms have sales of more than $600,000,000, and others. Figure 4-6c also shows that 75.6 percent of the entire group of 1,000 firms have less than $100,000,000 in annual sales.



4-6a. Organization Type



4-6b. Number of Employees



4-6c. Annual Sales (MM=$1,000,000)

☐ Respondents ▨ The Entire Sample

FIGURE 4-6. DEMOGRAPHICS FOR THE SAMPLE AND THE 128 RESPONDENTS

However, information from the 128 respondent firms provided different characteristics. Figure 4-6a shows that 35.2 percent of the 128 respondent firms are in manufacturing, 33.6 percent are in finance, 15.6 percent are in other (such as utility, transportation, etc.) and other types of business. Figure 4-6b shows that 23.4 percent of the 128 respondent firms have number of employees from 101 to 300 employees, 10.9 percent of the firms have 300 to 600 employees, 10.2 percent of the firms have more than 20,000 employees, and others. Figure 4-6c shows that 26.3 percent of the 128 respondent firms have annual sales of more than $600,000,000, 11.4 percent of the firms have annual sales from $20,000,000 to $50,000,000, 11.4 percent of the firms have annual sales from $50,000,000 to $100,000,000, and 11.4 percent of the firms have annual sales from $300,000,000 to $600,000,000, and others. Figure 4-6c also shows that only 40.3 percent of the 128 respondent firms have annual sales of less than $100,000,000. These differences indicated the possibility of some response bias which required further analysis.

The Chi-square goodness-of-fit test is used to analyze the compatibility between two groups. General hypotheses for nonresponse bias in the Chi-square goodness-of fit test are:

H_o: The distributions of the organization type, the number of employees, and the annual sales of the

128 respondent firms are not different from the distributions of the entire 1,000 firms.

H_a: The distributions of the the organization type, the number of employees, and the annual sales of the 128 respondent firms are different from the distributions of the entire 1,000 firms.

The expected frequency of the 128 respondent firms should follow the observed frequency of the entire 1,000 firms. From the Chi-square results, the null hypothesis was rejected. Therefore, the respondents did not match the population for the organization type, the number of employees, and the annual sales. Table 4-3 presents the results from the Chi-square test for the three investigated variables. The Chi-square inspected whether the respondent group follows the same distribution of the designated 1,000 firms. The statistic of the Chi-square test for the type of organizations is 182.59 (significance level .000). The Chi-square statistic for the size of employees is 83.26 (significance level .000). The Chi-square statistic for the annual sales is 158.81 (significance level .000). Each shows that the variance is large, and the two groups are significantly different. The Chi-square results indicated that the distribution of the respondent group differ from the distribution of the entire 1,000 firms with respect to the three variables. Therefore, the respondent firms may not be representative of the 1,000 sample firms and the

survey results may have been affected by response bias. Thus, the findings from this research may be limited to the 128 respondent firms. The findings can only be extrapolated to the entire sample, and/or to the population with extreme care.

TABLE 4-3

CHI-SQUARE FOR NONRESPONSE BIAS

Variables	Chi-Square	Degree of Freedom	Observed Significance (p-value)
Organization Type	182.59	10	.000
Number of employees	83.26	11	.000
Annual Sales	158.81	8	.000

Reliability and Validity Test

The reliability and validity test of the research instrument was a two-step approach. First, the reliability and validity were tested according to the methodology discussed in Chapter III. Second, after factor analysis, the reliability of the composed factors was examined.

Preliminary Reliability Test

Reliability refers to the stability or consistency of the measuring instrument. A measure is reliable to the extent that it provides consistent outcomes. As suggested

by Churchill (1979), reliability can reflect the validity of the measure and coefficient alpha should be measured first. The calculated coefficient alphas are listed in Table 4-4. Table 4-4 shows the results from the reliability test of eight Y items (MIS downsizing success) and 35 X items (MIS downsizing activities). First, Cronbach's coefficient alpha was calculated on the total eight MIS downsizing success items (Y1 to Y8). The overall alpha for MIS downsizing success was .8886. Nunnally (1978) recommended that an alpha of .50 and .60 should suffice. Since the alpha is high, no variable was dropped from further analysis and this research instrument seems to adequately measure the anticipated dimensions.

The 35 MIS downsizing activity variables should group into thirteen sets according to past studies. The first set contained five items of organizational effectiveness (X1 to X5) and has a Cronbach's coefficient alpha of .8190. The second set contained four user satisfaction items (X6, X7, X8 and X15) and has a Cronbach's coefficient alpha of .6601. The third set contained three items of user attitude (X9 to X11) and has a Cronbach's alpha of .7485. The fourth set contained three user involvement items (X12 to X14) and has a Cronbach's coefficient alpha of .7659. The fifth set contained the total ten user appreciation items (X6 to X15) and has a Cronbach's coefficient alpha of .8735. The sixth set contained four items of the

supporting role of MIS department (X16 to X19) and has a Cronbach's coefficient alpha of .7651. The seventh set contained two items of facilitation to users (X21 and X22) and has a Cronbach's coefficient alpha of .7317. The eighth set contained four items of communication between users and the MIS department (X20 to X23) and has a Cronbach's coefficient alpha of .8706. The ninth set contained four items of commitment from top management and users (X24 to X27) and has a Cronbach's coefficient alpha of .8253. The tenth set contained three items of quality of applications (X28 to X30) and has a Cronbach's coefficient alpha of .8731. The eleventh set contained two items of efficiency of applications (X31 and X32) and has a Cronbach's coefficient alpha of .7049. The twelfth set contained three items of the adequacy of applications (X33 to X35) and has a Cronbach's coefficient alpha of .6474. The thirteenth set contained a total of eight items of appropriate applications (X28 to X35) and has a Cronbach's coefficient alpha of .8571.

None of the thirteen sets have a Cronbach's alpha smaller than .6474; and the overall Cronbach's alpha is .9559 for the entire 35 MIS downsizing activity items. None of the items were dropped from further statistical analysis because they are all reliable based on Nunnally's criterion. This indicated that these 35 items provide a satisfactory measure of the intended dimensions.

TABLE 4-4

CRONBACH'S ALPHA FOR THE SYSTEM SUCCESS AND MIS ACTIVITIES

Items (Variable Code)	Grand Mean	Alpha
MIS Success after Downsizing (Y1 to Y8) [Improvements in MIS Performance] Total 8 items	5.117	.8886
Importance of MIS Activities for MIS Downsizing Success (X1 to X35) Total 35 items	5.346	.9559
Organizational Effectiveness (X1 to X5)	5.498	.8190
User Appreciation (X6 to X15)	5.136	.8735
User Satisfaction (X6 to X8 and X15)	5.180	.6601
User Attitude (X9 to X11)	5.156	.7485
User Involvement (X12 to X14)	5.057	.7659
MIS Support Services (X16 to X19)	5.490	.7651
Communication between Users and MIS department (X20 to X23)	5.484	.8706
Facilitation to users (X21 to X22)	5.523	.7317
Commitment from Top Management and Users (X24 to X27)	5.185	.8253
Appropriate Applications (X28 to X35)	5.451	.8571
Quality of Applications (X28 to X30)	5.555	.8731
Efficiency of Applications (X31 and X32)	5.414	.7049
Adequacy of Applications (X33 to X35)	5.372	.6474

Validity Test

Both content and construct validity were investigated for the eight Y items (MIS downsizing success) and the 35 X items (MIS downsizing activities). Content validity examines the appropriateness or "representativeness" of the content. This study was predicated on a reasonably thorough and extensive search of literature and, based on that search, extracted possible items for the measures. Next, several MIS experts (MIS professor, DBA students who majored in MIS, and MIS managers) read and criticized the statements and clarity of the questionnaire. Revision of the questionnaire continued in a cyclical fashion until these experts were satisfied that the questionnaire presented the appropriate content for the intended purpose.

Construct validity refers to the validity of the theory behind the instrument. This study utilized factor analysis to examine the underlying structure of the overall measure. Figure 4-7 displays a screen plot of the eight MIS downsi- zing success items. According to the plot, two factors have eigenvalues greater than 1 and can be extracted. Table 4-5 presents the eigenvalues of the two factors and discloses that about 62.2 percent of the total variance can be explained by the two extracted factors.

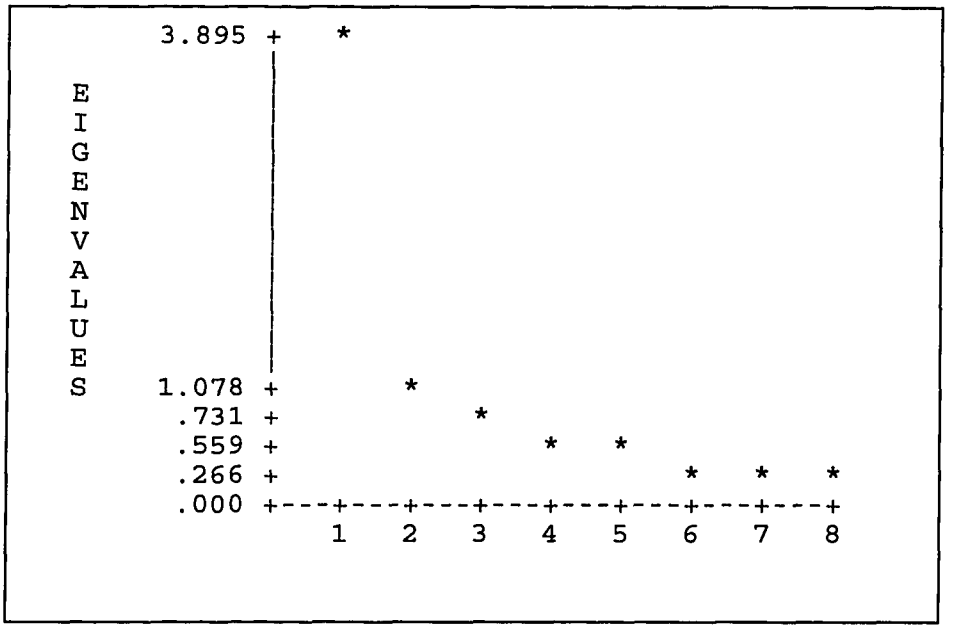


FIGURE 4-7. SCREEN PLOT OF EIGENVALUES FOR MIS DOWNSIZING SUCCESS

TABLE 4-5

FACTOR STATISTICS FOR MIS DOWNSIZING SUCCESS FACTORS

Factors	Factor Labels	Eigenvalues	Percent of Variance
Factor 1	User-Oriented Improvements	3.895	48.7
Factor 2	System Effectiveness	1.078	13.5
			Total: 62.2

Table 4-6 presents the factor matrix by the items of MIS downsizing success after rotation by the varimax method. The varimax method is an orthogonal rotation method which maximizes the sum of the variances of the required loadings of the factor matrix (Hair et al. 1987). Based on the matrix, two factors can be extracted. These two factors are interpreted as, or labeled as, User-Oriented Improvements and System Effectiveness. The two composed factors appear to be consistent with the literature as the major performance criteria of MIS downsizing success.

TABLE 4-6

FACTOR MATRIX FOR MIS DOWNSIZING SUCCESS

Code	Items	Factor 1	Factor 2
Factor 1: User-Oriented Improvements			
Y7	Overall productivity of users	.8465	.2103
Y6	Response to users' priority	.7823	.1757
Y5	Relevance and quality of output for Users	.7724	.2042
Y4	Generating Flexibility of the System	.6921	.1826
Factor 2: System Effectiveness			
Y3	Cost savings in MIS management	-.0285	.8856
Y2	Time savings in new system development	.3275	.6469
Y1	System availability and timely response	.4263	.6024
Y8	Speed and efficiency of applications	.5210	.5409

The first composed factor is labeled "User-Oriented Improvements" and is composed of four items -- the improvements of: "overall productivity of users (Y7)", "understanding and response to user's priority (Y6)", "relevance and quality of information output for users (Y5)", and "generating flexibility of the system (Y4)." Zmud (1979), Ginzberg (1981), and Yaverbaum (1988) all suggest that user factors are critical to the performance of MIS success. Therefore, these four items are grouped together.

The second factor is labeled "System Effectiveness" and is also composed of four items -- the improvements of: "cost savings in operation, maintenance, and IS resource management (Y3)", "time savings in new system development (Y2)", "system availability and timely response (Y1)", and "speed and efficiency of applications (Y8)." Hamilton and Chervany (1981a) suggest that measurement of system performance and effectiveness is a must for MIS success evaluation and included productivity, computer performance, service, etc. for measuring system effectiveness. Miller and Doyle (1987), Raghunathan et al. (1989) and Bergeron et al. (1993) suggest that system availability and timely response (Y1) is an important measure for "System Effectiveness." Therefore "improvement in system availability and timely response (Y1)" can be grouped in this factor for further analysis. Also, "improvement in

speed and efficiency of applications (Y8)" can improve a user's job performance. Miller and Doyle (1987) and Bergeron et al. (1993) grouped "reduction in users' work, effective execution of tasks", "time savings", "cost-effectiveness of applications", and "low cost applications" into one factor. Therefore, "improvement in speed and efficiency of applications (Y8)" can be grouped in "System Effectiveness" for further analysis.

Factor analysis was also performed on the 35 MIS downsizing activities. Figure 4-8 displays the screen plot of MIS downsizing activity variables' eigenvalues. The plot shows that seven factors have eigenvalues greater than one and can be extracted from the 35 MIS downsizing activity variables. Table 4-7 discloses the eigenvalues of the seven factors and also discloses that about 69.9 percent of the total variance can be explained by the seven factors.

Table 4-8 presents a factor matrix of the 35 MIS downsizing activity items after varimax rotation. Based on the matrix, the seven factors are labeled by the researcher as: "Communication between Users and the MIS department (CSF1)", "Management Objectives of MIS/DP Operations (CSF2)", "Commitment and Support of MIS downsizing (CSF3)", "MIS department Service Function (CSF4)", "User Participation (CSF5)", "Appropriate Applications (CSF6)", and "User Satisfaction (CSF7)."

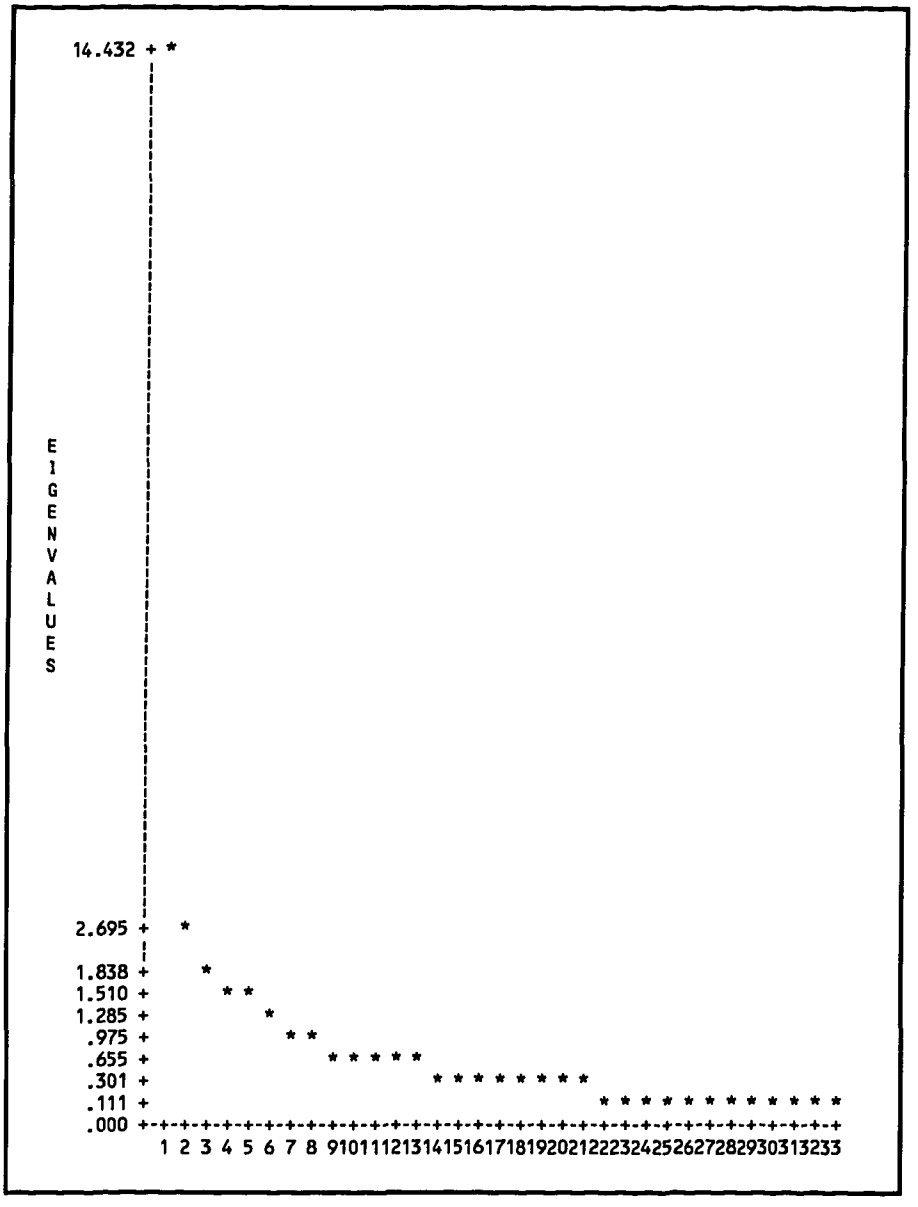


FIGURE 4-8: SCREEN PLOT FOR MIS DOWNSIZING ACTIVITIES

TABLE 4-7

FACTOR STATISTICS FOR MIS DOWNSIZING ACTIVITIES

Factor	Factor Labels	Eigenvalue	Percent of Variance
CSF1	Communication between Users and the MIS Department	14.432	41.2
CSF2	Management Objectives of MIS/DP Operations	2.695	7.7
CSF3	Commitment and Support of MIS Downsizing	1.838	5.3
CSF4	MIS Department's Service Function	1.612	4.6
CSF5	User Participation	1.510	4.3
CSF6	Appropriate Applications	1.285	3.7
CSF7	User Satisfaction	1.095	3.1
			Total: 69.9

TABLE 4-8

FACTOR MATRIX FOR MIS DOWNSIZING ACTIVITIES

	CSF1	CSF2	CSF3	CSF4	CSF5	CSF6	CSF7
X22	.7738	.1678	.1235	.0769	.2138	.0348	.2654
X20	.7198	.1025	.1928	.2466	.2834	.2092	.1117
X21	.6464	.0960	.2346	.2329	.1451	.4805	-.0212
X28	.6204	.5029	.2160	.1730	-.0294	-.1327	.2183
X23	.6037	.1726	.2085	.1165	.1864	.3547	-.0408
X12	.5924	.0323	.1753	.2773	.3019	.3601	.1584
X30	.5487	.5442	.2722	.1829	.1491	.0856	.1065
X18	.5483	.4021	.0201	.2955	.0278	.0596	.3369
X2	.0749	.8001	.1125	.1776	.1073	-.0013	.0922
X32	.2364	.7529	.0278	.2898	.1091	.1467	.1376
X31	.0320	.7141	-.0402	.0846	.1952	.2802	-.1259
X3	.2979	.6267	.3876	-.0324	.2223	.1488	.1308
X29	.5141	.6030	.0581	.1035	.0549	.0678	.1833
X5	.0551	.5812	.5248	-.0025	.0415	.1557	.3835
X24	.0068	-.0745	.6898	.3113	.3974	.0971	.2510
X1	.1346	.3616	.6832	.0980	-.0811	-.0423	.1409
X4	.3156	.1607	.6815	.2031	.2617	.1064	-.1546
X25	.1329	.0238	.6745	.2674	.1963	.0420	.4261
X26	.2697	-.0002	.6238	.2524	.0379	.3264	.0520
X16	.4619	.3105	.5609	.2270	.0414	.0847	-.0870
X17	.3467	.1377	.0923	.7178	.2059	.0793	-.0452
X27	.2399	.0134	.2928	.7018	.2017	.0834	.1174
X35	.0065	.1688	.1629	.6711	.0939	.2442	.0956
X19	.3103	.3235	.2338	.5582	-.0377	-.1396	.1193
X6	.1068	.4170	.2071	.5376	.1696	.1651	.2048
X13	.2475	.1068	.2453	.1579	.7631	-.0295	.0398
X8	.1188	.2770	-.1601	.0065	.6692	.0179	.2829
X14	.1986	.1932	.3296	.3933	.6164	.1162	-.0608
X11	.2549	.0734	.2816	.3510	.5831	.2523	.2651
X33	.1290	.1670	.0344	.1746	-.0059	.7688	.2088
X10	.2695	.2420	.1600	.0739	.2136	.5320	.2717
X34	.3657	.4815	.2722	.0509	-.1056	.4930	.1646
X9	.1783	.0219	.1033	.2681	.3296	.2375	.6831
X7	.1938	.2958	.1581	-.0128	.0492	.2017	.5902
X15	.3698	.3596	.2190	.2677	.1902	.2123	.4374

Factor matrix of MIS downsizing activities (Table 4-8) also presents that 26 of the 35 MIS downsizing activities have one loading of greater than .5 and no other loadings greater than .4. Two of the variables (X34 and X15) have primary loadings of less than .5, but greater than .4. While three of the variables (X21, X18, and X16) have secondary loadings of less than .5, but greater than .4. Given the evidence that these variables are extracted from and suggested by the literature, elimination from further analysis is not considered appropriate. These five variables have been assigned to the factor on which they load the highest.

Table 4-8 also presents four other variables (X28, X30, X29 and X5) load ambiguously on two factors (CSF1 and CSF2); their secondary loadings are greater than .5. Because communication is a management function, it appears reasonable that two composed factors, "Communication between users and the MIS department (CSF1)" and "Management objectives of MIS/DP operations (CSF2)" are correlated. For example, "promote high quality information output (X29)" is one of the MIS department's management functions and clearly should be coordinated through communication with users. Some previous literature (Magal et al 1988; Bergeron et al. 1993) grouped these variables together. Following this precedent, these ambiguous variables have been assigned to the factor on which they

load the highest. Therefore, "promote high quality information output (X28)", and "promote high quality applications for the downsized MIS (X30)" have been assigned to CSF1, "Communication between users and the MIS department." "Improve general organizational effectiveness (X5)" and "promote high quality user database and applications (X29)" have been assigned to CSF2, "Management objectives of MIS/DP operations." Table 4-9 groups the components of the seven factors and presents a partial justification for the labels.

Table 4-10 shows a mapping of the seven factors of this research with Rockart's CSF and Martin's CSF. The table is meant to show that the seven factors of this research can be subjectively mapped consistently with Rockart's CSF and Martin's CSF, and consequently these factors are appropriately used for further analysis.

Posterior Reliability Test

After factor analysis, reliability tests were performed on the two composite factors of MIS downsizing success and on the seven composite factors of MIS downsizing activities. Table 4-11 presents coefficient alphas for the two groups of factors. None of the nine composite factors' coefficient alpha is lower than .7167. Consequently, these factors provide a reliable and consistent measure of intended dimension and no further elimination of variables appeared necessary.

TABLE 4-9

COMPONENTS OF THE SEVEN CRITICAL SUCCESS FACTORS

CSF1: Communication Between Users and the MIS Department X12 Generate users' understanding of the downsized system X18 Manage IS resources effectively X20 Communicate with users about IS procedures and services X21 Provide training to IS staff and users X22 Respond to user's request for IS support X23 Communicate with users X28 Promote high quality information output X30 Promote high quality applications for the downsized IS
CSF2: Management Objectives of MIS/DP Operations X2 Improve organizational effectiveness & performance X3 Increase the quality of decision making X5 Improve general organizational effectiveness X29 Promote high quality user database and applications X31 Reduce the data processing and maintenance cycle X32 Improve the efficiency of applications for users
CSF3: Commitment and Support of MIS Downsizing X1 Attain organizational objectives X4 Facilitate the management of change X16 Provide competent IS staffs X24 Promote acceptance of the IS downsizing concept to the whole firm X25 Promote support of top management for the IS downsizing concept X26 Design a strategic IS downsizing plan
CSF4: MIS Department's Service Function X6 Improve users' confidence in the system X17 Provide a basis for control of standards, policies, etc X19 Provide reliable and qualified IS services X27 Promote users' commitment and support for the IS downsizing concept X35 Implement appropriate applications for downsizing
CSF5: User Participation X8 Permit control over IS services by users X11 Generate users' positive attitudes toward IS downsizing X13 Generate users' participation in the IS downsizing design X14 Involve users in downsized IS
CSF6: Appropriate Applications X10 Ease the use of PC tools for users X33 Promote applications that make the converting process easier X34 Operate applications that provide competitive advantage for the firm
CSF7: User satisfaction X7 Improve access to the system X9 Increase the use of downsized information systems X15 Generate user satisfaction with the downsized IS

TABLE 4-10

MAPPING THE SEVEN FACTORS WITH ROCKART'S AND MARTIN'S CSF

Rockart's CSF	Martin's CSF	Seven CSF
-Service (Operations and Development)	-Data Processing Operations -System Development	-Appropriate Applications
-Communication between Users and the IS Staff	-Relationships with the Management of the Parent Organization	-Communication between Users and the MIS Department -User Participation -User satisfaction
-Human Resources	-Human Resources Development	-MIS Department's Service Function
-Repositioning the IS Function (Technical) (Organizational) (Psychological) (IS Managerial)	-Support of the Objectives and Priorities of the Parent Organization -Management of Change (Technological) -Management Control of the MIS/DP Organization	-Commitment and Support of MIS Downsizing -Managerial Objectives of MIS/ DP Operations

TABLE 4-11

COEFFICIENT ALPHA FOR THE EXTRACTED FACTORS

Factors (items)	Alpha
MIS Downsizing Success:	
User-Oriented Improvements (Y4, Y5, Y6, Y7)	.8815
System Effectiveness (Y1, Y2, Y3, Y8)	.7908
MIS Downsizing Activities:	
Communication between Users and the MIS Department (X12, X18, X20, X21, X22, X23, X28, X30)	.9133
Managerial Objectives of MIS/DP Operations (X2, X3, X5, X29, X31, X32)	.8725
Commitment and Support of MIS Downsizing (X1, X4, X16, X24, X25, X26)	.8663
MIS Department's Service Function (X6, X17, X19, X27, X35)	.8181
User Participation (X8, X11, X13, X14)	.8008
Appropriate Applications (X10, X33, X34)	.7274
User Satisfaction (X7, X9, X15)	.7167

Hypotheses Testing

The hypotheses were tested using the canonical correlation analysis. Hair et al. (1987) recommended three criteria be used for interpreting the canonical function. The three criteria are: (1) the canonical correlation, (2) the significance level of the F-statistic, and (3) the redundancy index. This study used the canonical correlation analysis of SPSS and inspected these three criteria.

For the canonical correlation, this study examined the correlation between dependent and canonical variables from SPSS results. For the canonical function, this study examined several multivariate F-statistics that were provided by SPSS results; such as Pillais' F-test, Hotellings' F-test, and Wilks' F-test for the canonical function. For each dependent (criterion) variable, the univariate F-tests and Roy-Bargman stepdown F-tests from the SPSS results were examined. For the redundancy index, this study used the SPSS results and calculated the redundancy index according to the formula suggested by Hair et al. (1987). The calculation of the redundancy index is a two-step approach: (1) calculate the amount of shared variance in the criterion set that is explained by the criterion canonical variate, (2) calculate the amount of variance in the criterion canonical variate that can be

explained by the predictor set canonical variate (that is the square of the canonical correlation). The redundancy index is then calculated by multiplying these two components. The canonical loadings for each hypothesis tested are also examined.

This study employed two approaches for hypotheses testing. The first approach was to inspect the original six groups of hypotheses as discussed in Chapter III. The second approach was to examine the seven factors extracted from factor analysis. Both approaches are presented in the following sections.

Hypotheses Testing of the Original Six groups

For the canonical correlation analysis purposes, the criterion (dependent) variables are calculated from the MIS downsizing success variables. The predictor (independent) variables are represented by the MIS downsizing activity variables.

There are two criterion variables used for each hypothesis test. The eight MIS downsizing success variables are grouped into two criterion variables according to the factor analysis results. The first criterion variable, coded as SFAC1, is the mean of the four MIS downsizing success variables that were extracted into the first factor by factor analysis. The first factor was labeled "User-Oriented Improvements." Table 4-12 shows the

factor loadings for these four variables. The factor loadings ranged from .692 to .847.

TABLE 4-12

FACTOR LOADINGS FOR SFAC1

Code	User-Oriented Improvements Variables	Factor Loading
Y7	Overall productivity of the users	.847
Y6	Understanding and response to users' priority	.782
Y5	Relevance and quality of information output for users	.772
Y4	Flexibility of the system	.692

The second criterion variable, coded as SFAC2, is the mean of the other four MIS downsizing success variables that were extracted into the second factor by factor analysis. This factor was labeled "System Effectiveness." Table 4-13 shows the factor loadings for these four variables. The factor loadings ranged from .541 to .886.

TABLE 4-13

FACTOR LOADING OF SFAC2

Code	System Effectiveness Variables	Factor Loading
Y3	Cost savings in operation, maintenance, and IS resource management	.886
Y2	Time savings in new system development	.647
Y1	System availability and timely response	.602
Y8	Speed and efficiency of applications	.541

The first group of hypotheses deals with the relationship between user appreciation and MIS downsizing success. It has two subset hypotheses. The first examines user involvement and the second examines user attitudes. The first subsets of hypothesis statement are:

H_o: User involvement in the process of MIS downsizing is not related to MIS downsizing success.

H_{1a}: User involvement in the process of MIS downsizing is related to MIS downsizing success.

The three MIS downsizing activity variables for testing this hypothesis are:

X12: Generate users' understanding of the downsized MIS,

X13: Generate users' participation in the MIS downsizing design,

and X14: Involve users in downsized MIS.

These three variables are the predictor variables for the canonical correlation analysis. The canonical correlation analysis was performed on the two criterion variables, SFAC1 and SFAC2, and three predictor variables, X12, X13 and X14.

Table 4-14 shows the results of the canonical correlation analysis for user involvement. The canonical correlations are high, .967 and .776, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the three MIS downsizing activities) is high. The significance level for the F-

statistic is less than .000. The cumulative redundancy index is .728, and indicates that 72.8 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the three MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, user involvement in the process of MIS downsizing is related to MIS downsizing success.

TABLE 4-14

THE CANONICAL CORRELATION FOR USER INVOLVEMENT

Criterion (MIS Downsizing Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.967	.000	.352
SFAC2	.776	.000	.376
			Total .728

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X12: User understanding of downsized MIS	.272	.872
X13: User participation	.793	.483
X14: User involvement	.913	.076

The second subset tested that users' attitude toward MIS downsizing is related to MIS downsizing success. The hypothesis statements for this subset are:

H_o: Users' attitude is not related to MIS downsizing success.

H_{1b}: Users' attitude toward MIS downsizing is related to MIS downsizing success.

There are three variables of MIS downsizing activities for this hypothesis testing. They are:

X9: Increase the use of downsized MIS,

X10: Ease the use of PC tools for users,

and X11: Generate users' positive attitudes toward MIS downsizing.

These three variables are the predictor variables for the canonical correlation analysis. The canonical correlation analysis was performed on the two criterion variables, SFAC1 and SFAC2, and these three MIS downsizing activity variables, X9, X10 and X11.

Table 4-15 shows the results of the canonical correlation analysis for user attitude. The canonical correlations are high, .961 and .758, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the three MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .850, and indicates that 85 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the three MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null

hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, user's attitude toward MIS downsizing is related to MIS downsizing success.

TABLE 4-15

THE CANONICAL CORRELATION FOR USER ATTITUDE

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.961	.000	.759
SFAC2	.758	.000	.121
			Total .850

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X9: Increase the use of downsized MIS	.952	.181
X10: Ease the use of PC tools for users	.722	-.270
X11: Users' positive attitudes	.644	-.687

Next, the variables from these two subsets plus four other variables, X6, X7, X8 and X15, (a total of ten variables) and the two criterion variables were analyzed by the canonical correlation analysis for the first general hypothesis. This hypothesis tested that user appreciation and MIS downsizing success are positively related. The hypothesis statements are:

H_o: User appreciation is not related to MIS downsizing Success.

H_1: User appreciation is related to MIS downsizing success.

Table 4-16 shows the ten predictor variables and the results of the canonical correlation analysis for user appreciation. The canonical correlations are high, .992 and .626, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the ten MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .851, and indicates that 85.1 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the ten MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, user appreciation is related to MIS downsizing success.

The second group of hypotheses implies the importance of communication and alliance between users and the MIS department. Through communication and coordination, an MIS department can provide appropriate facilities to users. This hypothesis has one subset hypothesis. The subset hypothesis statements are:

H_o: Facilitation to users is not related to MIS downsizing success.

H_{2a}: Facilitation to users is related to MIS downsizing success.

The two predictors for the canonical correlation are:

X21: Provide training to IS staff and users

and X22: Respond to user's request of IS support.

TABLE 4-16

THE CANONICAL CORRELATION FOR USER APPRECIATION

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.992	.000	.762
SFAC2	.626	.000	.089
			Total .851

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X6: Improve user' confidence in the system	.506	-.314
X7: Improve access to the system	.797	.225
X8: Permit control over MIS services by users	.636	-.344
X9: Increase the use of downsized MIS	.618	-.099
X10: Ease the use of PC tools for users	.445	-.242
X11: Users' positive attitudes	.372	-.398
X12: Users' understanding of downsized MIS	.458	-.010
X13: Users' participation	.422	-.580
X14: Involve users in downsized MIS	.273	-.796
X15: User satisfaction with downsized MIS	.646	-.217

Table 4-17 shows the results for facilitation to users. The canonical correlations are high, .978 and .732, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the two MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative

redundancy index is .846, and indicates that 84.6 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the two MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, facilitation to users is related to MIS downsizing success.

TABLE 4-17

THE CANONICAL CORRELATION FOR FACILITATION TO USERS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.978	.000	.705
SFAC2	.732	.000	.141
			Total .846

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X21: Provide users and IS staff training	.763	.646
X22: Response to user's request of IS support	.970	-.242

Next, two other variables (X20 and X23) were added to this subset (a total of four variables) and the two criterion variables were analyzed by the canonical correlation analysis for the second general hypothesis.

This hypothesis tested the relationship of communication between users and the MIS department to MIS downsizing success. The hypothesis statements are:

H_o: Communication between users and the MIS department is not related to MIS downsizing success.

H_2: Communication between end-users and the MIS department is related to MIS downsizing success.

Table 4-18 shows the results for communication. The canonical correlations are high, .968 and .765, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the four MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .811, and indicates that 81.1 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the four MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, communication between users and the MIS department is related to MIS downsizing success.

TABLE 4-18

THE CANONICAL CORRELATION FOR COMMUNICATION

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.968	.000	.601
SFAC2	.765	.000	.210
			Total .811

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X20: Communicate with users about IS procedures and services	.791	.560
X21: Provide training to IS staff and users	.540	.634
X22: Respond to user's request of IS support	.845	.030
X23: Communicate with users	.865	.150

The third hypothesis suggests an MIS department should support users' needs. An effective MIS department should provide the required hardware and software applications to users. Also, an MIS department staff should be competent to provide the internal services and consulting in support of the operations of the firm. An MIS department should provide training courses to users for updating MIS knowledge and skills applicable for MIS downsizing.Based on these points, the hypothesis statements are:

H_o: The support services of an MIS department are not related to MIS downsizing success.

H_3: The support services of an MIS department are related to MIS downsizing success.

Table 4-19 presents the results for the MIS department's support services. The canonical correlations are high, .964 and .751, and indicate that the bivariate correlation between the MIS downsizing success and the four MIS downsizing activities is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .847, and indicates that 84.7 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the four MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, the support services of an MIS department are related to MIS downsizing success.

TABLE 4-19

THE CANONICAL CORRELATION FOR MIS SUPPORT SERVICES

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.964	.000	.720
SFAC2	.751	.000	.127
			Total .847

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X16: Provide competent MIS staffs	.430	-.213
X17: Provide a basis for control of standards, polices, etc.	.641	-.083
X18: Manage MIS resources effectively	.822	.515
X19: Provide reliable and qualified MIS services	.864	-.450

The fourth hypothesis is that support and commitment from top management and users will be related to MIS downsizing success. Top management and users who actively participate in the MIS downsizing planning process, will understand MIS downsizing concepts better and be more likely to support MIS downsizing. Their commitment and support for MIS downsizing will impact the success of MIS downsizing. The hypotheses statements are:

H_o: Commitment and support from top management and users are not related to MIS downsizing success.

H_4: Commitment and support from top management and users are related to MIS downsizing success.

Table 4-20 presents the results for commitment and support. The canonical correlations are high, .981 and .712, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the four MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .849, and indicates that 84.9 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the four MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. The results indicated that

commitment and support from top management and users are related to MIS downsizing success.

TABLE 4-20

THE CANONICAL CORRELATION FOR COMMITMENT AND SUPPORT

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.981	.000	.722
SFAC2	.712	.000	.127
			Total .849

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X24: Promote acceptance of the MIS downsizing concept to the whole firm	.780	.565
X25: Promote support of top management for the MIS downsizing concept	.643	.598
X26: Design a strategic MIS downsizing plan	.262	.542
X27: Promote users' commitment and support for the MIS downsizing concept	.871	-.228

The fifth hypothesis suggests that MIS downsizing should assist in overall organizational effectiveness. As MIS downsizing can support organizational objectives and priorities, organizational performance and managerial decision making should be improved. Management control and management of change should be improved also. The hypotheses are:

H_o: Organizational effectiveness is not related to MIS downsizing success.

H_5: Organizational effectiveness is related to MIS downsizing success.

Table 4-21 presents the results for organizational effectiveness. The canonical correlations are high, .948 and .777, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the five MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .831, and indicates that 83.1 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the five MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Therefore, organizational effectiveness is related to MIS downsizing success.

The sixth group of hypotheses is related to the effectiveness of appropriate software applications for MIS downsizing. Applications should meet business requirements, be easy to use, maintain and update. Appropriate software applications should meet the criteria of quality, efficiency and adequacy. Thus, there are three hypotheses subsets plus one general hypothesis for this hypothesis testing.

TABLE 4-21

THE CANONICAL CORRELATION FOR ORGANIZATIONAL EFFECTIVENESS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.948	.000	.692
SFAC2	.777	.000	.139
			Total .831

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X1: Attain organizational objectives	.469	.025
X2: Improve organizational effectiveness & performance	.883	-.345
X3: Increase the quality of decision making	.743	-.033
X4: Facilitate the management of change	.428	-.397
X5: Improve general organizational effectiveness	.837	.437

The first subset of hypothesis tested that the quality of software applications is related to MIS downsizing success. The hypotheses are:

H_o: The quality of applications is not related to MIS downsizing success.

H_{6a}: The quality of applications is related to MIS downsizing success.

There are three predictor variables in these hypotheses: quality of information output, quality of database, and the quality of applications for the downsized MIS.

Table 4-22 presents the results for the quality of applications. The canonical correlations are high, .970 and .731, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success

and the three MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .843, and indicates that 84.3 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the three MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Therefore, the quality of applications is related to MIS downsizing success.

TABLE 4-22

THE CANONICAL CORRELATION FOR THE QUALITY OF APPLICATIONS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.970	.000	.714
SFAC2	.731	.000	.129
			Total .843

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X28: Promote high quality information output	.889	.032
X29: Promote high quality user database and applications	.811	.534
X30: Promote high quality applications for the downsized MIS	.954	-.226

The second hypothesis subset tested that the efficiency of applications is related to MIS downsizing success. There are two predictor variables for this hypothesis: reduced maintenance cycle and improved the efficiency. An efficient application should be able to reduce the maintenance cycle and improve the efficiency of applications for users. Thus this study tested these two variables with the two MIS downsizing success variables. The hypotheses are:

H_o: The efficiency of applications is not related to MIS downsizing success.

H_{6b}: The efficiency of applications is related to MIS downsizing success.

The canonical correlation analysis results are shown in Table 4-23. The canonical correlations are high, .959 and .734, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the two MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .818, and indicates that 81.8 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the two MIS downsizing activity variables. The canonical loadings are high, .717 and .974, in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis

has sufficient evidence to be supported. Therefore, the efficiency of applications is related to MIS downsizing success.

TABLE 4-23

THE CANONICAL RESULTS FOR THE EFFICIENCY OF APPLICATIONS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.959	.000	.673
SFAC2	.734	.000	.145
			Total .818

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X31: Reduce the data processing and maintenance cycle	.717	.697
X32: Improve the efficiency of application for users	.974	-.227

The third hypothesis subset tested that the adequacy of applications is related to MIS downsizing success. This hypothesis is that for MIS downsizing success, the software applications should be appropriate for the downsized MIS. An adequate application would make the conversion process of MIS downsizing easier. Also, an adequate application should provide competitive advantage for the downsized MIS. These three variables are the predictor variables for the canonical correlation analysis. The hypotheses are:

H_o: The adequacy of applications is not related to MIS downsizing success.

H_{6c}: The adequacy of applications is related to MIS downsizing success.

Table 4-24 provides the results for the applications' adequacy. The canonical correlations are high, .980 and .714, and indicate that the bivariate correlation between the two linear composites (MIS downsizing success and the three MIS downsizing activities) is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index indicates that 83 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate. The canonical loadings are high in each canonical function, .399, .673, and .919 for each. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Therefore, the adequacy of applications is related to MIS downsizing success.

The general hypothesis thus tested that an appropriate application should have quality, efficiency, and adequacy as tested from the three subsets. All of the eight variables were tested with the two criterion variables. The hypotheses are:

H_o: Appropriate software application is not related to MIS downsizing success.

H_6: Appropriate software application is related to MIS downsizing success.

TABLE 4-24

THE CANONICAL CORRELATION FOR THE APPLICATIONS' ADEQUACY

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.980	.000	.683
SFAC2	.714	.000	.147
			Total .830

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X33: Promote applications that make the converting process easier	.399	.759
X34: Operate applications that provide competitive advantage for the firm	.673	.605
X35: Implement appropriate applications for downsizing	.917	-.274

Table 4-25 provides the results for the appropriate applications. The correlations are .983 and .673, and indicate that the bivariate correlation between the two linear composites is high. The significance level for the F-statistic is less than .000. The cumulative redundancy index is .800, and indicates that 80 percent of the variance in SFAC1 and SFAC2 has been explained by the canonical variate for the eight MIS downsizing activity variables. The canonical loadings are high in each canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Therefore, appropriate software application is related to MIS downsizing success.

TABLE 4-25

THE CANONICAL CORRELATION FOR THE APPROPRIATE APPLICATIONS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.983	.000	.653
SFAC2	.673	.000	.147
			Total .800

Predictor (MIS Downsizing Activities)	Canonical Loading 1	2
X28: Promote high quality information output	.578	.308
X29: Promote high quality user database and applications	.513	.420
X30: Promote high quality applications for the downsized MIS	.628	.259
X31: Reduce the data processing and maintenance cycle	.637	.454
X32: Improve the efficiency of application for users	.891	.190
X33: Promote applications that make the converting process easier	.234	.731
X34: Operate applications that provide competitive advantage for the firm	.417	.626
X35: Implement appropriate applications for downsizing	.604	-.135

Hypotheses Testing by Factors

THE canonical correlation analysis was used to examine the relationships between the seven factors that were extracted from 35 MIS downsizing activity variables and the two factors that were extracted from the eight MIS downsizing success variables. The results from the canonical correlation analysis served two purposes in this study. One purpose was to retest the proposed hypotheses, and the other one was to show that these seven factors are critical success factors (CSF) for MIS downsizing success.

When performing the canonical correlation analysis for the seven MIS CSF, there are two criterion variables in each of the canonical functions. The two criterion variables, SFAC1 and SFAC2, are the two factors extracted from the eight MIS downsizing success variables by factor analysis. SFAC1 is labeled "User-Oriented Improvements" and SFAC2 is labeled "System Effectiveness." For each canonical correlation analysis, the predictor variables are the variables that have been extracted into that particular critical success factor. The testing of the hypotheses for the seven CSF is presented in the section following.

Critical Success Factor One: Communication between Users and the MIS Department

From factor analysis, the first extracted critical success factor (CSF) from the 35 MIS downsizing activities is labeled "Communication between Users and The MIS

Department." This factor is composed of eight MIS downsizing activity variables. This study took those eight variables as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: Communication between users and the MIS department is not related to MIS downsizing success.

H_a: Communication between users and the MIS department is related to MIS downsizing success.

Table 4-26 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis. The canonical correlations are high, .971 and .740, and indicate that the relationship between SFAC1 and the eight MIS downsizing activities contributes more than 97 percent to the two linear composites; and the relationship between SFAC2 and the eight MIS downsizing activities contributes 74 percent to the two linear composites. The cumulative redundancy index is .858, and indicates that 85.8 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the eight predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000. The canonical loadings are high in the canonical function.

TABLE 4-26

THE CANONICAL CORRELATION FOR FACTOR ONE:
COMMUNICATION BETWEEN USERS AND THE MIS DEPARTMENT

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.971	.000	.740
SFAC2	.740	.000	.118
			Total .858

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	2
X22: Respond to user's request for IS support	.774	.557	-.311
X20: Communicate with users about IS procedures and services	.720	.666	.114
X21: Provide training to IS staff and users	.646	.522	.269
X28: Promote high quality information output	.620	.826	-.141
X23: Communicate with users	.604	.603	-.227
X12: Generate users' understanding of the downsized system	.592	.610	.202
X30: Promote high quality applications for the downsized IS	.549	.881	-.210
X18: Manage IS resources effectively	.548	.792	.262

These results of Table 4-26 also indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, communication between users and the MIS department is highly related to MIS downsizing success; and this factor is one of the CSF for MIS downsizing success. This finding also supports the proposed hypothesis that communication between users and the MIS department is related to MIS downsizing success (H_2).

Critical Success Factor Two:
Management Objectives of MIS/DP Operations

From factor analysis, the second extracted CSF from the 35 MIS downsizing activities is labeled "Management Objectives of MIS/DP Operations." This factor is composed of six MIS downsizing activity variables. This study used those six variables as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: Management objectives of MIS/DP operations are not related to MIS downsizing success.

H_a: Management objectives of MIS/DP operations are related to MIS downsizing success.

Table 4-27 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis.

TABLE 4-27

THE CANONICAL CORRELATION FOR FACTOR TWO:
MANAGEMENT OBJECTIVES OF MIS/DP OPERATIONS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.980	.000	.719
SFAC2	.677	.000	.115
			Total .834

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	2
X2: Improve organizational effectiveness & performance	.800	.782	-.231
X32: Improve the efficiency of applications for users	.753	.942	-.183
X31: Reduce the data processing and maintenance cycle	.714	.702	.167
X3: Increase the quality of decision making	.627	.648	.071
X29: Promote high quality user database and applications	.603	.570	.185
X5: Improve general organizational effectiveness	.581	.711	.567

Table 4-27 also presents the canonical correlations are high, .980 and .677, and indicate that the relationship between SFAC1 and the six MIS downsizing activities contributes 98 percent to the two linear composites, and the relationship between SFAC2 and the six MIS downsizing activities contributes 67.7 percent to the two linear composites. The cumulative redundancy index is .834, and indicates that 83.4 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the six predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000 and the canonical loadings are high. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, management objectives of MIS/DP operations are highly related to MIS downsizing success; and this factor is one of the CSF for MIS downsizing success. This finding also supports the proposed hypothesis that organizational effectiveness is related to MIS downsizing success (H_5).

Critical Success Factor Three:
Commitment and Support of MIS Downsizing

The third factor extracted from the 35 MIS downsizing activities is labeled "Commitment and Support of MIS Downsizing." This factor is composed of six MIS downsizing

activity variables. Those six variables were used as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: Commitment and support of MIS downsizing is not related to MIS downsizing success.

H_a: Commitment and support of MIS downsizing is related to MIS downsizing success.

Table 4-28 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis. The canonical correlations are high, .976 and .738, and indicate that the relationship between SFAC1 and the six MIS downsizing activities contributes 97.6 percent to the two linear composites; and the relationship between SFAC2 and the six MIS downsizing activities contributes 73.8 percent to the two linear composites. The cumulative redundancy index is .852, and indicates that 85.2 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the six predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000. The canonical loadings are high in the canonical function. These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported.

TABLE 4-28

THE CANONICAL CORRELATION FOR FACTOR THREE:
COMMITMENT AND SUPPORT OF MIS DOWNSIZING

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.976	.000	.718
SFAC2	.738	.000	.134
			Total .852

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	2
X24: Promote acceptance of the IS downsizing concept to the whole firm	.690	.831	.387
X1: Attain organizational objectives	.683	.732	.084
X4: Facilitate the management of change	.682	.694	-.384
X25: Promote support of top management for the IS downsizing concept	.675	.686	.412
X26: Design a strategic IS downsizing plan	.624	.282	.378
X16: Provide competent IS staffs	.561	.560	-.108

This finding indicate that commitment and support of MIS downsizing is highly related to MIS downsizing success; and this factor is one of the CSF for MIS downsizing success. This finding also supports the proposed hypothesis that commitment and support from top management and users is related to MIS downsizing success (H_4).

Critical Success Factor Four:
MIS Department's Service Function

The fourth factor extracted from the 35 MIS downsizing activities is labeled "MIS Department's Service Function." This factor is composed of five MIS downsizing activity variables. Those five variables were used as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: MIS department's service function is not related to MIS downsizing success.

H_a: MIS department's service function is related to MIS downsizing success.

Table 4-29 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis. The canonical correlations are high, .940 and .802, and indicate that the relationship between SFAC1 and the five MIS downsizing activities contributes 94 percent to the two linear composites; and the relationship between SFAC2 and the five MIS downsizing activities contributes 80.2 percent to the

two linear composites. The cumulative redundancy index indicates that 80.7 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the five predictor variables. The significance level of the F-statistic is less than .000. The canonical loadings are high in the canonical function.

These results indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, the MIS department's service function is highly related to MIS downsizing success; and this factor is one of the CSF for MIS downsizing success. This finding also supports the proposed hypothesis that the support services of an MIS department are related to MIS downsizing success (H_3).

Critical Success Factor Five:
User Participation

The fifth factor is labeled "User Participation." This factor is composed of four MIS downsizing activity variables. This study took those four variables as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: User participation is not related to MIS downsizing success.

H_a: User participation is related to MIS downsizing success.

TABLE 4-29

THE CANONICAL CORRELATION FOR FACTOR FOUR:
MIS DEPARTMENT'S SERVICE FUNCTION

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.940	.000	.600
SFAC2	.802	.000	.207
			Total .807

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	Canonical Loading 2
X17: Provide a basis for control of standards, policies, etc	.718	.570	.477
X27: Promote users' commitment and support for the IS downsizing concept	.702	.665	.107
X35: Implement appropriate applications for downsizing	.671	.817	-.313
X19: Provide reliable and qualified IS services	.559	.814	.089
X6: Improve users' confidence in the system	.538	.715	.562

Table 4-30 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis. The canonical correlations are high, .956 and .780, and indicate that the relationship between SFAC1 and the four MIS downsizing activities contributes 95.6 percent to the two linear composites; and the relationship between SFAC2 and the four MIS downsizing activities contributes 78 percent to the two linear composites. The cumulative redundancy index is .810, and indicates that 81 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the four predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000. and the canonical loadings are high in the canonical function.

The results from Table 4-30 indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, user participation is highly related to MIS downsizing success; and this factor is one of the critical success factors for MIS downsizing success. This finding also supports the proposed hypothesis that user involvement in the process of MIS downsizing is related to MIS downsizing success (H_{1a}).

TABLE 4-30

THE CANONICAL CORRELATION FOR FACTOR FIVE:
USER PARTICIPATION

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.956	.000	.602
SFAC2	.780	.000	.208
			Total .810

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	2
X13: Generate users' participation in the IS downsizing design	.763	.774	-.127
X8: Permit control over IS services by users	.669	.863	.437
X14: Involve users in downsized IS	.616	.742	-.580
X11: Generate users' positive attitudes toward IS downsizing	.583	.617	.022

Critical Success Factor Six:
Appropriate Applications

The sixth factor extracted from the 35 MIS downsizing activities is labeled "Appropriate Applications." This factor is composed of three MIS downsizing activity variables. Those three variables were used as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: Appropriate applications are not related to MIS downsizing success.

H_a: Appropriate applications are related to MIS downsizing success.

Table 4-31 presents the factor loadings of MIS downsizing activities and the results of the canonical correlation analysis. One of the canonical correlations is .966 (for SFAC1), and the other one is .161 (for SFAC2). They indicate that the relationship between SFAC1 and the three MIS downsizing activities contributes 96.6 percent to the two linear composites; and the relationship between SFAC2 and the three MIS downsizing activities contributes only 16.1 percent to the two linear composites. The cumulative redundancy index indicates that 74.1 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the three predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000. The canonical loadings are high in the canonical function.

TABLE 4-31

THE CANONICAL CORRELATION FOR FACTOR SIX:
APPROPRIATE APPLICATIONS

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.966	.000	.736
SFAC2	.161	.000	.005
			Total .741

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	Canonical Loading 2
X33: Promote applications that make the converting process easier	.769	.646	.641
X10: Ease the use of PC tools for users	.532	.812	-.403
X34: Operate applications that provide competitive advantage for the firm	.493	.893	.165

These results of Table 4-31 indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, appropriate applications are highly related to MIS downsizing success; and this factor is one of the CSF for MIS downsizing success. This finding supports the proposed hypothesis that appropriate software application is related to MIS downsizing success (H_6).

Critical Success Factor Seven:
User Satisfaction

The seventh factor extracted from the 35 MIS downsizing activities is labeled "User Satisfaction." This factor is composed of three MIS downsizing activity variables. This study took those three variables as the predictor variables for the canonical correlation analysis. The hypothesis statements for this CSF are:

H_o: User satisfaction is not related to MIS downsizing success.

H_a: User satisfaction is related to MIS downsizing success.

Table 4-32 presents the factor loading for each variable of MIS downsizing activities and the results of the canonical correlation analysis. The canonical correlations are high, .996 and .591, and indicate that the relationship between SFAC1 and the three MIS downsizing activities contributes 99.6 percent to the two linear

composites; and the relationship between SFAC2 and the three MIS downsizing activities contributes 59.1 percent to the two linear composites. The cumulative redundancy index is .838, and indicates that 83.8 percent of the variance in the criterion variables (SFAC1 and SFAC2) can be explained by the linear composite of the three predictor variables (MIS downsizing activities). The significance level of the F-statistic is less than .000. The canonical loadings are high in the canonical function.

The results from Table 4-32 indicate that the null hypothesis is rejected at the significance level of .000, and the research hypothesis has sufficient evidence to be supported. Thus, user satisfaction is highly related to MIS downsizing success; and this factor is one of the critical success factors for MIS downsizing success. This finding supports the proposed hypothesis that user appreciation is related to MIS downsizing success (H_1); because if users are satisfied with the downsized MIS, they will increase their use of the downsized MIS. If the downsized MIS improves access to the system, it will generate users' satisfaction with the downsized MIS. Thus, users appreciate the downsized MIS.

TABLE 4-32

THE CANONICAL CORRELATION FOR FACTOR SEVEN: USER SATISFACTION

Criterion (Success)	Canonical Correlation	Significance of F-Statistic	Redundancy Index
SFAC1	.996	.000	.755
SFAC2	.591	.000	.083
			Total .838

Predictor (MIS Downsizing Activities)	Factor Loading	Canonical Loading 1	2
X9: Increase the use of downsized information systems	.683	.691	-.355
X7: Improve access to the system	.590	.908	.374
X15: Generate user satisfaction with the downsized IS	.437	.718	-.639

Prediction Model

Several regression analyses were employed in an attempt to determine the best prediction model for MIS downsizing success. The stepwise approach was used for all the regression analyses to discover the best prediction model. The stepwise approach examines the partial correlation coefficients to find an additional predictor variable that explains both a significant portion, and the largest portion of the error remaining from the previous regression equation. In this study, the results of stepwise approach make the independent variables have positive coefficients in the regression equation.

Prediction by MIS Downsizing Activities

The first regression model uses each of the two MIS downsizing success factors (User-Oriented Improvements and System Effectiveness) as the dependant variable, and the 35 variables of MIS downsizing activities as the independent variables (predictor variables). The dependent variable in the first regression equation is SFAC1. SFAC1 is labeled "User-Oriented Improvements" for MIS downsizing success. SFAC1 is the mean of the four MIS downsizing success variables (Y4, Y5, Y6, Y7). By stepwise approach, the results of this regression analysis indicate that three MIS downsizing activities (X32, X8 and X35) are in the regression model.

Table 4-33 presents the regression model for User-Oriented Improvements. In this regression model, multiple R is .524. This indicates that the correlation between SFAC1 and independent variables (X32, X8 and X35) is 52.4 percent. R^2 (coefficient of determination) is .275 and indicates that 27.5 percent of the variance in SFAC1 is explained by the independent variables (X32, X8 and X35). The F-statistic for the regression model is .000, indicating that there is sufficient evidence to support this regression equation. The t-test for each coefficient is less than .045, indicating that each coefficient is significantly different from zero at the significance level of .045 or less. Therefore, from this equation model,

Improve the efficiency of application for users (X32), Permit control over IS services by users (X8), and Implement appropriate applications for MIS downsizing (X35), can be used to explain and predict one part of the MIS downsizing success -- User-Oriented Improvements (SFAC1).

TABLE 4-33

REGRESSION FOR SFAC1 (USER-ORIENTED IMPROVEMENTS)

Multiple R = .524	R Square = .275	Signif F = .000
Dependent Variable	SFAC1: User-Oriented Improvements	
Independent Variables	Regres Coeff	Sig. T
X32: Improve the efficiency of application for users	.268	.000
X8: Permit control over IS services by users	.125	.019
X35: Implement appropriate applications for downsizing	.140	.045
Constant	2.573	.000

The dependent variable in the second regression equation is SFAC2. SFAC2 is labeled "System Effectiveness" for MIS downsizing success. SFAC2 is the mean of the other four MIS downsizing success variables (Y1, Y2, Y3, Y8). By the stepwise approach, the results of this regression analysis indicate that only two MIS downsizing activities (X7 and X31) are in the regression model. Table 4-34 presents the regression model for system effectiveness. In

this regression model, multiple R is .459. This indicates that the correlation between SFAC1 and independent variables (X7 and X31) is 45.9 percent. R^2 is .211 and indicates that 21.1 percent of the variance in SFAC1 is explained by the independent variables (X7 and X31). The F-statistic for the regression model is .000, indicating that there is sufficient evidence to support this regression equation. The t-test for each coefficient is less than .012, indicating that each coefficient is significantly different from zero. Therefore, from this equation model, Improve access to the system (X7) and Reduce the data processing and maintenance cycle (X31) can be used to explain and predict the other part of the MIS downsizing success -- System Effectiveness (SFAC2).

TABLE 4-34

REGRESSION FOR SFAC2 (SYSTEM EFFECTIVENESS)

Multiple R = .459	R Square = .211	Signif F = .000
Dependent Variable	SFAC2: System effectiveness	
Independent Variable	Regres coeff	Sig. T
X7: Improve access to the system	.349	.000
X31: Reduce the data processing and maintenance cycle	.182	.012
Constant	2.136	.000

Prediction by Extracted Factors

Regression analysis was also performed on the factors generated from the factor analysis. The dependent variables in the regression are the two factors generated from the eight MIS downsizing success variables -- SUCES1 and SUCES2. The independent variables in the regression are the seven factors formulated from the 35 MIS downsizing activity variables. The seven factors are the critical success factors for MIS downsizing that this research proposes. These seven factors are coded: CSF1, CSF2, CSF3, CSF4, CSF5, CSF6, and CSF7.

Table 4-35 shows the labels of the seven CSF and the canonical correlation results. The canonical correlation for "User-Oriented Improvements (SUCES1)" is .682 and for "System Effectiveness (SUCES2)" is .687. The redundancy index indicates that 23.2 percent of the variance of "User-Oriented Improvements" can be explained by the seven CSF; and 23.6 percent of the variance of "System Effectiveness" can be explained by the seven CSF. The cumulative redundancy index indicates that 46.8 percent of the overall variance of the MIS downsizing success can be explained by the seven critical success factors. The canonical loadings indicate that CSF2, CSF5, and CSF4 each contributes more than 36 percent for SUCES1; CSF7 and CSF6 each contributes more than 48 percent for SUCES2. The following regression analysis ascertains this relationship.

TABLE 4-35

THE CANONICAL CORRELATION FOR MIS DOWNSIZING SUCCESS AND CSF

Criterion (MIS Downsizing Success)	Canonical Corr.	Signif F	Redundancy Index
SUCES1: User-Oriented Improvements	.682	.000	.232
SUCES2: System Effectiveness	.687	.000	.236
			Total .468

Predictor (Seven Factors Generated from MIS Downsizing Activity variables)	Canonical Loading 1	2
CSF1: Communication between users and MIS department	.129	-.065
CSF2: Management objectives of MIS/DP operations	.731	-.019
CSF3: Commitment and support of MIS downsizing	.001	.168
CSF4: MIS department's service function	.367	-.185
CSF5: User participation	.440	-.361
CSF6: Appropriate applications	-.002	.485
CSF7: User satisfaction	.325	.759

Regression analysis was performed on each success factor (SUCES1 and SUCES2). Table 4-36 shows the regression model for SUCES1 (User-Oriented Improvements) and the variables composed in each factor. In the regression model for SUCES1, the correlation between SUCES1 and the three independent variables (CSF2, CSF5 and CSF4) is 51.8 percent. R^2 is .268 and indicates that 26.8 percent of the variance in SUCES1 is explained by the three independent variables (CSF2, CSF5 and CSF4). The F-statistic for the regression model is .000, indicating that there is sufficient evidence to support this regression equation. The t-test for each coefficient, except for constant, is less than .008, indicating that each coefficient is significantly different from zero at the significance level of .008 or less. The significance level of t-test for the constant is .969. This indicates that the null hypothesis (constant is equal to zero) cannot be rejected, and that the coefficient for the constant is equal to zero. Therefore, from this equation model, "Management objectives of MIS/DP operation (CSF2)", "User participation (CSF5)" and "MIS department's service function (CSF4)" can be used to explain and predict one part of MIS downsizing success -- "User-Oriented Improvements (SUCES1)."

TABLE 4-36

REGRESSION FOR SUCES1:
USER-ORIENTED IMPROVEMENTS

Multiple R = .518	R Square = .268	Signif F = .000

Dependent Variable	SUCES1: User-Oriented Improvements	Factor loading
	Y7 Overall Productivity of the Users	.8465
	Y6 Response to users' priority	.7823
	Y5 Relevance and Quality of Output for Users	.7724
	Y4 Generate Flexibility of the System	.6921

Independent Variables	Regres Coeff	Sig. T
CSF2: Management Objectives of MIS/DP Operation	.394	.000
X2: Improve organizational effectiveness & performance		
X3: Increase the quality of decision making		
X5: Improve general organizational effectiveness		
X29: Promote high quality user database and applications		
X31: Reduce the data processing and maintenance cycle		
X32: Improve the efficiency of applications for users		
CSF5: User Participation	.273	.006
X8: Permit control over IS services by users		
X11: Generate users' positive attitudes toward IS downsizing		
X13: Generate users' participation in the IS downsizing design		
X14: Involve users in downsized IS		
CSF4: MIS Department's Service Function	.211	.008
X6: Improve users' confidence in the system		
X17: Provide a basis for control of standards, policies, etc		
X19: Provide reliable and qualified IS services		
X27: Promote users' commitment and support for the IS downsizing concept		
X35: Implement appropriate applications for downsizing		
Constant	-.003	.969

Table 4-37 shows the regression model for SUCES2 and the composed variables of the predictor variables. In this regression model, the correlation between SUCES2 (System Effectiveness) and independent variables (CSF7) is 31.4 percent. R^2 is .099 and indicates that only 9.9 percent of the variance in SUCES2 is explainable by the independent variables (CSF7).

The results from Table 4-37 presents that this is not a good prediction model, even though the F-statistic is significant (significant F = .000), because there is only one tenth of the proportion of variance in SUCES2 that can be explained by CSF7 (User satisfaction). The t-test for the coefficient is less than .000, indicating that each coefficient is significantly different from zero. The significance level of t-test for the constant is .956. This indicates that the null hypothesis (constant is equal to zero) cannot be rejected, and that the coefficient for the constant is equal to zero. Therefore, from this equation model, "User satisfaction (CSF7)" can hardly explain and predict the other part of MIS downsizing success -- "System Effectiveness (SUCES2)."

TABLE 4-37

REGRESSION FOR SUCES2:
SYSTEM EFFECTIVENESS

Multiple R = .314	R Square = .099	Signif F = .000
Dependent Variable	SUCES2: System Effectiveness	Factor loading
	Y3 Cost Savings in MIS Management	.8856
	Y2 Time Savings in New System Development	.6469
	Y1 System Availability and Timely Response	.6024
	Y8 Speed and Efficiency of Applications	.5409

Independent Variable	Regres Coeff	Sig. T
CSF7: User Satisfaction X7: Improve access to the system X9: Increase the use of downsized information systems X15: Generate user satisfaction with the downsized IS	.318	.000
Constant	-.005	.956

Multicollinearity represents a possible explanation of causing the regression model unreliable. Some MIS downsizing activities may be highly interrelated. For example, MIS department's support service maybe highly interrelated with communication between top management and users. Communication between users and the MIS department may be highly interrelated with commitment and support from top management and users. However, eliminating the multicollinearity is beyond the scope of this research and rather is left as avenue of research in future studies. The following chapter presents discussions, implications, conclusions, possible future studies, and a summary.

CHAPTER V

DISCUSSION, IMPLICATION, AND SUMMARY

This chapter presents a discussion of the findings and implications, possible limitations, and a summary of the research. The first section presents a discussion and draws implications based on the data analysis. The second section describes the potential contributions from this study. The third section discusses the possible limitations of this study. The fourth section suggests possible future studies. Finally, the fifth section presents a summary and conclusion.

Discussions and Implications

As indicated in the previous chapter, 128 usable questionnaires were received representing a response rate of 14.32 percent. The data analysis indicated a possible response bias due to the different distribution between the entire sample and the 128 respondent firms. Therefore, the findings can only be extrapolated to the population as a whole with extreme care.

A possible explanation for the different response rates is that more management information systems (MIS) managers from larger firms responded to the questionnaire

than MIS managers from smaller firms. As evidence of such bias it should be noted that: 23.4 percent of the respondent firms had annual sales of more than $600,000,000; yet in contrast, only 4.3 percent of the 1,000 firms had annual sales of more than $600,000,000. Also as further evidence of response bias due to large size of the responding firms, 10.2 percent of the respondent firms had more than 20,000 employees; yet again in contrast, only 4.6 percent of the 1,000 firms in the sample had more than 20,000 employees.

Another possible reason is that large firms presumably are more likely to have had experience with MIS downsizing and are more likely to take an interest in this study. Smaller firms may have had less experience with MIS downsizing or may have been operating in environments with existing downsized MIS. Because these smaller firms are less likely to be able to compare their MIS performance before and after downsizing, they may be less likely to reply to the questionnaire. Lack of experience with downsizing of MIS in smaller firms is a testable hypothesis and an interesting possible future study.

The results of preliminary reliability testing were satisfactory. Each Cronbach's alpha for the proposed hypothesis exceeds .65. The posterior reliability testing results were also satisfactory. The lowest Cronbach's alpha for the extracted factors was .7167. Thus, none of

the items needed to be eliminated from the statistical analysis. The high reliability of the tests suggests that the research instrument is reliable and consistent.

Validity testing shows that most of the variables have a straightforward loading. The questionable variables have been assigned to the factor on which they load the highest and which also matches the suggestions of the literature.

The significant results from canonical correlation analysis support the research hypotheses, both the hypotheses of the original designed research model and the hypotheses of the seven composite critical success factors (CSF). The canonical correlations are significant for each hypothesis. Most of the hypotheses have a cumulative redundancy index higher than 80 percent. That means more than 80 percent of the variance of MIS downsizing success can be explained by the particular MIS downsizing activities. The six sets of hypotheses for the research model were significantly supported.

The canonical correlation results for MIS downsizing success and the seven CSF extracted from factor analysis support the originally designed research model. The seven CSF and their elements are presented again in Table 5-1. The seventh factor, user satisfaction (CSF7), can be considered a subset of user appreciation which is a

surrogate for user satisfaction. Since "increasing the use of a downsized MIS (X9)", "improving access to the system (X7)" and "generate user satisfaction with the downsized MIS (X15)" represent user satisfaction (CSF7), they serve to support the hypothesis that user appreciation is related to MIS downsizing success (H_1). Figure 5-1 and Table 5-2 show the seven derived CSF follow a logical consistency with regard to the original research model.

The seven CSF can be subjectively mapped with Rockart's CSF and Martin's CSF (refer to Table 4-10 of Chapter IV), and consequently, the seven CSF support the research model (the originally designed six sets that determine the CSF for MIS downsizing). Table 5-3 shows that the hypotheses of the originally designed research model have been supported. Table 5-4 shows that the hypotheses of the seven composite factors are also supported.

From research results, prediction models of MIS downsizing success based on the composite CSF and the individual MIS downsizing activities can be formulated. The prediction model of MIS downsizing success from the composite CSF shows that the most important composite CSF for MIS downsizing success are: Management objectives of MIS/DP operations (CSF2), User participation (CSF5), and the MIS department's service function (CSF4). This implies that a successful downsizing of MIS should focus on these

three composite CSF. For each composite CSF, there are certain critical MIS downsizing activities (refer to Table 5-1). The regression equation implies that an organization thus should focus on these critical MIS downsizing activities for a successful downsizing of MIS.

The regression model also supports three originally designed research hypotheses: organizational effectiveness is related to MIS downsizing success (H_5), user participation is related to MIS downsizing success (H_{1a}), and the MIS department's service function is related to MIS downsizing success (H_3). These MIS downsizing activities, particularly those are the elements of CSF2, CSF4, CSF5, should be critical variables for management attention in MIS downsizing.

The prediction model might not include some important CSF due to the stepwise approach; because the stepwise approach only selects those variables that are not selected in a previous step. Therefore, MIS managers should focus on those MIS downsizing activities that have apparently been ignored by the management or the organization.

The other prediction model takes the individual MIS downsizing activities as the predictors. This prediction model shows that the five most important individual MIS downsizing activities are: "to improve organizational effectiveness and performance (X2)", "to improve access to the system (X7)", "to permit control over IS services by

users (X8)", "to reduce data processing and maintenance cycle (X31)", and "to implement appropriate applications for MIS downsizing (X35)." These five individual variables can be considered to represent three different groups of the research model. "Improvement of organizational effectiveness and performance (X2)" is one of the variables for the hypothesis that "organizational effectiveness is related to MIS downsizing success (H_5)." "Improved access to the system (X7)" and "permitting control over IS services by users (X8)" are the two variables from the hypothesis that "user appreciation is related to MIS downsizing success (H_1)." "Reducing data processing and improved maintenance cycle (X31)" and "implementing appropriate applications for downsizing (X35)" are the two variables for the hypothesis that "appropriate applications are related to MIS downsizing success (H_6)." Again, this prediction model might only include the variables that were selected in the stepwise approach.

Therefore, this research suggests that MIS managers should examine MIS downsizing activities according to the importance of the composite CSF. That is "Communication between users and the MIS departments (CSF1)" is the most important criterion, and those MIS downsizing elements of CSF1 should be the most critical MIS downsizing activities. Next, "Management Objectives of MIS/DP Operations (CSF2)" should become the focus.

TABLE 5-1

COMPONENTS OF THE SEVEN CRITICAL SUCCESS FACTORS

CSF1: Communication Between Users and the MIS Department X12 Generate users' understanding of the downsized system X18 Manage IS resources effectively X20 Communicate with users about IS procedures and services X21 Provide training to IS staff and users X22 Respond to user's request for IS support X23 Communicate with users X28 Promote high quality information output X30 Promote high quality applications for the downsized IS
CSF2: Management Objectives of MIS/DP Operations X2 Improve organizational effectiveness & performance X3 Increase the quality of decision making X5 Improve general organizational effectiveness X29 Promote high quality user database and applications X31 Reduce the data processing and maintenance cycle X32 Improve the efficiency of applications for users
CSF3: Commitment and Support of MIS Downsizing X1 Attain organizational objectives X4 Facilitate the management of change X16 Provide competent IS staffs X24 Promote acceptance of the IS downsizing concept to the whole firm X25 Promote support of top management for the IS downsizing concept X26 Design a strategic IS downsizing plan
CSF4: the MIS department's Service Function X6 Improve users' confidence in the system X17 Provide a basis for control of standards, policies, etc X19 Provide reliable and qualified IS services X27 Promote users' commitment and support for the IS downsizing concept X35 Implement appropriate applications for downsizing
CSF5: User Participation X8 Permit control over IS services by users X11 Generate users' positive attitudes toward IS downsizing X13 Generate users' participation in the IS downsizing design X14 Involve users in downsized IS
CSF6: Appropriate Applications X10 Ease the use of PC tools for users X33 Promote applications that make the converting process easier X34 Operate applications that provide competitive advantage for the firm
CSF7: User satisfaction X7 Improve access to the system X9 Increase the use of downsized information systems X15 Generate user satisfaction with the downsized IS

TABLE 5-2

THE RESEARCH MODEL AND THE SEVEN CSF

Research Model (The Originally Designed Six Groups)	Seven CSF (Extracted from Factor Analysis)
H_1 : User Appreciation H_{1a}: User Involvement H_{1b}: User Attitude	CSF5: User Participation CSF7: User Satisfaction
H_2 : Communication between users and the MIS department H_{2a}: Facilitation to users	CSF1: Communication between Users and the MIS Department
H_3 : The support services of the MIS department	CSF4: MIS Department's Service Function
H_4 : Commitment and support from top management and users	CSF3: Commitment and Support of MIS Downsizing
H_5 : Organizational effectiveness	CSF2: Management Objectives of MIS/DP Operations
H_6 : Appropriate software application H_{6a}: The quality of applications H_{6b}: The efficiency of applications H_{6c}: The adequacy of applications	CSF6: Appropriate Applications

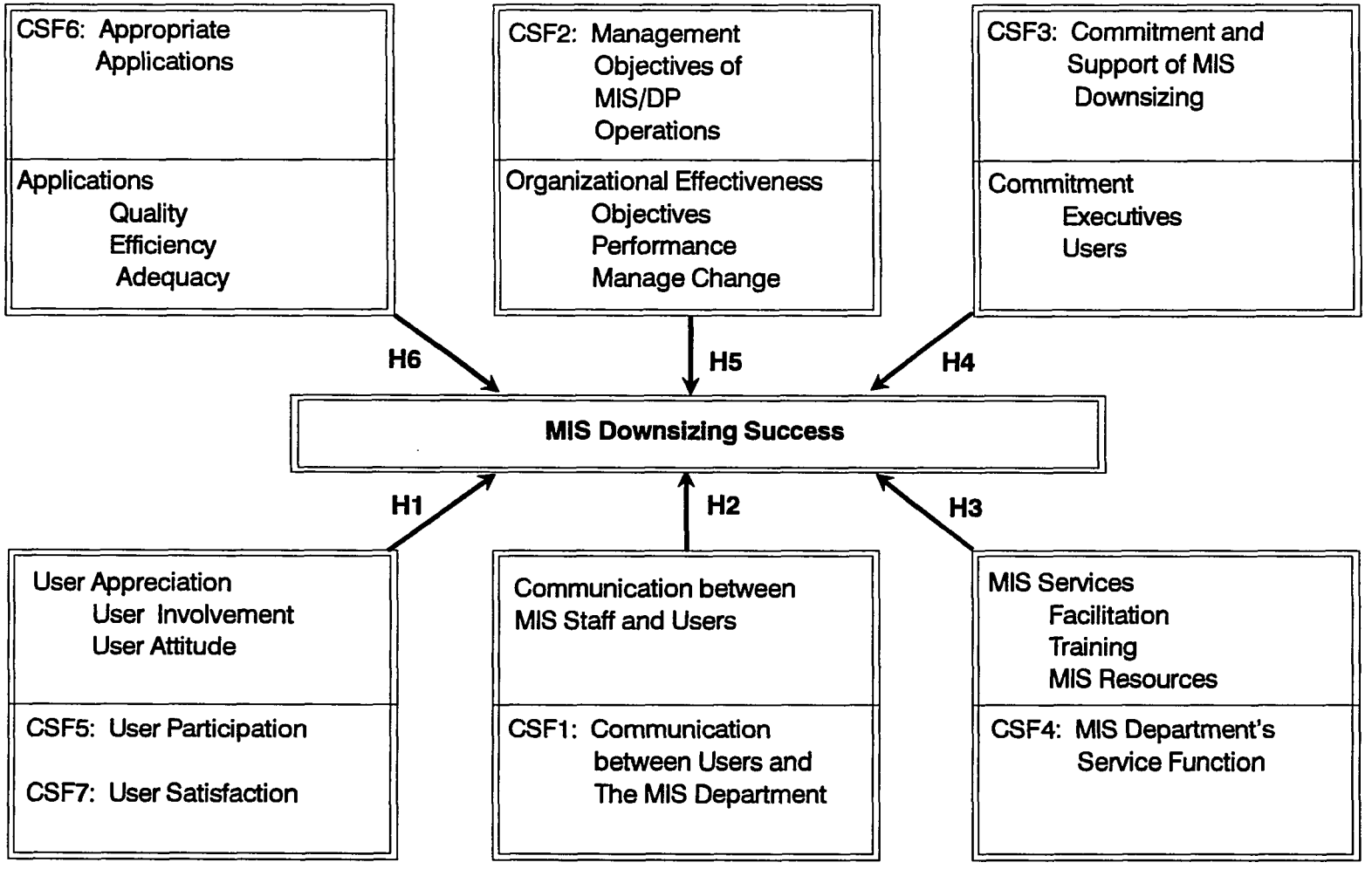


FIGURE 5-1. THE RESEARCH MODEL AND THE SEVEN CSF

TABLE 5-3

THE ORIGINAL RESEARCH HYPOTHESES AND THE RESULTS

Research Hypotheses	Results from Canonical Correlation Analysis
H_1 : User Appreciation is related to MIS Downsizing Success. H_{1a}: User involvement in the process of MIS downsizing is related to MIS downsizing success. H_{1b}: Users' attitude toward MIS downsizing is related to MIS downsizing success.	Significantly Supported
H_2 : Communication between end-users and the MIS department is related to MIS downsizing success. H_{2a}: Facilitation to users is related to MIS downsizing success.	Significantly Supported
H_3 : The support services of an MIS department are related to MIS downsizing success.	Significantly Supported
H_4 : Commitment and support from top management and users are related to MIS downsizing success.	Significantly Supported
H_5 : Organizational effectiveness is related to MIS downsizing success.	Significantly Supported
H_6 : Appropriate software application is related to MIS downsizing success. H_{6a}: The quality of applications is related to MIS downsizing success. H_{6b}: The efficiency of applications is related to MIS downsizing success. H_{6c}: The adequacy of applications is related to MIS downsizing success.	Significantly Supported

TABLE 5-4

THE SEVEN COMPOSITE CSF AND THE RESULTS

Research Hypotheses	Results from Canonical Correlation Analysis
CSF1: H_a: Communication between users and the MIS department is related to MIS downsizing success.	Significantly Supported
CSF2: H_a: Management objectives of MIS/DP operations are related to MIS downsizing success.	Significantly Supported
CSF3: H_a: Commitment and support of MIS downsizing is related to MIS downsizing success.	Significantly Supported
CSF4: H_a: the MIS department's service function is related to MIS downsizing success.	Significantly Supported
CSF5: H_a: User participation is related to MIS downsizing success.	Significantly Supported
CSF6: H_a: Appropriate applications are related to MIS downsizing success.	Significantly Supported
CSF7: H_a: User satisfaction is related to MIS downsizing success.	Significantly Supported

Potential Contributions

The findings from this research support that there is a significant direct relationship between MIS downsizing and certain critical success factors. Several benefits and

contributions are expected from establishing CSF for MIS downsizing success. Some of them are:

1. To provide a check list for MIS downsizing -- From the findings of this research (refer to Table 5-1), MIS managers can attend to what seems to be the most important activities and select an approach to be more likely to achieve success in MIS downsizing. An MIS manager may be able to use the findings from this study as a check list for MIS downsizing. For example, if an MIS manager takes Table 5-1 as a check list and finds that few or no users are involved in the MIS downsizing activities, then he/she should set up procedures for increasing users' participation.

2. To provide a guideline for MIS resource management -- MIS managers may be able to use the CSF findings (refer to Table 5-1) of this research for better MIS resources management, such as investment in hardware, software, and human resources. For example, through communication with users, an MIS manager may make a decision for purchasing or developing appropriate software for users' needs. The elements of "Communications between users and the MIS department (CSF1)" (refer to Table 4-9) may provide a guideline for this type of communication, i.e., "communicate with users (X23)", "respond to user's request for IS support (X22)", or "communicate with users about IS procedures and services (X20)."

3. To identify information needs -- The CSF may be useful for MIS managers to identify their information needs as suggested by Rockart (Rockart, 1979 and 1982). For example, during the communication process between MIS managers and line managers, both sides will provide their information needs to each other. Through the results of this and similar research it may be that line managers will understand more about the effects of the downsized MIS, and MIS managers will understand more about the required support services that the line managers need.

4. To evaluate the performance of the MIS department -- The CSF may be useful as criteria for end-users, executives, and managers to evaluate the performance of the MIS department, MIS managers, chief information officers, or other executives. CSF provide a potential foundation for successful MIS downsizing. If certain MIS downsizing activities can not be achieved, or are being ignored by the MIS department, MIS managers, chief information officers or other executives, one may judge that the downsized MIS may not be successful. For example, if users have never been able to "communicate with the MIS department (X23)", never been "provided training from the IS department (X21)", and/or never been "made aware of IS procedures and services (X20)", users may evaluate that the performance of the MIS department is very poor.

5. To evaluate for purposes of system planning and control -- The CSF may be useful as evaluation criteria for system planning and control. MIS managers may be able to take these critical success factors as guidelines for system design and control. For example, during system design, the results of this study clearly show that "users should be involved in (X13)" or "communicated with about proper control procedures for MIS downsizing (X20)", or that the MIS department should "design a strategic IS downsizing plan (X26)" for a successful MIS downsizing.

6. To furnish a foundation for communication -- The CSF can provide a foundation for communication between the MIS department and the user departments as well as improve communication between MIS managers and their directors or subordinates. For example, if the MIS department recognizes that "commitment and support from the users (X27)" is important, then the MIS department will try to "provide the required information, support, or services to users (X19)." To find users' needs, the MIS department may select from several starting points for communication. For example, communication with users may be initiated by "providing training to users (X21)" and "generate users' understanding of the downsized system (X12)."

7. To strengthen organizational goals -- CSF can help the whole organization understand the most important criteria and enhance its competitive stance. For example, if a

downsized MIS "reduces the time for the data processing (X31)", an organization will get required information faster and/or cheaper. If the information is sensitive to time, then a successfully downsized MIS should "provide more prompt information (X34)", thus enhancing the organization's competitive advantage.

8. To provide a base for the future research -- Further research can expand on the findings from this study. For example, the results of this study imply that smaller firms are more likely to have had less experience with MIS downsizing than larger firms. This provides a basis for an interesting future study.

Possible Limitations of The Research

This research is subject to several possible limitations. The first is related to the possible response bias, making extrapolation of the findings to general MIS downsizing questionable. If response bias exists, the findings of this research can only be applied to other MIS departments or to other firms with care. However, even if the response bias does exist, it is possible that, the respondents are adequate representatives because of their experience in downsizing MIS. In other words, if this study had collected data in two-steps, i.e., -- first, by identifying which firms had downsized and requesting them to participate in this research; second, to mail the questionnaire to those firms identified as having

experience in MIS downsizing -- then this study would likely have been free of response bias. A possible future study could conduct a limited number of case studies to compare the results to clarify and evaluate the possible response bias from this study.

A second possible limitation is due to the research subjects, MIS managers. This research takes the approach in which business and industrial MIS managers' perception of CSF is the main target. Other approaches could be from end-users' perception, the performance of MIS organizations, or from the type of computer in use.

A third possible limitation is due to the data. The possibility of collinearity (relationship between two independent variables) or multicollinearity (relationship between an independent variable and a set of other independent variables) may cause the regression coefficient to be unreliable. A study for the inter-relationships between or with a set of MIS activity variables could disclose the inter-relationships. Then if the collinearity and/or the multicollinearity could be identified and removed, a stronger regression equation could be formed.

A fourth possible limitation is the statistical approach. The stepwise regression procedure allows only one variable to enter the regression equation in each step. In the event that some combination of variables would explain a significant portion of the variance, but no

single one is significant by itself, none of them would be included into the regression model. Although studies might take an all-possible-subsets regression approach, there will be a huge number of models to be tested. As a result, the CSF for the prediction model might not be the most uniquely suitable critical success factors; others might also exist. There is no guarantee that the selected CSF are complete, and completeness is a judgmental limitation of this research.

Other Possible Future Studies

This research centers on extracting critical success factors for MIS downsizing. The risks of MIS downsizing are discussed in the literature review section but are not being measured. There are two reasons for this omission: the purpose of this study is mainly to isolate potential success factors, not failure factors; and the questionnaire might have been too long if these questions were included, thereby reducing the response rate. In a fail/success or risk/return relationship, knowing one outcome often gives the other. The possible future study of risk factors may support the findings of this study.

Other studies could compare the MIS downsizing performance by type of organizations, annual sales, number of employees, and years of using computers. In other words, a possible future study might or might not find the differences of MIS downsizing performance among: different

types of organizations, different sizes of organizations, and different experiences in computer operation.

Another possible future study is related to the potential problem of agency. That is a conflict of interests between principals (owners) and agents (managers) (Jensen and Meckling 1976). Because of different incentives and different management functions, MIS managers from different management levels might have different perceptions of MIS downsizing. For example, if a chief information officer initiates the MIS downsizing plan and also designs and carries out the MIS downsizing procedures, he/she is more likely to confirm the decision and the results. However, a lower level information manager who might have to carry out the conversion process and solve the conflicts and problems, might have a different perspective. Consequently, comparing different respondents from different management levels might produce interesting findings for a possible future study.

Summary and Conclusion

The newly developed computer technologies increase the speed and capacities while they decrease the prices of personal computers (PCs), workstations, and mid-range computers. In this study, MIS downsizing refers to moving MIS applications from mainframe computers to smaller computer systems. The term MIS downsizing is construed to include both MIS rightsizing and MIS outsourcing which are

popular in the professional literature. Many organizations have downsized their MIS without theoretical or academic rationalization. Not all of their MIS downsizing efforts have been successful. So, this research has empirically identified critical success factors (CSF) for MIS downsizing success from MIS managers' perspectives in order to aid interested organizations. The research model is based on the classic CSF studies by Rockart (1982) and Martin (1982), along with others identified in newer literature. A mailing list was purchased and questionnaires were mailed to MIS managers from randomly selected U. S. firms. 128 of the returned questionnaires were usable, yielding a response rate of 14.32 percent.

As presented in Chapter I, this research had three objectives. The first objective was to identify the CSF for MIS downsizing success. Seven CSF were extracted by factor analysis judged reasonably identifiable and significantly supported by hypotheses testing.

The second objective was to study actual MIS downsizing practices and provide a possible empirical foundation to extend existing knowledge concerning MIS downsizing success. The previous section discussed "the potential contributions" and "the possible future studies" for this objective.

The third objective was to develop a prediction model for MIS downsizing success. According to the regression

equation, the most important CSF for MIS downsizing success are "Management objectives of MIS/DP operations", "User participation", and "the MIS department's service function."

In order to accomplish the above objectives, five statistical procedures were used. The first procedure was to calculate descriptive statistics which provided demographic information about the respondents. Also, the mean and standard deviations of the eight MIS downsizing success and the 35 MIS downsizing activities were presented.

The second procedure utilized the Chi-square goodness-of-fit test to examine possible nonresponse bias. A possible response bias was found due to differences in the distributions between the entire sample and the 128 respondent firms which favored large firms. The findings can only be extrapolated to the population with caution.

The third procedure utilized Cronbach's alpha to examine the reliability of the questionnaire and factor analysis to examine the validity of the questionnaire. All of the variables were reliable and consistent; the smallest Cronbach's alpha exceeded .65. Most of the variables are valid; they load obviously. The questionable variables had been assigned to the factor on which they load the highest and also matched with the suggestions of the literature.

The fourth procedure utilized canonical correlation analysis to test the hypotheses and identify the CSF. All of the research hypotheses were significantly supported. The proposed six CSF from the research model: "user appreciation", "communication between users and the MIS department", "the support services of the MIS department", "commitment and support from top management and users", "organizational effectiveness", and "appropriate software application", were statistically significant (significance level of .000) for MIS downsizing success. The seven composite CSF derived from the factor analysis were also significantly related to MIS downsizing success. In the order of importance, the seven composite CSF were: "communications between users and the MIS department", "management objectives of MIS/DP operations", "commitment and support of MIS downsizing", "the MIS department's service function", "user participation", "appropriate applications", and "user satisfaction."

The fifth procedure utilized multiple regression analysis to develop a prediction model. The prediction model supports the implication that the most important composite CSF for MIS downsizing success are: "management objectives of MIS/DP operations", "user participation" and "the MIS department's service function."

The potential contributions, the possible limitations, and the possible future studies were discussed in the

previous sections of this chapter. It should be noted that although these limitations seems to be apparent, the findings are reasonably clear. The proposed research model was supported by hypotheses testing. The seven CSF extracted from factor analysis also supported the research model and the research hypotheses.

As this research assesses the evolution of MIS downsizing, the results from this empirical study serve as a foundation for further research. Additional research may provide a better understanding, and thereby improve and/or confirm the findings of this research.

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APPENDIX A

SAMPLE QUESTIONNAIRE

Survey of Information System Downsizing

In this survey, information system (IS) downsizing refers to moving IS applications from mainframe computers to smaller systems (including IS rightsizing and IS outsourcing). Please check the answer that best describes the characteristics of your company.

1. Three years ago, approximately what percent of computer applications operated on your mainframe computers?
   __0% __1 to 15% __16 to 30% __31 to 45% __46 to 60% __61 to 75% __76 to 90% __91% above

2. Now, approximately what percent of computer applications operated on mainframe computers?
   __0% __1 to 15% __16 to 30% __31 to 45% __46 to 60% __61 to 75% __76 to 90% __91% above

3. Two years from now, approximately what percent of computer applications will be operated on mainframe computers?.
   __0% __1 to 15% __16 to 30% __31 to 45% __46 to 60% __61 to 75% __76 to 90% __91% above

4. In your organization, what will be the primary hardware platform after IS downsizing?
   __Stand-Alone PCs __PC networks __Workstations __UNIX Multiuser __Minicomputer
   __Mainframe __Other (Please specify)

Please indicate your opinion about the following statements using the scale: 1 being strongly disagree and 7 being strongly agree. (*Please circle or check the appropriate item*).

(SD) Strongly Disagree 1	(MD) Moderately Disagree 2	(D) Disagree 3	(N) Neither Agree Nor Disagree 4	(A) Agree 5	(MA) Moderately Agree 6	(SA) Strongly Agree 7

Please choose the score that best describes the *improvements in system performance* of your computer-based information processing systems after downsizing.

	SD	MD	D	N	A	MA	SA
1. System availability and timely response	1	2	3	4	5	6	7
2. Time savings in new system development	1	2	3	4	5	6	7
3. Cost savings in operation, maintenance, and IS resource management	1	2	3	4	5	6	7
4. Generate flexibility of the system	1	2	3	4	5	6	7
5. Relevance and quality of information outputed for users	1	2	3	4	5	6	7
6. Response to users' priority	1	2	3	4	5	6	7
7. Overall productivity of the users	1	2	3	4	5	6	7
8. Speed and efficiency of applications	1	2	3	4	5	6	7

Please choose the score that best describes your agreement with the following statements on the importance of IS activities for IS downsizing success of your firms.

	SD	MD	D	N	A	MA	SA
1. Attain organizational objectives	1	2	3	4	5	6	7
2. Improve organizational effectiveness & performance	1	2	3	4	5	6	7
3. Increase the quality of decision making	1	2	3	4	5	6	7
4. Facilitate the management of change	1	2	3	4	5	6	7
5. Improve general organizational effectiveness	1	2	3	4	5	6	7
6. Improve users' confidence in the system	1	2	3	4	5	6	7
7. Improve access to the system	1	2	3	4	5	6	7
8. Permit control over IS services by users	1	2	3	4	5	6	7
9. Increase the use of downsized information systems	1	2	3	4	5	6	7
10. Ease the use of PC tools for users	1	2	3	4	5	6	7
11. Generate users' positive attitudes toward IS downsizing	1	2	3	4	5	6	7
12. Generate users' understanding of the downsized system	1	2	3	4	5	6	7
13. Generate users' participation in the IS downsizing design	1	2	3	4	5	6	7
14. Involve users in downsized IS	1	2	3	4	5	6	7
15. Generate user satisfaction with the downsized IS	1	2	3	4	5	6	7
16. Provide competent IS staffs	1	2	3	4	5	6	7
17. Provide a basis for control of standards, policies, etc	1	2	3	4	5	6	7
18. Manage IS resources effectively	1	2	3	4	5	6	7
19. Provide reliable and qualified IS services	1	2	3	4	5	6	7
20. Communicate with users about IS procedures and services	1	2	3	4	5	6	7
21. Provide training to IS staff and users	1	2	3	4	5	6	7
22. Respond to user's request for IS support	1	2	3	4	5	6	7
23. Communicate with users	1	2	3	4	5	6	7
24. Promote acceptance of the IS downsizing concept to the whole firm	1	2	3	4	5	6	7
25. Promote support of top management for the IS downsizing concept	1	2	3	4	5	6	7
26. Design a strategic IS downsizing plan	1	2	3	4	5	6	7
27. Promote users' commitment and support for the IS downsizing concept	1	2	3	4	5	6	7
28. Promote high quality information output	1	2	3	4	5	6	7
29. Promote high quality user database and applications	1	2	3	4	5	6	7
30. Promote high quality applications for the downsized IS	1	2	3	4	5	6	7
31. Reduce the data processing and maintenance cycle	1	2	3	4	5	6	7
32. Improve the efficiency of applications for users	1	2	3	4	5	6	7
33. Promote applications that make the converting process easier	1	2	3	4	5	6	7
34. Operate applications that provide competitive advantage for the firm	1	2	3	4	5	6	7
35. Implement appropriate applications for downsizing	1	2	3	4	5	6	7

Please check the answer that best describes the characteristics of your company and your position.

1. What is your organization's primary type of business?
   ____Agriculture ____Construction ____Education ____Finance/Insurance
   ____Government ____Health ____Manufacturing ____Mining
   ____Retail ____Services ____Wholesale ____Other (please specify)

2. Which of the following best describes your position in the management structure of your firm?
   ____Upper ____Upper Middle ____Middle ____Lower Middle ____Low

3. Approximately how many full and part-time employees work for your organization?
   __1 to 10 __11 to 30 __31 to 60 __61 to 100 __101 to 300 __301 to 600 __601 to 1,000 __1,001 to 2,000 __2,001 to 5,000 __5,001 to 10,000 __10,001 to 20,000 __20,001 or more

4. Approximately how many years has your organization used computers?
   __< (Less than) 1 year __1 to < 5 years __5 to < 10 __10 to < 15 __15 to 20
   __20 to < 25 __25 to < 30 __30 to < 35 __35 years or more

5. How would you describe the overall performance of IS after downsizing in your organization?

0	15	30	45	60	75	90	100
Complete Failure !	____!	____!	____!	____!	____!	____!	____! Very Successful

6. Approximately what are the annual sales for your organization?
   __Under $1,000,000 __$10,000,000 to $19,999,999 __$100,000,000 to 299,999,999
   __$1,000,000 to $4,999,999 __$20,000,000 to $49,999,999 __$300,000,000 to 599,999,999
   __$5,000,000 to $9,999,999 __$50,000,000 to $99,999,999 __$600,000,000 or more

7. Would you like to have a copy of the results from my survey?
   ____No ____Yes (Please provide a return address or attach a business card)

8. Please add any comments you would like: