CRITICAL SUCCESS FACTORS OF LODGING YIELD MANAGEMENT SYSTEMS: AN EMPIRICAL STUDY

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Hotel, Restaurant, and Institutional Management at Virginia Polytechnic Institute and State University, Blacksburg, Virginia.

by

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ABSTRACT

The primary objective of this research effort was to examine the relationships between successful lodging yield management systems and controllable independent variables in the form of critical success factors (CSFs). The identification of variables consequential to system success is considered to be an important step towards improving system design, implementation, and operation.

Twenty-three system success constructs, 27 potential CSFs, and three confounding variables were identified through an extensive literature review, discussions with system vendors, developers, and users, and through data analysis. Eleven different lodging yield management systems (LYMSs) were identified, and three of them were sampled.

The dependent variables were converted into a single weighted regression factor score using a principal components model. The respondent's position, size of property, and type of property were found to be confounding variables. The dependent and independent variables were correlated to identify the CSFs.

Every independent variable was identified as a CSF for at least one of the three systems, and the strength of the correlations were generally high. System, user, and task factors were found to be highly correlated to system success. Support and environmental factors were found to be moderately to weakly correlated to system success.

ACKNOWLEDGMENTS

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Thank you, everyone.

DEDICATION

I dedicate this work to my beloved wife, Shirley, to my wonderful children, Tess and Justin, to my loving mother, Ann Astor, and to my generous step-father Ted Astor.

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CHAPTER ONE
INTRODUCTION

Lodging yield management systems (LYMSs) are a relatively new class of information systems that have been constructed specifically for the lodging industry. These systems are an adaptation of airline yield management systems and are designed to increase revenue by manipulating micro-economic market variables.

LYMSs represent a technology with the potential to offer lodging organizations significant competitive advantages. Airline yield management systems, the LYMS counterpart, proved to be an indispensable tool for competitive airline companies. Airline companies employing the technology have attributed substantial market and financial gains to the technology. Airline companies that have not used the technology have not performed as well, and at least one company attributed its demise to its competitor's usage of a yield management system (Scheier, 1989). If yield management technology can be perfected in the lodging environment, as it has in the airline environment, it will become a primary competitive weapon.

Even with such potential, industry acceptance has been sluggish. This may be attributed to several factors. First, the lodging industry has always been slow to adopt information technology (IT). Second, the yield management technology required for the lodging environment is different than that found in the airline industry. Third, problems have been encountered implementing and operating the systems because of their complexity and organizational impact. And, fourth, large investments and strong commitments are required to perfect the systems and adapt the organization to the technology.

The primary objective of this research effort is to examine the relationships between successful LYMSs and controllable independent variables. If significant and substantial relationships are found, critical success factors (CSFs) can be identified so that systems can be designed better, users can operate the systems more effectively, and the organization can adjust better to the technology. Researchers have investigated the critical success factors for many different types of information systems, but no one has performed this service for LYMSs.

This study draws from a considerable amount of past information system (IS) research. The literature review has provided the study with theories, ideas, models, and categorization schemes to make the task more productive, manageable, and valuable. Some of these concepts are applied directly and others are modified to fit the research criteria.

This study takes a formal approach to research and the material is presented in a standard thesis format. This chapter introduces the topic; its objectives, its limitations, and describes the study's organization. The second chapter reviews past research and related literature, and introduces elements used by the study to reach its goals. After the literature review, the research methodology is presented. In the chapters following the methodology, data are analyzed, findings are discussed, conclusions are made, the research is summarized, and opportunities for future research are addressed.

The researcher has found this topic to be very interesting and hopes this interest is shared by the reader. The investigation is viewed as a means to contribute back to society while enjoying personal growth in the process. In honor of scientific tradition, the search for truth takes precedence over other aspects of this effort. The fact that this research is even possible must be attributed to the many people who have dedicated their time, effort, and talents towards creating the foundations and technology on which this study is based.

Statement of the Problem

This study identifies and analyzes the relationships between successful LYMSs and controllable independent variables in the form of CSFs. The identification of variables consequential to system success is an important step towards improving system design, implementation, and operation.

The study problem is to identify and isolate variables crucial to LYMS success by investigating potential success variables and identifying the critical ones. Exogenous and confounding variables must be controlled for during this process whenever possible. This study problem entails a series of sub-problems.

1) The LYMS must be defined and qualities that differentiate it from other ISs must be specified.

2) A means to determine system success must be developed.

3) A methodology must be generated to identify and collect variables relating to

successful and unsuccessful operation.

4) Variables identified in step three must be operationalized.

5) A questionnaire incorporating the operationalized variables must be designed and tested.

6) A representative sample must be drawn from the population of LYMS users.

7) The sample must be surveyed.

8) Data must be analyzed to identify the variables critical to system success.

9) The findings must be discussed.

10) Opportunities for future research must be addressed.

Justification of the Study

The topic of this study was selected for several reasons. The researcher is a student of hotel, restaurant, and institutional management, with special interests in information systems. LYMSs are a type of information system expressly designed for the lodging industry. These systems captured the researcher's attention because of their tremendous competitive potential, as demonstrated by the airline industry counterpart: airline yield management systems.

Approximately five years after their inception, an initial literature review in 1991 revealed that very few LYMSs were installed. Mark Eble (1991), a LYMS developer and consultant, was contacted and he confirmed these findings. Further discussion revealed difficulties with user acceptance, design, implementation, and operation resulting from the system's complexity and organizational impact. Eble (1991) found he was required to introduce and educate LYMS users to the yield management concept as part of his sales effort. His most successful installations were lodging units where he was able to facilitate the development of "... a yield management culture" (Eble, 1991). Certain factors appeared to be related to system success and Eble (1991) expressed interest in research that could help make his systems more successful.

Other developers were contacted including Mr. Eric Orkin (1991) of Dover, NH, and Mr. Joseph B. Garvey (1991) of Orinda, CA. Both expressed interest in research that could help identify variables important to the success of their LYMSs and agreed to work with the researcher.

An expanded literature review disclosed a vacancy in the body of knowledge with respect to the identification of variables relating to LYMS success. Many other types of information systems have been studied in this capacity, including decision support systems (DSSs), executive information systems (EISs), industry specific ISs, and management information systems (MISs). The identification and isolation of variables crucial to IS success is a subject that has interested numerous IS researchers including: Baroudi, Olson, and Ives, 1986; Benbasat and Schroeder, 1977; Benbasat and Taylor, 1978; Brent, 1986; Cerullo, 1980; Cheney and Dickson, 1982; Delone, 1988; Ein-Dor and Segev, 1978; Ginzberg 1974; Huber, 1983; Ives and Olson, 1984; Keen and Scott-Morton, 1978; Lee 1989; Liang, 1986; Lucas, 1978; Magal, 1987; Pyle, 1986; Rainer 1989; Rockart, 1982; Sanders and Courtney, 1981; Trait and Vessey, 1988; and Yen, 1989. The identification of success variables provides practical benefits to information system developers and users. It provides the researcher with information for the development and testing of new and existing theory.

This study is justified because inadequate information exists on the topic, problems have been encountered during system design, implementation and operation, the systems have been slow to be received, and industry representatives have shown interest and support for the research.

The industry interest and research support is particularly significant. Educational programs in hotel, restaurant, and institutional management originated from industry demand and have been successful because of their continuous and close industry ties. While the value of basic research cannot be disputed, applied research is particularly appropriate for programs in higher education with strong industry affiliations. It is the intent of this research to provide benefits to both industry and basic research. This is accomplished by the review and compilation of literature, model development and testing, methodological development and testing, hypothesis development and testing, development of a list of variables critical to the success of LYMSs, and a discussion of the findings.

Conceptual and Theoretical Underpinnings

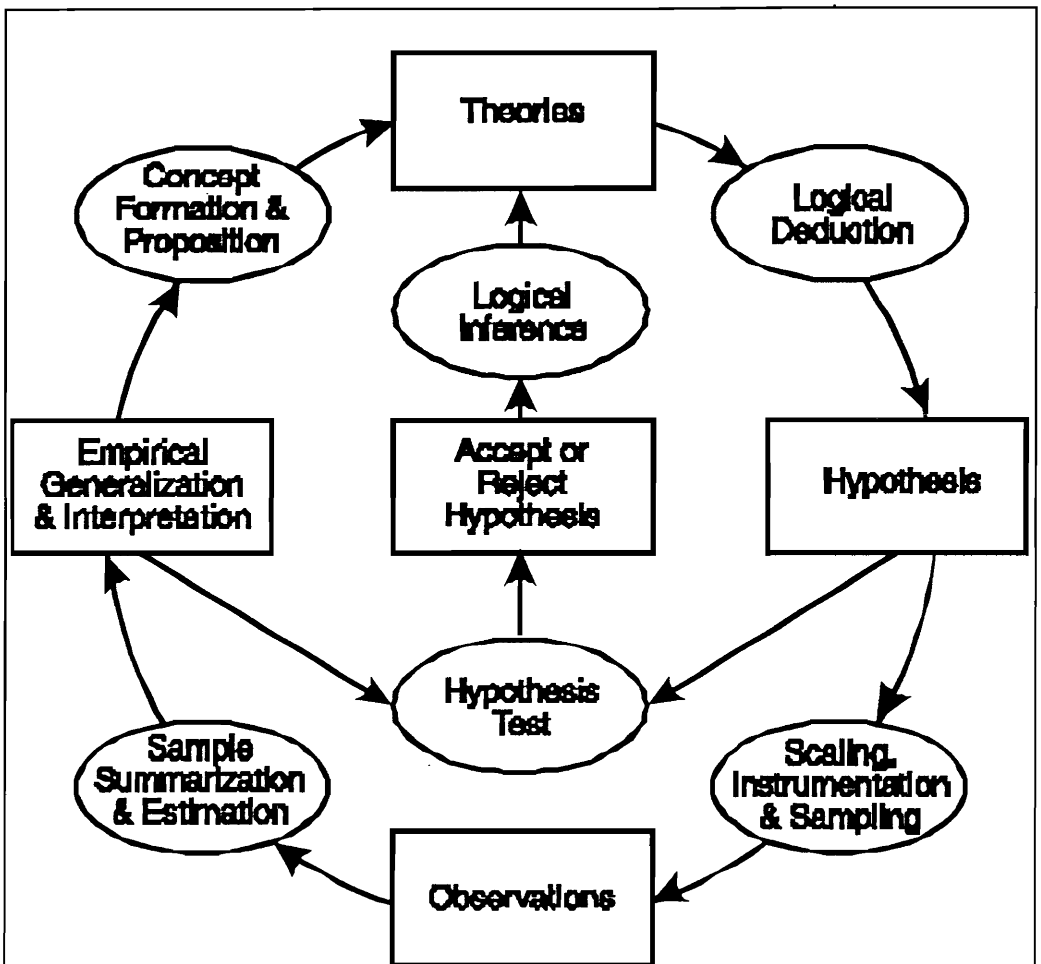
The current body of literature is not developed well enough to make the primary focus of this study LYMS theory development. Nor, is it developed well to LYMS enough to test theories specific to LYMSs. The literature review revealed little research relating variables to system success.

The prime objective of this empirical research is to establish relationships between successful LYMSs and controllable independent variables in the form of CSFs. Because the research is broad-based, it also makes contributions to general IS theory: by testing categorization schemes and adding to the body of knowledge.

As depicted in Figure 1, Wallace's (1971) conceptual model of the scientific approach shows research as a circular process, or, if viewed three dimensionally, helical. It is helical because as new research is added, the body of knowledge is increased, lifting the circle in a spiraling fashion.

In a technical sense, research can begin at any point on the wheel, but in a practical sense, research is most efficient when existing theory is used to develop hypotheses, hypotheses are tested to validate theory, and theory is developed from logical inferences and sound observations. For this reason, and because it makes the research more substantial and significant, current IS theory has been integrated into the development of this study and its research hypothesis.

The meet the objectives of this study, LYMS success variables must be identified and tested. Theory developed by IS researchers is used to make this process more manageable and valid. For example, the IS development cycle has been shown to affect success variables and stage-theory (see "Stage-Theory" in chapter two) is employed to control for this phenomenon. An end-user categorization scheme is used to control for the effect of the user's



Note: Rectangles represent informational components, ovals represent methodological controls, and arrows represent information transformations.

Figure 1
Conceptual Model of the Scientific Approach
(Adapted from Wallace, 1971, p. 8)

system relationship on the user's system evaluation. Employing existing IS theory makes the hypothesis, and the study itself, more useful and more robust.

To identify and isolate variables crucial to LYMS success, the critical success factor (CSF) approach has been selected. This approach is based on the natural phenomenon, and subsequent theories, that some variables are more related to system success than others (Rockart, 1979). This method has proven to be substantial and popular. Numerous Ph.D. dissertations have employed the CSF approach including: Jenster (1985), Larson (1988), Lee (1990), Liang (1986), Magal (1987), McGaughey (1991), Pinto (1986), Pyle (1986), Reddick (1990), Trafford (1987), Williams (1987), and Zadnik (1985).

Park (1990 p. 61) stated the "... CSF concept is likely to gain more acceptance in systems areas, and its importance is likely to increase over time in the future [sic] due to the increased significance of information processing. Therefore, more empirical and normative studies should be carried out to improve the current status of the CSF concept."

The CSF approach contains several conceptual components. Success factors exist at different conceptual levels. They may be categorized using a variety of conceptual models. And, factors may be predicted or explained using a variety of theories and theoretically-based models.

The flexibility of the CSF approach is one of its major strengths and one of its major weaknesses. It often results in the identification of a great number of factors making it difficult to develop and test theory. To help control for this tendency towards factor proliferation, Ligon's (1990) work on causal-based identification techniques was adapted to provide a simple test to identify "critical" factors as opposed to "general" factors.

The review of literature contains a section dedicated to the conceptualization of the CSF approach and goes into more detail on how the method can be applied to identify CSFs for LYMSs.

The design, implementation, and operation of LYMSs, affect, and are affected by, developers, vendors, lodging employees, lodging guests, and the external environment. The roles of developers and vendors are typically assumed by the same entity and are referred to as developers/vendors.

Developers/vendors relate to LYMSs because they design, develop, market, sell, introduce, and support the systems. Lodging employees relate to the systems because they must adapt to and operate them using yield-oriented tasks, tactics, and strategies. Lodging guests relate to the LYMS because their collective market behavior affects system responses and their political interests may affect regulatory legislation. At the same time, many guests may not even be cognizant of the system's operation. The external environment relates to the LYMS both directly and indirectly.

A conceptual model depicting the variables of interest for this study is presented in Figure 2. There are four environments that interact with the system. They include: developer/vendor, user, lodging guest, and general environments. These environments impact the system in a variety of ways.

The system is impacted by the general environment from social, economic, political, legal, and competitive elements. The system is impacted by the developer/vendor, user, and guest environments from advances in computer technology and characteristics of human behavior.

These environments also interact with each other. Developers/vendors, users, and guests are products of the general environment and are subject to its changing conditions. Developers work with users to develop and refine their systems, users are subjected to the designs imposed by the developers, and guests react to the yield-oriented programs designed by developers, executed by the system, and supported and operated by the users.

Because each environment contains variables that modify LYMS effectiveness, the variety and complexity of system and environmental interaction makes it difficult, if not impossible, to begin analyzing the LYMS using a holistic approach. A more reasonable approach is to identify and isolate a portion of the system for introductory research, such as this study.

The primary area of interest for this study includes the LYMS itself, guest, user, and developer/vendor variables that may influence system success. Again, because this study is limited, these variables are examined only from the user's point of view. The term "users" refers to the lodging unit employees that operate and utilize the system.

The interaction between the system, its environments, and temporal events, results in CSFs, as well as exogenous and confounding variables. The control of exogenous and confounding variables represents a challenge to this study. Part of this challenge is satisfied by delimiting the effort to the study of *user* system success. Another part of this challenge is satisfied by controlling variables shown to affect the identification of CSFs in previous

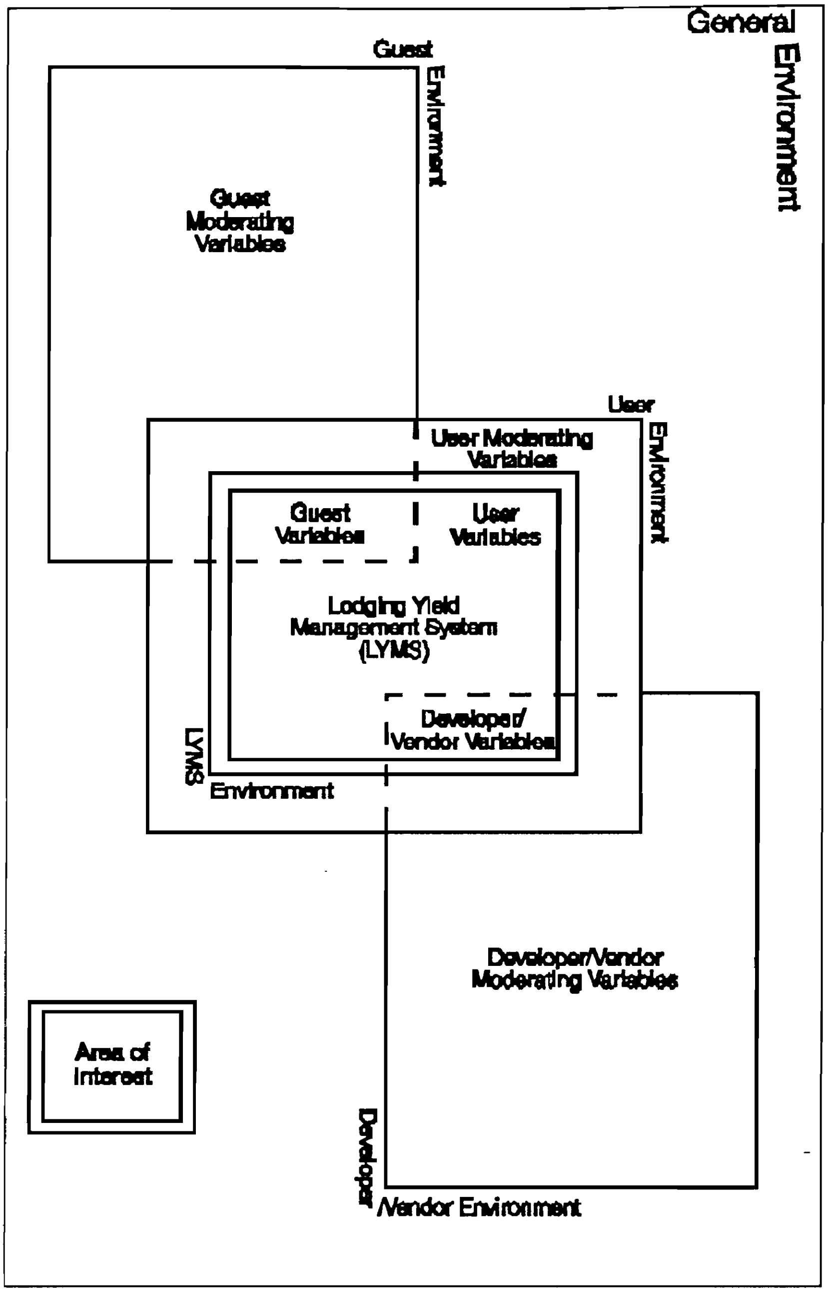


Figure 2
Conceptual Model of LYMS/CSF Study Variables

information system (IS) research.

Potential CSFs are identified using an interview methodology developed by Rockart and a team of MIT researchers (1982). A multiple constituency approach, proposed and tested by Rainer (1989), was used to help insure that CSFs could be identified.

The questionnaire development, sampling, descriptive, and analytical methodologies used in this study were based on standard processes and procedures. Sampling procedures were based on probability theory, and data description and analysis were based on conventional statistical theory.

Purpose of the Study

The primary purpose of this study was to increase the body of IS knowledge by determining what relationships exist between successful LYMSs and controllable independent variables in the form of CSFs. By identifying CSFs relating to the operation of LYMSs the body of IS knowledge can be increased so that developers can improve system design, systems can be better implemented, and users can operate systems more efficiently and effectively.

An increase in the body of knowledge presents a opportunity for researchers to better understand the general nature of ISs, by comparing and contrasting systems and to better understand the nature of LYMSs. Increasing the body of knowledge creates more opportunities to develop IS theory and more hypotheses to test.

Objectives of the Study

The objective of this study are: 1) to determine what relationships exist between successful LYMSs and controllable independent variables in the form of CSFs and 2) to add to the body of IS knowledge in an applied industry setting.

There are several outputs that result from the process of meeting these objectives.

1) A literature review is performed.

2) Applicable theories, models, and hypotheses are identified.

3) Methodologies and categorization schemes are generated to identify, collect, and analyze potential success variables.

4) A set of variables related the successful LYMS is developed.

5) These variables are categorized and operationalized producing a set of survey questions.

6) A set of survey results are realized and analyzed producing a list of potential CSFs for LYMSs.

7) The hypothesis is tested.

8) A discussion on the results of the hypothesis testing is presented.

9) Propositions on how CSFs can be applied to improve the design, implementation, and operation of LYMSs are composed.

Delimitations of the Study

To help control for exogenous and confounding variables, and to restrict the study to a size that can be concluded under time and resource limitations, certain delimitations were established.

1) The performance of different LYMSs will not be compared.

2) This study is delimited to interviewing and surveying developers/vendors and users.

3) The resulting CSFs are restricted to factors relating to goals, as defined by an adaptation of Ligon's (1990) work in isolating critical factors. This delimitation is to minimize factor proliferation and to make the resultant factors more robust. Critical factors are those factors "necessary for achievement" compared to general factors that "would help to achieve" stated goals (Ligon, 1990).

4) This study is delimited to cross-sectional analysis. Time constraints prohibit the use of a longitudinal study, but the research could be extended and expanded at a later date.

5) This study is delimited to property level systems and does not directly evaluate corporate level LYMSs.

Limitations of the Study

This study, like all research efforts, is subject to limitations. Some limitations result from the nature of the study itself, and others from the study's delimitations. Several limitations apply to this study.

1) This study is limited by the financial and temporal resources of the researcher.

2) Because of the subject matter's complexity, it is not possible for all confounding variables to be controlled or for all exogenous variables to be identified.

3) Because this study is cross-sectional, it may not be representative of LYMSs developed after the study is concluded. And, since cross-sectional studies are not able to follow developmental system and organizational processes, some CSFs may remain hidden that can only be revealed in longitudinal studies.

Assumptions of the Study

Certain assumptions are required to proposed and perform this study.

1) It is assumed variables exist, within the population of variables associated with LYMSs, that significantly affect LYMS success.

2) It is assumed these variables can be identified, isolated, and measured using the available research technology.

3) It is assumed a representative sample of LYMS developers/vendors and users will

cooperate with the investigation.

4) It is assumed the people surveyed will, collectively, respond in a truthful manner.

Research Question

The investigation of CSFs for a new type of information system offers many possible research questions. A partial list of these may be seen in the section entitled "Future Research Directions," in chapter five. Because of resource limitations, all questions could not be addressed in this particular study. Instead, only questions related to the primary focus of the investigation were entertained.

Since this study investigated the CSFs of LYMSs, several related questions arise. First, can the CSFs for successful LYMSs be isolated and identified? Second, if they can, how strongly are they associated to LYMS success. And, third, how do these CSFs compare to the CSFs of other ISs?

Since the primary objective of this study is to determine if relationships exist between successful LYMSs and controllable independent variables in the form of CSFs, the main research question that results is: "What relationships exist between the variables identified as potential CSFs and LYMS success?" When stated in its null format it appears as: $H_0 1$: No relationships exist between variables identified as potential CSFs and LYMS success.

Methodology Overview

The methodology used in this study combined methods used in Rockart's (1982) CSF approach, an adaptation of Ligon's (1990) critical factor identification procedure, and traditional research methods for empirical research and analysis.

Potential CSFs were identified through the review of literature, and by interviewing developers and users Two primary constituency groups were interviewed including: developers/vendors and users. The results of these interviews provided the study with potential CSFs that were used to develop the questionnaire.

The questionnaire contains operationalized variables representing dependent and independent study elements. The dependent variables, used to measure system success, were adapted from a questionnaire developed by previous researchers (see Appendix A), information gathered in the review of literature, and information developed from interviews. The independent elements are CSFs, identified from CSF interviews, the literature review, and evaluated using an adaptation of Ligon's (1990) work. Appropriate measurement scales were determined for each set of variables. The questionnaire was then pre-tested and prepared for use in the main study.

The empirical setting and sampling procedures was then determined. The appropriate sample sizes were determined and the samples were selected and prepared for data collection.

The survey data were collected for the main study and described. The data were then prepared, analyzed, and described. The findings were discussed and summarized, and ideas for future research were presented in chapter five.

An overview of the research methodology is depicted in Figure 3.

Definition of Terms

Booking limits - The maximum number of inventory units of a particular bucket (see buckets) that can be sold.

Buckets - The different types of inventory sets. For example, a certain type of room or a certain type of seat.

Distinct rate classes - A bucket of inventory that has been approved for sale in a fixed fashion where the amount offered for sale is independent from other buckets (see nested rate classes). For example, at a 100 room property, 35 rooms are offered at the rack rate, 35 rooms are offered at the corporate rate, and 30 rooms are offered at the package rate.

Effectiveness - A measure of the degree to which a correct decision has been made and realized (Moje, 1990, p. 5).

Efficiency - A measure of the ratio between output and input (Moje, 1990, p. 5).

Elastic demand - Demand for a product is elastic with respect to its price when the percentage change in quantity demanded is greater than the percentage change in price, in absolute terms. A decrease in price will cause total revenue to increase, and an increase in price will cause total revenue to decrease (Truett and Truett, 1987).

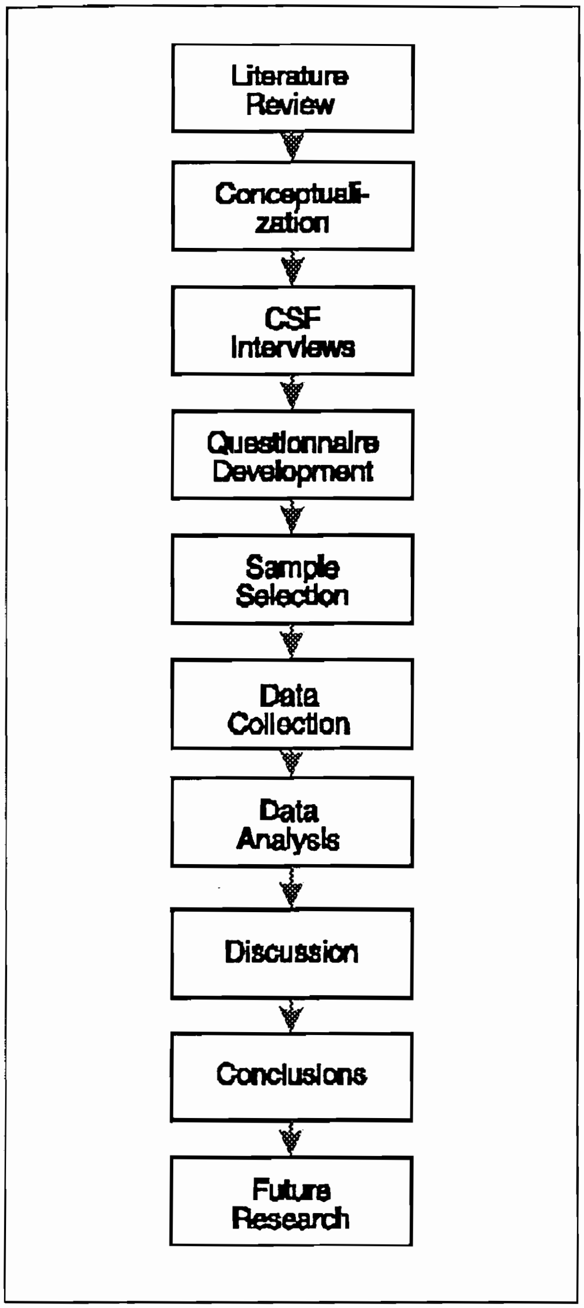


Figure 3
Research Methodology Flow Chart

Expert System - A computer-based information system performing at or near the level of a human expert in a particular field of endeavor. Its components typically include a knowledge base, inference engine, control subsystem, rules or frames, and a user interface.

Good(s) - Tangible product(s) exchanged for currency.

Implementation - An on-going process that includes system development from conceptualization, through the feasibility study, systems analysis and design, programming, training, conversion, and installation of the system (Lucas, 1981, p. 14).

Inelastic demand - Demand for a product is inelastic with respect to its price when the percentage change in quantity demanded is less than the percentage change in price, in absolute terms. An increase in price will cause total revenue to increase, and a decrease in price will cause total revenue to decrease (Truett and Truett, 1987).

Lodging Yield Management - A process for maximizing revenue per available room (Kimes, November 1989).

Nested Rates - A bucket of room inventory approved for sale in a variable fashion where the amount offered for sale is dependent on the amount of other buckets sold. Booking limits are bound for lower rates, but variable for higher rates (see distinct rate classes). For example, at a 100 room property, between 35 to 100 rooms are held at rack rate depending on the sales patterns of corporate and package rates. From 0 to 35 rooms are held at the corporate rate, and from 0 to 30 rooms are held at the package rate.

Rack Rate - A standard rate, before discounts are applied, for a particular room or room type.

Service(s) - Intangible product(s) exchanged for currency, goods, or other services.

Threshold limits - The upper and lower bounds of a buffered forecast demand.

Abbreviations

CBIS - Computer-Based Information System

DSS - Decision Support System

EIS - Executive Information System

EMSR - Expected Marginal Seat Revenue

IC - Information Center

IRA - Information Requirements Analysis

IS - Information System

IT - Information Technology

LYMS - Lodging Yield Management System

MIS - Management Information System

MIT - Massachusetts Institute of Technology

PC - Personal Computer

PMS - Property Management System

Organization of the Study

This study takes a traditional approach to its organization. It is divided into five chapters including introduction, review of literature, research methodology, data description and analysis, and discussion, conclusions and summary. A bibliography and appendix follow the last chapter and a vita has been included under the requirements of Virginia Tech's Graduate School.

Parts of this chapter have been included in accordance with preferences expressed by the committee chairs and other parts have added by preferences of the researcher. The section entitled "conceptual and theoretical underpinnings" was found to be very beneficial to the researcher; helping him to formulate a more viable study. Sections on delimitations and limitations were included to differentiate between limitations by design and limitations by nature.

The next chapter, the review of literature, has been divided into two sections. The first reviews the literature on LYMSs and the second reviews the literature on CSFs. Each section is provided with a summary since they contain a large amount of information. The chapter finishes with a summary comparison of CSFs identified in the general IS literature and CSFs identified in the LYMS literature. These summary comparisons are presented in a table format and were compared to the study's findings in the last chapter.

The research methodology chapter begins by discussing the characteristics of LYMSs. It explored and developed methods that may be used to measure LYMS success. The CSF approach was discussed and a CSF categorization scheme was developed. Potential confounding variables were explored and operationalized. The research design was then described in detail including the selection of the research topic, preliminary work and research, CSF methodology, and the research hypothesis. The LYMS population was examined and interviews were conducted with developers and system users. The survey questionnaire was developed by operationalizing variables developed from the literature review and the CSFs derived during interviews. In this chapter the questionnaire is pre-tested and the main study begins.

The data description and analysis chapter discussed the data collection procedures and described the processes used to purify the data and determine what constitutes usable surveys. In this chapter the data were analyzed and assessed for reliability and validity. Mann-Whitney U-tests and Kruskal-Wallis 1-way ANOVA models were used to evaluate distribution differences to establish independence between systems and to identify confounding variables. Factor analysis was used to identify and develop the dependent variables and correlation analysis was used to test the research hypothesis.

The last chapter discussed, concluded, and summarized the findings. This included primary and secondary findings, implications to practitioners and researchers, and limitations of the study. Ideas and questions for future research were also presented in this chapter.

CHAPTER TWO
REVIEW OF LITERATURE

This review of literature is divided into two sections. These include lodging yield management systems (LYMSs) and critical success factors (CSFs).

LYMSs is a relatively new class of information systems (ISs) that are slowly being introduced into the lodging industry. Due to its short history, there is relatively little literature on the subject. Another factor that tends to limit its recorded body of knowledge is the competitive and proprietary nature of the system. Most LYMSs are designed to provide lodging properties with a competitive edge and developers tend to protect their system specifics to maintain a sales advantage.

There have been several articles about the general nature of LYMSs. Most of these were, in some sense, of a promotional nature, especially the early articles. The nature of the LYMS was discussed in an attempt to educate the industry about how they work and what they could do. As the industry became more informed about LYMSs, the systems became the subject of more critical discussions. The systems have also been the subject of several masters theses.

A close cousin of LYMSs, airline yield management systems has a longer history and a larger body of knowledge. Many characteristics attributed to airline yield management systems are related to LYMSs, but the systems have divergent sets of technology. Early LYMS developers discovered that airline yield management systems could not be directly applied to lodging properties because they have distinct yield management attributes. This necessitated the adaptation of many elements. Because LYMSs are related to airline yield management systems, considerable references are made to the airline yield management literature.

Lodging Yield Management Systems

Introduction to LYMSs

A LYMS is a computer-based system that facilitates the lodging yield management process. At its most fundamental level, the process strives to allocate rooms to customers at prices that maximize the firm's revenue. The LYMS attempts to match room prices to market forces using technology, economic theory, and specific strategies.

The technology is based on electronic computer hardware and special purpose yield management software that integrate with existing computer-based lodging property management systems (PMSs). The economic theory is based on balancing supply and demand at the local, or micro-economic level. Strategically, LYMSs attempt to match room prices to market demand: preventing the hotel from filling before high paying customers have purchased their rooms, and by recommending discounts and other sales strategies to prevent rooms from going unsold (Relihan, 1989).

Since the purpose of yield management is to maximize the firm's revenue, critics often suggested that its goal is realized at the customer's expense. When LYMSs are used properly, they are not a systematic method for abusing customers, but a means to align the firm's pricing policies with market demand. Customers who are willing and who can afford to pay more for a room do so and customers who are not willing or who cannot afford to pay for higher priced lodging are able to obtain rooms in exchange for their flexibility.

The lodging yield management process employs the following mechanisms. Customers are identified and segmented on the basis of their demand characteristics. Price elasticity, price boundaries, and time sensitivity are determined for each identified market segment. A sales forecast is made and rooms are reserved for the customer segments that, historically, are willing to pay the highest rates. Since forecasted sales are seldom realized exactly as predicted, pricing adjustments and other sales strategies are used to either attract or discourage customers as the sale date approaches. This process attempts to balance supply and demand forces while providing the greatest amount of revenue, over a given period, for a particular set of rooms. There are many variations to this process, but to be considered true yield management, they must incorporate the concept of revenue maximization.

The availability of powerful computers has made LYMSs possible since many computations are required to keep room prices in balance with market conditions. Without computers, market measures and pricing adjustments could not be determined quickly enough to allow hoteliers to react to market fluctuations on a real-time basis, and they would consistently miss their windows of opportunity.

Relihan (1989) claims that yield management is the same as traditional pricing practices except for the "... frequency and scope of the decision-making process." To a large degree this is true, but the yield management process is also much more structured and formalized and tends to unify the goals and strategies of the operations and marketing departments; departments that have often operated in opposition to each other.

This section will define LYMSs technology, describe characteristics peculiar to yield management, look at organizational infrastructures required to support LYMSs, discuss yield management strategies and tactics, examine the strategic importance of LYMSs, and consider criticisms, applications, and measurements of LYMS success.

Historical Perspective of LYMSs

LYMSs, as we know them today, originated from the adaptation of airline yield management concepts and technology. The airlines began their developmental efforts in the late seventies by searching for ways to increase revenue. At the time, they were not aware of the potential complexity, sophistication, and strategic importance these systems would eventually have on their industry.

The airline's efforts to increase revenue were driven primarily by the repercussions of airline deregulation legislation. This legislation allowed a large number of newly formed airlines to enter the marketplace, sharply driving up competition. To gain and maintain market share, deep discounting was the competitive weapon of choice, by both existing and newly formed airline companies. Over the next decade, the airline industry suffered substantial losses and many companies went out of business (Relihan, 1989).

During this time, yield management systems emerged as a strategic competitive weapon. As the technology was refined, it became more powerful and its benefits became more apparent. Revenue increases of over five percent were credited to airline yield management systems (Belobaba, 1987; Cross, 1986; Lloyds, 1985). According to Airline Business (1987, p. 17), revenue improvements ranging $200 million to $500 million by carriers with $1 billion to $5 billion in revenues resulted from the use of yield management systems. These dramatic results encouraged most of the remaining major airlines to also adopt the technology. They were also an impetuous for continuing with research and development. In 1991 American Airlines received the Franz Edelman Award of Management Science Achievements for the development of its airline yield management system (Aviation Daily, 1991, p. 330).

One result of this high level of activity in airline yield management research and development was a great deal of literature. Much less literature is available for LYMSs since there has been less research and development for lodging applications. While lodging yield management is growing steadily, it has not enjoyed the success of airline yield management systems and has been slow to catch on. During a phone conversation with Mr. Orkin (October 1991), he believed that less than one percent of lodging properties had installed yield management systems as of late 1991. This was also found to be true at the time the research was completed for this study in May of 1994. This may be due to several reasons.

First, the lodging industry has always lagged in adopting high-end technologies. When computers were becoming widely embraced in other industries during the late sixties, the lodging industry was uninterested. Computer technology did not gain wide acceptance in the industry until a decade later. Although the industry benefited from this delay by obtaining better equipment at lower cost, they did not begin their IS learning curve until they actually employed the technology.

Second, strong commitments and investments are required for these systems to be properly designed and integrated into the business. In general, lodging properties have been losing money each year since the tax reform laws of 1986. At that time, properties lost much their investment attraction as a tax shield, and occupancy rates have not substantially increased over the last seven years. Lodging industry experts realize they are from eight to twelve years behind the airline industry in terms of reservation system technology and are only beginning to fund new and powerful systems. Spending the large sums of money required to develop this sophisticated information technology is a major emotional shock for hotel chains, but motivated by the hope it will stop their losses and start making them profits (Pepper, 1990, p. 36). In general, lodging properties have been operating under an increasingly competitive environment and are beginning to rely more and more on information technology.

Third, yield management may be better suited to the airline industry than to the lodging industry. It works exceptionally well with highly centralized information systems and homogeneous products like seats on an aircraft. It is more difficult to apply to lodging properties because lodging products are less homogeneous. Lodging rooms range from bed and breakfast offerings to luxury suites. The products involve varying lengths of stays and include associated offerings, like food and beverage, and gift shops. And, lodging ISs are, in general, much less centralized than those of airline companies.

Fourth, LYMSs, to be most effective, must operate at both the corporate and property levels. These systems can become quite complex and this has made implementation more difficult. A joint project by Marriott, Budget, and American Airlines, the Confirm travel industry reservation system has recently been scrapped after spending three years and over $125 million. The project failed because the reservation database couldn't be integrated with the yield management and decision support software (Halper, August 3rd 1992, p. 10).

Mr. Eric Orkin, an early pioneer in this area, began to apply the yield management concept to lodging properties during the mid-eighties. He developed a software system and an accompanying lodging yield management philosophy. Since Orkin, several other developers have begun to market LYMS products. Most of these are adaptations and variations of airlines yield management systems. Lovelock (1984) for example, proposed a form of yield management he calls the Asset-Revenue Generating Efficiency Measure. It provides measures to compare and integrate production and pricing efficiency.

Yield management applications are not limited to the airline and lodging industries. It has, for example, recently been applied to the locomotive industry. The world's first railroad yield management system was installed in the summer of 1991 by Amtrak. It is part of Amtrak's strategy to turn a profit by the year 2000 and end its use of government subsidies (Wilder, 1991, p. 8). Yield management is also beginning to find applications in other types of service industries, from hospitals to retail companies.

Based on benefits LYMSs provide to lodging properties, the research and development efforts, the increasing sophistication of software and hardware, the lowering costs of LYMSs, and the many successful systems currently installed, there appears to be a strong future.

Relihan (1989, p. 45) believed that models will be developed that optimize pricing of room rates, packages, length of stays, seasonality, group business, and will include special account recognition. Lieberman (1990, p. D4) believed that yield management application will develop to the point where travel agents take bid descriptions on the type of travel and lodging arrangements in which the client is interested. The airlines and hotels will then respond to the bid and if it is accepted by both parties, a reservation will be made.

Definition of LYMSs

Lodging yield management is not well understood because many conceptual variations exist, and because its implementations have employed a variety of strategies. It has even been termed the "dark science" by some members of the hotel industry.

To properly define LYMSs, the yield management process and the computer-based yield management system must both be delineated. As a computer-based system, LYMSs are a subset of management information systems (MISs). MISs, by definition, include all systems that support management decision making (Carlson, 1983; Davis and Olson, 1984). The LYMS is simply an electronic formalization of the lodging yield management process. The lodging yield management process is more difficult to define.

The term "yield" means to produce, to give up, or to furnish (Funk and Wagnalls, 1990). The term "yield management" originated with agriculture and refers to the management of livestock and botanical food production. It was adopted by the airline industry to label their efforts to extract the maximum amount of revenue per flight. The same term is now used to describe the lodging industry's effort to maximize its revenue.

A relatively generic term, "yield management" has been used in the lodging industry for almost any process that attempts to increase the business's profitability by manipulating internal or external variables. It has been used to refer to marginal analysis, supply-and-demand management, rate-and-inventory management, revenue maximization, and sales-yield management (Wolff, April 1989, p. 106, Yield-Management Meet). Ronald Woestemeyer, president of Seabrook Marketing, feels that the name yield management is used by the industry the way Kleenex is use to describe facial tissue (Feldman, December 1991, p. 89).

At its most basic level, lodging yield management refers to the management of marketing variables to maximize revenue. The concept's success with the airlines stems from the very close relationship between revenue and profitability. For businesses with very high capital investments and low variable costs, increasing revenue is essentially equivalent to increasing profits. Thus, an airline's success with revenue incrementation corresponds directly and positively to increased profitability.

As lodging properties began to adopt yield management practices they benefited from a similar relationship between revenue and profits. Like airlines, lodging properties are also capital intensive with relatively low variable costs, but they contain several interrelated profit centers. Because of different profit centers, defining yield management for lodging properties is more problematic.

Orkin (August 1988, p. 114), a pioneer in LYMSs, defined lodging yield management in terms of room revenue. His "yield statistic" is defined as the ratio of room revenue realized over room revenue potential. This is equivalent to the occupancy rate multiplied by the room rate efficiency, where room rate efficiency is the average room rate divided by the average room rate potential.

Orkin's (February 1988, pp. 52-53) yield formulas are as follows:

$$\text{Yield} = \frac{\text{Room Revenue Realized}}{\text{Room Revenue Potential}}$$

where,

Room Revenue Realized = Rooms Sold X Avg. Rate of Rooms Sold

and

Room Revenue Potential = Room Available X Avg. Rate Potential

Yield = Occupancy Ratio X Room Rate Efficiency Ratio

where,

$$\text{Occupancy Ratio} = \frac{\text{Rooms Sold}}{\text{Rooms Available for Sale}}$$

and

$$\text{Avg. Room Rate Ratio} = \frac{\text{Avg. Rate of Rooms Sold}}{\text{Avg. Rate Potential}}$$

Thus,

$$\text{Yield} = \frac{\text{Rooms Sold}}{\text{Rooms Available for Sale}} \times \frac{\text{Avg. Rate of Rooms Sold}}{\text{Avg. Rate Potential}}$$

Kimes (November 1989, p. 15) pointed out that one problem with Orkin's yield statistic is the difficulty of defining the average room rate potential, also expressed as the maximum average room rate. What exactly is meant by maximum average room rate? Is it the average rack rate set in relation to competition? Is it the average rack rate set from historical precedence? Is it an arbitrarily set average rack rate? Or, is it a hypothetical maximum average rate set by what marketers feel the market will bear? A rate that cannot be readily specified since the market is typically dynamic.

Kimes (November 1989, p. 15) suggested that a better definition, more in-line with what airlines propose, is the process of maximizing revenue per available room. In this case, Kimes is referring to the firm's total revenue, not just room revenue. As she stated in an earlier work the objective of yield management is to maximize the revenue of the firm, including, but not limited to, revenue from rooms, restaurants, gift shops, meeting rooms, and banquets (Kimes, October 1989).

Badinelli and Olsen (1990) also asserted that the value of goods and service products beyond the room rental must be factored into the LYMS model. They found this requirement to be a major distinguishing feature between airline yield management systems and LYMSs.

The lodging yield management process may best be defined as the measurement and manipulation of internal and external microeconomic lodging variables, such as inventory, pricing, guest incentives, and guest perceptions, to allocate specific lodging capacities to specific market segments at prices that maximize total firm revenue. Its theoretical underpinning is based on the economic principles relating to the interaction between supply and demand.

When too narrow a definition is used, or when the definition does not consider total firm revenue, the lodging yield management process is subject to shortcomings. Dunn and Brooks (1990) suggested that the market-demand pricing revenue approach of yield management systems is ineffective for long-term pricing decisions and they proposed a "market segment profit approach" where profit by market segment becomes the yield criteria. Under their proposal, market segment profit is determined by analyzing the profit impact by market segments on all property centers.

What would be the consequences if profit maximization became the process focus rather than revenue maximization as Dunn and Brooks (1990) have suggested? Broadly defined, a LYMS considers the profitability of each market segment across all departments because it is focused on maximizing the firm's overall revenue. As long as variable costs across departments are relatively low in proportion to their respective capital investments, increases or decreases in revenue is essentially the same as increases or decreases in profits (Kimes, October 1989).

By focusing on profits, rather than on revenue, an emphasis is often placed on cost-cutting rather than revenue-generating methodologies because it is easier to manipulate cost-cutting variables. Cost-cutting methodologies can also result in a short-term focus and, if not carefully controlled, will reduce the customer's value perception of the lodging experience. The success of yield management has resulted from its focus on revenue generation methodologies, rather than on cost-cutting methodologies. As long as revenue generation remains the process focus, the system remains a yield management system, whether it uses short-term strategies, or long-term strategies, or measures its success by profitability, or by revenue generation. While the more general objective of lodging yield management may be to maximize profits, the focus must remain on revenue maximization. Dunn and Brooks' (1990) recommendations appear to be the result of a narrow interpretation of the lodging yield management process and reinforces the necessity for the lodging yield management process to be defined broadly, considering total firm revenue.

For the purpose of this research effort, a LYMS will be defined as an electronic computer-based system that formalizes the measurement and manipulation of internal and external microeconomic lodging variables to allocate specific lodging capacities to specific market segments at prices that maximize the firm's total revenue.

Application Characteristics of LYMSs

Yield management is not a complex process conceptually, but its application can become quite complex. It may help the reader to understand these application complexities by describing the application characteristics of LYMSs. At the broadest conceptual level, the yield management process can be applied to a variety of settings from transportation, to lodging, to health, to retail services. It is most useful and appropriate when a firm is operating with a relatively fixed capacity, when demand can be segmented, when inventory is perishable, when products are sold in advance, when demand fluctuates, and when capacity production costs are high (Kimes, October 1989). Most lodging properties fit this description and are therefore good candidates for yield management.

Fixed Capacity and High Production Costs

When production capacity is variable and relatively inexpensive, capacity can be increased or decreased to match demand. When production capacity is relatively fixed, as with the airline and lodging industries, it becomes critical to manage that capacity to its fullest potential. The high fixed cost of properties results in overhead and interest expenses that make them particularly susceptible to failure during times of economic slowdown.

Lodging properties forfeit income when clients attempt to make reservations and they are already full. It is too expensive and too difficult to build additional rooms simply to accommodate occasional surges in demand. By manipulating prices and using strategic marketing alternatives, LYMSs attempt to extract the highest revenue from the market. They help managers utilize fixed inventories to their best advantage by increasing prices during periods of high demand to the point where demand drops off just as the hotel fills.

Perishable Inventory

Like most services, lodging inventory is perishable. If a room is not rented, the lost revenue can never be recovered. Simply put, room inventory cannot be stored; it cannot be placed on a shelf; it cannot wait for a customer to come along to buy it. This quality provides another opportunity for LYMSs. It is often refered to as the inventory control problem or inventory management problem.

Excluding close-in demand (demand that ocurrs close to the sale date), an unsold room typically becomes less valuable as it approaches its point of sale. In theory, as long as variable costs are covered, some revenue is better than none. The challenge to yield management is to refrain from selling rooms at low prices when it excludes higher paying patrons from obtaining the rooms they desire. At the same time, rooms must not be allowed to go unsold by keeping prices too high. This, in part, explains why good market forecasts are crucial to yield management systems.

<u>Fluctuating Demand</u>

Lodging properties are subject to demand variations on many different levels. Weekly variations occur because commercial travelers book heavier on weekdays and leisure travelers book heavier on weekends. Seasonal variations occur because pleasure travelers are more likely to travel during certain seasons. Variations also occur in daily, monthly, and yearly cycles. Yield management helps to smooth out varying demand by decreasing prices during periods of low demand and increasing prices during periods of high demand, and by providing strategic marketing alternatives.

Product Sold in Advance

If rooms were not sold in advance, lodging properties would be better off with auctions than with LYMSs. Different markets and different properties experience different demands at different times, but almost all lodging properties enjoy some advance bookings.

Since advance sales reduce uncertainty, hotel managers naturally feel more comfortable with advanced sell-outs. Unfortunately, uncertainty and flexibility also make purchasers less willing to pay premium rates when they reserve rooms in advance. Since advance reservations mean consumers have more time to shop around, the farther out a property sells its rooms, the more competitive it must be. Managing the right balance of advanced sales with close-in sales requires sophisticated yield management techniques.

Market Segmentation

Market segmentation is crucial to the yield management process. If the market is homogeneous there is no price differentiation between consumers and no requirement for yield management technology to balance supply and demand.

Commercial and leisure travelers represent some of the most distinct lodging market segments. These segments have quite different booking, demand, and price-elasticity characteristics. Typically, commercial travelers do not book as far in advance as do leisure travelers and are willing to pay more for their accommodations (Greenberg, 1985). In addition, commercial travelers demonstrate less price-elasticity, as a group.

One of the major functions of a LYMS is to determine how many rooms to hold for the commercial traveler segment since they are willing to pay more, but less willing to book in advance. If leisure travelers were to capture the room inventory that commercial travelers would have purchased at higher prices, but at a later date, the property forfeits revenue. On the other hand, if too few rooms are sold to leisure travelers, rooms will go unsold, and the property forfeits revenue. Yield management systems attempt to balance demand between the various market segments.

Other market segments also have special characteristics that can be used to manage their particular lodging demands. Examples of these segments include military, student, government, and foreign travelers. When the booking, demand, timing, and price-elasticity traits for these groups are carefully analyzed, patterns can often be identified. These patterns allow yield management strategies to be developed to optimize the relationship between market demand and room supply.

Multiplier Effect

LYMSs must simultaneously deal with several revenue generating departments. Every time a customer rents a room, other revenue departments increase their sales, in varying degrees. Revenue increase in non-room profit departments that result from room sales, is known as the multiplier effect. These increases must be incorporated into the yield formula.

The multiplier effect makes it difficult to apply airline yield management systems to the lodging environment without considerable adaptation. Airline yield management systems work safely under the assumption that firm revenue is equivalent to seat revenue. Lodging customers purchase more than rooms alone, and allocating reservations only on the basis of room sales can lead to solutions that fail to maximize yield (Dunn & Brooks, 1990; Quain, 1992; Kimes, November 1989). LYMSs should therefore incorporate all revenue producing departments of the lodging property into their revenue calculations. Quain (1992, p. 58) and Dunn and Brooks (1990) suggested that each revenue source be considered across each market segment.

Dynamic Nature

A characteristic common to almost all businesses is the dynamic and uncertain nature of their respective external environments. The external market is dynamic due to constant market fluctuations and uncertain because no one knows how much, in what direction, and for how long market conditions will fluctuate.

Probability theory is often employed to help reduce the uncertainty that managers face controlling their lodging capacities. To use probability-based models in dynamic environments for critical decision making, the calculations should be re-computed every time a variable changes its value. This makes computer-based LYMSs ideal candidates for capacity management.

Quality LYMSs must incorporate both probabilistic and dynamic components. There is uncertainty to the total number of bookings that will be made for each type of room and uncertainty to the timing of when rooms will be booked. LYMSs incorporate dynamic components because as the number of bookings vary each day, future estimates are affected, changing the allocation of remaining rooms among room types (Belobaba, May 1987, p. 67).

Pricing

Pricing is critical to LYMSs. Pricing in combination with the marketing mix are the variables most frequently used to control booking rates, which in turn controls room inventory. Market segments with elastic demand characteristics are, by definition, most responsive to changes in pricing. Properties must be able to increment prices by amounts small enough to adjust demand without precipitating an overreaction by the market. When demand is low, yield management offers more pricing options than what could be comfortably handled without a LYMS (Breen, November 1991, p. 29). Barbara Amster, American Airlines yield management vice-president, stated, in many cases, eight classes are enough. If prices are cut any finer they become difficult to manage (Feldman, December 1991, p. 89).

One of the most accurate ways to estimate the top price a particular segment is willing to pay is to survey current market rates since customers often do the same to determine their own top prices (Badinelli & Olsen, 1990). Because rates are frequently offered in response to competitive pressures, controlling the rate mix is as important, if not more important, as controlling prices (Belobaba, May 1987, p. 63).

LYMSs are able to automatically adjust room prices as market conditions change and as the sale dates of rooms approach their actual rental points. This may be done by directly changing room rates or by opening and closing rate categories. The rate mix may be established by property experts but the formalization of the rate structures and the ability to test them make the LYMS an indispensable part of the pricing component. Pricing is the most frequently used variable to control market demand for room inventory.

Inventory Control Techniques

Several different technologies may be used to adjust pricing, or open and close rate categories, and thus control room inventory. These methods include, but are not limited to: simulation, mathematical programming, economic based, and artificial intelligence technologies. LYMS inventory control technologies must work closely with demand forecasting. The solutions inventory control technologies provide are dependent upon sales forecasts. Some of these technologies, like artificial intelligence, may be used for both inventory control and demand forecasting.

Simulation Techniques

Simulation is a powerful allocation technique because a variety of variables can be introduced and tested in the process of maximizing yield. At this time, it does not seem to be a useful tool for LYMSs because it consumes an excessive amount of computer resources in dynamic applications.

Mathematical Programming Techniques

Mathematical programming techniques seek to derive the best inventory allocation solution. They are based on mathematical algorithms incorporating problem variables, probability theory, and operations research models. They include, but are not limited to: linear programming, nonlinear programming, probabilistic linear programming, dynamic programming, goal programming, and network approaches (Kimes, October 1989, p. 351; Relihan, 1989 p44). These techniques are sometimes referred to as optimization approaches.

Mathematical programming techniques have not been applied much to LYMSs, but offer considerable potential because they work well in both static and dynamic environments (Kimes, October 1989). The airline industry is attempting to adapt programming models to their yield management systems and have enjoyed some success but there are several inherent problems.

Belobaba (1987, p. 71) has found shortcomings with all mathematical programming and network formulation approaches because of the assumed independence of rate classes. Rate classes are not independent in the lodging environment because rate refusals may be converted into sales and demand levels are often intercorrelated. Room allotments determined using these methods may fail to maximize revenues in nested rate yield management system. In other cases it may not even be possible to find an analytical solution to the nested rate model. Another problem is that it is difficult, if not impossible, to incorporate all of the variables affecting room allocations into mathematical programming models without overwhelming the complexity and demands it places on computer resources.

Economic Based Techniques

Economic based approaches include marginal revenue models and amalgamations of other economic techniques. Marginal revenue models are popular because they do not typically demand a large amount of computer resources.

Williamson (1988) tested economic based approaches against mathematical programming approaches for airlines yield management systems. The economic based approaches included the leg-based version of Belobaba's expected marginal seat revenue (EMSR), prorated EMSR, and virtual nesting EMSR. The mathematical programming approaches included several types of linear programming. Laboratory tests indicated that the best application choice was dependent on the demand level. For example, at medium and high demand levels, linear programming had the best results and the virtual nesting EMSR had the worst results (Kimes, October 1989, p. 358).

Artificial Intelligence Techniques

Quantitative models do not work well with exceptions and there are variables that are difficult to account for using algorithms. Rapid market changes, unexpected events, and elements that change at random are difficult to incorporate into quantitative models (Belobaba, 1987, p. 66). A mathematical programming model, for example, would be inclined to reject a politically important group at a rate generating a relatively low yield, even if the sale could gain future customers and greater yields in the long-term.

The artificial intelligence expert systems technology can incorporate both qualitative and quantitative decision rules. Expert systems are computer-based systems that encapsulate human expertise in areas of narrow domains. Human expertise is held in a knowledge-base, usually in the form of rules or frames. The expert(s) may be a property or corporate level employee, a third party, or some combination. Expertise is usually based on experience derived under similar conditions.

System performance is limited by the skills and knowledge of the experts used to develop the programs. As conditions change, old rules must be updated and new rules must be added. Considerable system maintenance may be required in dynamic market conditions. For these reasons, expert systems, by themselves, work best in stable environments. Experience has shown that output from expert systems should be considered opinions, rather than solutions, since people who work with these systems often become experts themselves, and may be able to improve upon system derived solutions.

Designing an expert system that enables optimum decisions to be made is a complex process. System output must occur quickly for reservation clerks to respond to rate inquiries on a real-time basis. Expert systems technology can be applied to both room allocation and demand forecasting problems.

An expert LYMS application was developed for the Sonesta in Cambridge, Massachusetts. It required about 2000 rules and triggers to cover a wide range of booking contingencies (Anonymous, Second Quarter 1989, Improving the profit, p. 134) and was scrapped a few years later because of its high maintenance costs.

Neural networks is another artificial intelligence technology that has rarely been applied to lodging allocation and forecasting problems, but offers promise in relatively stable environments. Neural networks capture factor patterns using a weight schema, modeled after human nerve physiology. Patterns relating the problem variables to a successful outcome are developed and interpreted by the neural network program using one of many different algorithms. Under the learning approach, a pattern is computed and its results are compared to the desired solution. The variance is recorded and the program is re-run until the variance between the correct solution and the solution achieved by the program is reduced. Hundreds to thousands of runs may be made until a correct (or very close approximation) is achieved. The resulting weight pattern configuration is typically very robust and may be used to forecast sales. When the desired solution changes, the system must recompute to determine the new weight patterns. For this reason, the performance of neural networks, like expert systems, is limited in dynamic environments until more powerful computers become cost effective. In some ways neural nets behave like sophisticated regression analysis and suffer from some of the same limitations.

Demand Forecasting Techniques

Demand forecasting is crucial to the yield management process. It must address the customer's booking time-frame and spending activities. Long-range estimates are required for lodging properties when group business is involved since some groups book as far ahead as five years. In general, the longer the period between the prediction and the predicted point, the less accurate the prediction. Orkin (1988 February, p. 114) suggested that forecasting be done on a day-by-day basis incorporating weekly, monthly, yearly, and seasonal variations.

There are many different types of forecasting techniques, such as: moving averages, exponential smoothing, and regression analysis. Most of these techniques are rather simplistic when compared to real-world events and one must be careful not to over-rely on forecasting models.

Bookings often follow a Poisson distribution (Beckman, 1958; Kimes, October 1989, p. 351; Taylor, 1961; Thompson, 1961), but to be reliable and accurate, forecasting models must account for many significant variables and their interrelationships. This is a very difficult task at best. The trend for the more sophisticated LYMSs is to integrate several different types of forecasting models in conjunction with qualitative decision making and/or artificial intelligence (Areonomics, 1993). This allows models to forecast standard demand patterns, as well as demand surges around special events and holidays.

The effect of neighboring days must also be included in a quality forecast model. One day's sales is affected by its neighboring day's sales because people who wish to stay for two or more nights will be blocked when one of those nights is prematurely sold out (Orkin, August 1988). For this reason, LYMS inventory control and forecasting modules must work together.

There are several different classes of forecasting technologies employed by LYMSs. Many of these came out of the operations research literature and have been applied and tested in the airline industry. Airlines have some of the most well developed forecasting systems in the world. Their high degree of data centralization helps them do this. Lodging properties, on the other hand, must forecast using less centralized data because some patrons book directly with the property and others book through corporate reservations. It is not unusual for all group business to be managed at the property level. The most common forecasting technologies fall into several categories, including, but not limited to: qualitative, time-series analysis, and causal relationships techniques. The science is difficult to categorize since many forecasting models are hybrids of two or more methods that may incorporate other technologies such as artificial intelligence.

Qualitative Decision-Making Techniques

Qualitative techniques are primarily judgmental and are based on educated and experiential subjective estimates and opinions. The power of judgmental opinions should not be underestimated. It is commonly integrated into sophisticated computerized lodging forecasting systems. People who are in touch with the business and its environment are often well informed and can make accurate predictions. Some experts have developed well-formed heuristics over the years that they apply to their forecasting problems. Other experts may make reliable forecasts but are unable to explain how they do it because they use their intuition. When heuristics are used and can be communicated, they can be incorporated into expert systems, since expert systems are capable of assimilating qualitative and quantitative decision making techniques.

Time-Series Analysis Techniques

Time-series analysis is based on the premise that historical activity can be used to predict future activity. It includes the more traditional forecasting techniques of moving averages, exponential smoothing, regression analysis, and other statistical methodologies. Time-series analysis has enjoyed considerable success as a forecasting tool.

One adaptation of time-series techniques is threshold programming. In threshold programming, actual bookings are compared to a time-series forecasted demand level and the variance is computed. If the variance exceeds a preset limit, known as the threshold, room rates are adjusted to bring the bookings back within tolerance. As Relihan (1989) pointed out, there are several advantages to this approach. It is simple to understand, can be easily graphed, and reduces overreaction by management.

The main criticism of time-series technology is that it only considers historical variations. Changes to the business organization and its environment are not incorporated into the model until after the fact. In most cases, once an event has occurred, it is too late to adjust its impact on the revenue stream. This is why many systems combine time-series technology with other techniques, including qualitative judgments.

Causal Relationships Techniques

Causal relationships are based on the assumption that predicted activity is a result of underlying phenomenon composed of variables that can be isolated and measured. It is difficult to isolate causal variables since there are usually many moderating and confounding variables associated with the variables of interest (Kerlinger, 1986, p. 361). The relationships are often more predictive than explanatory and therefore less reliable than true causal relationships (ibid). The introduction of additional moderating or confounding variables can degrade the predictive power to the point where it is of little value (ibid). Because of this, causal relationships techniques are also best employed in conjunction with other forecasting techniques.

Organizational Infrastructure

Orkin (February 1988) found a supporting infrastructure important to the successful operation of the LYMS. He suggests that four areas are of particular consequence including personnel, guest history database, strategies and tactics, and feedback.

Personnel

Lodging personnel must be sufficiently flexible to adapt to the LYMS. They must be able to respond appropriately to changes resulting from varying demand conditions and top management must create an environment that encourages employees to embrace the LYMS philosophy (Orkin, February 1988).

Guest-History Database

A comprehensive guest history database is required to forecast guest segments and their potential occupancy rates. The system should be capable of providing the information on a day-by-day basis (Orkin, August 1988). If several computer systems relating to sales and operations are functioning within the same environment, they should be well integrated to keep the LYMS updated in a real-time mode.

Strategies and Tactics

"Many critical decisions are made by a casual continuation of past practices, rather than an analysis of and choice for the future (Orkin, August 1988)." Experts believe that organizational strategies must be developed to direct the role of yield management within the organization (Orkin, August 1988; Godwin, 1989; Kimes, October 1989).

At the organizational level, the LYMS strengthens the communication link between marketing and operations, particularly between marketing and reservations. LYMSs are characterized by Sieburgh (1989) as providing unprecedented cooperation between sales and reservations. The formation of this link, the formalization of strategy development, and the maximization of revenue could be considered LYMS meta-strategies.

Mark Eble, a yield management consultant who worked for Laventhol and Horwath noted that "... a yield management program makes explicit a firm's strategies so that those strategies can outlive management." He also pointed out that these systems will not compensate for poor management (Godwin, 1989, p. 8). Sieburg (1988) sees this process as the institutionalization of management intuition where forecast meetings become strategic planning sessions instead of reviews of outdated reports.

Many specific strategies must be developed for the LYMS to operate in the best interest of the business. These strategies include organizational, marketing, operational, and sales strategies.

Organizational Strategies

Planning for revenue maximization requires organizational strategies that support the LYMS. The operations and marketing departments have traditionally worked with some opposition to each other. Marketing worked with a fundamental concern to sell capacity (sell rooms) and operations worked with a fundamental concern to protect capacity (make rooms available).

The LYMS operates under the philosophy of revenue maximization. Depending on demand characteristics, the LYMS may strive towards selling capacity or it may strive towards protecting capacity. Thus, the system provides a strategy that supersedes the traditional and natural interest of the operations and marketing departments individually.

In addition to linking the marketing and operations departments, other organizational strategies supporting LYMS objectives are required for successful operation. Such strategies are likely to change over the system's natural life-cycle. For example, during implementation the organizational strategy may be to gain system approval from each department independently. During integration the organizational strategy may be to develop interdepartmental communication. And, during internalization, the organizational strategy might be to integrate the departments at high developmental levels.

Orkin (August 1988) a LYMS developer/vendor observed that Hyatt and Hilton enjoyed better interdepartmental relations after the implementation of their yield management system. It appeared that yield management systems and their supporting strategies may naturally encourage interdepartmental communication.

Marketing Strategies

Many LYMS marketing strategies may already be in place and some follow directly from the organization's mission statement. They can either affect, or be used to develop, sales, overbooking, incentive, and organizational strategies.

One important LYMS marketing consideration is the market mix. The market mix is often considered as important as pricing for LYMSs, since pricing is frequently bounded by competition. An ideal market mix must be blueprinted along with alternative mixes, since the desired mix may not be realized (Orkin, August 1988). In addition, the preferred market mix will change as organizational and environmental factors vary.

Various marketing strategies may be developed for the organization. Yield management systems, by their nature, support strategies that maximize revenue. While supporting this most fundamental strategy, the system may embrace a variety of sub-strategies, sometimes inadvertently. For example, while demand is high, the strategy of maximizing revenue will tend to set prices high, as if the organization was trying to build an image of high quality. When demand is low, the strategy of maximizing revenue will tend to set prices more typical of those strategies for stimulating incremental demand, increasing market share, establishing presence in a new market, creating an image of price leadership, or driving a competitor out of business. Thus, the natural inclination of LYMSs is to be very responsive in the short-term but lack design for long-term strategies (Kimes, October 1989). This has resulted in criticisms from a few astute researchers.

Long-term marketing strategies are an important aspect of successful lodging organizations and cannot not be ignored. They are developed and employed whether or not they are specifically incorporated into the LYMS. Long-term strategies are realized in marketing plans, advertisements, promotions, maintenance levels, capital investments, employee training, and so forth. The market's reaction to the property, and its competitive position, is responded to by the LYMS through sales strategies. Future LYMSs may better incorporate long-term strategies, but current systems are designed to be programmed more at the tactical and operational levels.

Sales Strategies and Tactics

One of the most crucial functions of the LYMS is its support for reservationists and group sales agents (Breen, 1991, p. 29). Depending on the current marketing strategy, a variety of strategies and tactics can be developed to support the sales effort. Sales tactics for LYMSs may be classified on the basis of guest demand levels.

Orkin (February 1988) has suggested some specific sales tactics for high and low demands. When demand exceeds supply, properties can 1) reduce or cancel low-rate offers and special packages, 2) raise rates, 3) require minimum lengths of stay, or 4) some combination of these. When supply exceeds demand policies should encourage the appropriate promotional efforts. Properties can 1) provide special promotional rates, 2) lower current rates, 3) solicit new business, 3) create and promote low cost packages, or 4) some combination of these.

Sales strategies must be developed to accommodate guests who wish to book across periods where the desired rate is sold out on some of the days requested (Orkin, February 1988). In this situation, the guest might be offered an alternative stay-period at a lower rate, the desired stay-period at a higher rate, or some other stay-period/rate combination, depending on the sales strategy.

The multiplier effect complicates sales strategies. Since LYMSs should be programmed to suggest rates for maximizing overall property revenue, revenue producing areas like food and beverage, banquets, meetings, and shops must be considered when each additional client is booked into the property.

Operational Strategies

Operational areas are directly impacted by LYMSs. Reservations will respond to inquiries by interacting with the LYMS. Marketing mix and pricing will affect the type of client, frequency of visits, and timing of client stays. This in turn affects engineering, maintenance, housekeeping, and front-desk employees. Strategies to integrate the operations department with the LYMS are important to help minimize resistance and to help insure the system is not defeated. Cases have been documented where front-desk employees have used their override power to provide clients with rates lower than what the LYMS recommended, thinking the client will become a loyal customer (Flint, 1988, p. 65).

Reservations is a critical arm of the LYMS since reservationists are often in a position to segment clients and offer appropriate yield-producing rates. Organizational strategies and the resulting tactics of this department must be in-line and supportive of the LYMS or the system will not maximize revenue. For example, supporting policies should permit a rate structure broad enough to balance supply against demand.

Overbooking Strategies and Tactics

Cancellations and no-shows are a fact of life and most hotels will book their properties in excess of 100% whenever possible. In general, no-show and cancellation data is used to form overbooking tactics (Jones & Hamilton, 1992, p. 95).

Overbooking must be executed with caution since walking guests is not only expensive in terms of lost sales, but expensive in terms of lost good-will. There are many variations to overbooking policies that tend to confuse and sometimes aggravate consumers. The most desirable overbooking strategy overbooks exactly enough clients at the highest possible prices to cover the vacancies left by no-shows and cancellations. This is seldom achieved since it involves forecasting a stochastic process.

Probabilities of cancellations and no-shows for each market segment must be computed. Kimes (October 1989, p. 351), stated that cancellations often follow a binomial distribution (Alstrup et al., 1986; Ladany, 1976; Rothstein, 1971). Once cancellations and no-shows are forecasted, a strategy must be developed that maximizes revenue while considering the direct and indirect costs associated with walking clients. If that cost is deemed high, one overbooking strategy might be to remain two standard deviations below the forecasted cancellation and no-show levels. If that cost is deemed low, another overbooking strategy might be to remain two standard deviations above the forecasted cancellation and no-show levels.

Incentive Strategies

Strategies must also be designed to align the interest of lodging employees to the success of the LYMS. This includes management, marketing, operations, and every other department that is related to the system's operation. Front desk employees and reservationists must be encouraged to book reservations in a revenue-productive manner. Marketing personnel must be encouraged to sell, advertise, and promote in a revenue-productive manner. And, management must be encouraged to run the property in a revenue-productive manner.

Hotel operators have traditionally been evaluated on occupancy percentage and average room rates. This has led to a "seesaw effect" where managers tend to forsake either the occupancy percentage or the average room rate for the other (Orkin, August 1988). Managers will lower average room rates to raise occupancy percentages, or raise average room rates to lower occupancy percentages, in order to keep occupancy and rate statistics in-line with what they believe ownership expects. By evaluating managers on the basis of yield formulas, they are encouraged to focus on increasing overall property income, rather than on keeping the average room rates and occupancy percentages "looking good," but independent of each other. "Any [lodging performance] measure that creates such a conflict between the hotel's best interest and the statistical representation of productivity is seriously flawed and will not effectively promote yield maximization (Orkin, August 1988, p. 114)." Managers must therefore be encouraged to set yield-productive policies for themselves and their employees by engaging the appropriate performance incentives and by measuring them with the appropriate yield statistics.

Feedback

The LYMS should be supported through feedback. Feedback provides information about variables relating to the performance of the LYMS. Without this feedback Orkin (August 1989) believes the system could perform poorly without the organization being aware of it. Feedback that tracks the system's performance allows management to make adjustments to help prevent major revenue losses.

Strategic Importance of LYMSs

Not enough LYMSs are installed to evaluate the strategic importance of LYMSs across the industry (Eble, 1991). The lodging industry has been slow to adopt LYMSs and the technology has not been perfected. Estimations relating to the potential strategic importance of

LYMSs may be derived from experiences in the airlines industry and by the logical implications of a competitive lodging environment with revenue maximization tools.

The airlines developed, adopted, and perfected yield management in about a ten year period. This provides a basis for analyzing the potential strategic impact of yield management systems within the lodging industry. The airline industry's experiences may not parallel the future of the lodging industry but, it is of value to review the literature base.

It is generally accepted that airline yield management systems have become very important to airline companies. They have been credited to have made the difference between success and failure for the airline companies employing them. Donald Burr, founder of People's Express, believed American Airline's use of yield management was the primary reason his airline went bankrupt (Scheier, 1989, p. 127).

People's Express was a no-frills, low fare airlines, that grew rapidly. The airline was a competitive threat to all airlines that flew the same routes since the market was relatively elastic. American Airlines used computerized yield management pricing tools to match Peoples Express's low fares on seats that would otherwise go unsold while selling the rest of their seats at normal prices. For the same cost, clients opted for American Airlines over People's Express because American provided a better value (its purchase included more amenities). In addition, customers who made reservations well in advance tended to commit to the company (Freedman, 1989, p. 52). The market was small enough that American Airline's cut into People Express's market share eventually pushed them out of business.

Airline yield management systems are routinely used as competitive weapons as well as incremental revenue generators. R.L. Crandall, chairman, president, and CEO of American Airlines stated, "We estimate that yield management has generated $1.4 billion in incremental revenue in the last three years alone. This is not a one-time benefit. We expect to see yield management generate at least $500 million annually for the foreseeable future" (Smith, Leimkuhler, & Darrow, 1992, p. 31). John Watson, CEO of British Airways stated "Yield management saves us tens of millions of pounds a year." (Layne, 1989, p. 45).

Many characteristics of the lodging environment make LYMSs good candidates for strategic applications similar to those used in the airlines industry (see Characteristics of LYMSs, in this chapter). Lodging and IS experts are predicting that LYMSs could easily become a strategic competitive weapon as its counterpart has for the airlines. The first lodging yield management conference occurred in April 1989 at Charlotte, NC and was sponsored by James C. Makens and Associates and Pace Communications. The key note speaker, Ronald A. Nykiel, Senior V.P. at Stouffer Hotels, believed by the year 2000 only the lodging properties practicing yield management will have survived (Wolff, 1989, Newcomer Yield Management, p. 106).

Some hotel chains are taking the American Airline approach by making large investments in information technology. Most of the publicized endeavors are reporting immediate revenue gains. Holiday Inn's Reservation Optimization (HIRO) System is the first length-of-stay optimization system to be integrated with a central reservation system. It takes a black-box approach and has been shown to increase revenue by an average of three percent immediately upon installation. From a strategic point-of-view, Richard Smith, Holiday Inn's vice-president of information technology, believed HIRO puts Holiday about five years ahead of other major lodging chains (Salomon, 1992, p. 33).

It is now difficult to find an airline company without a yield management system. As airline yield management systems became more ubiquitous the strategic benefits have become less tangible, and many airline executives now view the systems as a competitive necessity. A similar scenario could easily occur in the lodging industry.

Criticisms on LYMSs

LYMSs are not without their share of criticisms. Some criticisms stem from the belief that the systems take advantage of the customer in the process of revenue maximization. Other criticisms have to do with the reduction of the middle agent's ability to negotiate rates. And, other criticisms have to do with the implementation, operation, and performance of the systems.

Public awareness of LYMS usage has had both positive and negative consequences. On the positive side, a higher level of public awareness brings greater tolerance to differential pricing based on supply and demand. Airline travelers do not find it unusual to pay different amounts for the same flight and same type seating as fellow passengers. In general, the lodging industry lacks the usage of variable rates and subsequently lacks its client's acceptance. Yet, lodging properties must be able to adjust rates by small degrees to determine price elasticity and to provide pricing control (Relihan, 1989, p. 45). More and more claims of false advertising are being levied against the airlines for yield management price juggling (Cowan & Gargan, 1991, p. D4 col. 1). Negative publicity has resulted from airlines displaying their flights in a biased fashion. This negative publicity has spilled over making the public more sensitive to the issues involving LYMSs. Arthur Weiss, deputy state attorney general of Kansas stated, "We'll have to watch hotels. You don't want to let them play the same games airlines play" (Dahl, 1988).

Consumers often find the multitude of prices difficult to deal with and the process becomes illegal if pricing is used as a bait-and-switch tactic. Bait-and-switch occurs when a low fare is advertised with the intention to limit the number of sales at the low fare and switch customers to a higher fare. Federal Trade Commission and state laws require advertisers to set aside sufficient inventory to meet anticipated demand or to mention the possible shortage in a prominent disclaimer. In the extreme, applying yield management arbitrarily, or too narrowly, could make it discriminatory and illegal (Lieberman, 1990, p. D3). Lodging properties are more vulnerable to legal action than airlines since neither the FTC, nor state advertising laws apply to airline companies. The U.S. Transportation Department has sole authority to regulate carriers (Cowan & Gargan, 1991, p. D4 col. 1).

Travel agents and others who work as middle agents between lodging properties and their guests feel threatened by LYMSs. Wardell (1989, p. 75) stated "It should be obvious that your mission as an agent is squarely in opposition to the objectives of supplier yield management. If you sell your services as a travel management company, your goal is keeping prices down for customers, thereby minimizing the supplier's profit."

Even if lodging properties do not make more money, travel managers fear they will become formidable negotiators since they will have a better understanding of the value of a particular business segment. For example, many travel agents believe the larger the group the better the price they should receive, but with yield management this becomes a fallacy. Under yield management more business at a low rate is not always good business for the vendor (Wardell, 1989, p. 76).

Middle agents also feel their credibility is lowered as a result of yield management practices. Situations occur where the hotel offers rates lower than what travel agents were able to negotiate since rates vary depending on supply and demand. When this happens guests tend to loose respect for their travel agents (Ricciardi, 1992, p. 13). Lodging properties respond to this criticism by saying that travel managers still receive an overall rate that is lower than what yield management would provide over the long-term, but travel agents believe their clients should automatically be offered the lowest rate upon check-in (Ricciardi, 1992, p. 13).

Some planners are concerned they will loose the personal interaction they are accustomed to, but others feel, in the long run, it will make the travel industry sounder (Tritsch, 1989, p. 41).

Like all ISs, LYMSs have implementation, operation, and performance problems. Several types of managerial problems may develop with yield management systems. There may be a loss of competitiveness resulting from a short-term focus. Customers may become alienated as a result of varying prices. Employees may suffer from morale problems since less decision making is required. Changes in the reward systems where sales staff are rewarded for revenue-yield rather than past measures can result in employee complaints and terminations. The system also requires employees to be properly trained and indoctrinated. Good data organization is required and information must be centralized and well integrated into the PMS and corporate-level systems. Implementation requires a commitment by top management. And, even the most sophisticated computer-generated forecast cannot be completely trusted (Jones & Hamilton, 1992, p. 92; Kimes, October 1989, p. 360)

Another interesting problem is that the success of LYMSs may be culturally based. Guido Sonino, route supervisor for Varig, noted that yield management works better in the U.S. than it does in Latin America. According to Sonino, Latin America does not have a plethora of fares and people seldom have to travel at the last minute. Also, he stated, unstable economic conditions lead to constant surprises. Demand is only high a few weeks a year and fluctuations in the exchange rates can reduce revenues when the group actually pays for their accommodations (Lima, August 1991, p. 107).

It is also possible for LYMSs to be undermined. Travel agents might waive restrictions to sell a reservation at a lower fare (Flint, 1988, p. 65). LYMSs can be partially defeated when travel agents check high-priced reservations that have been made in advance and compare them to changing prices on a daily basis. When a lower price is found the high priced reservation is converted to the lower priced reservation (Wardell, 1989, p. 76). This can present a serious threat to some pricing policies, especially when the process is automated. The process can be automated by programming a reservation computer to re-evaluate rates on a daily or hourly basis and convert the reservation each time a lower fare is encountered. This could lead to a technology war where one technology is upped by another in a spiraling cycle, much like radar/radar-detector technology.

Application Requirements of LYMSs

Yield management practices have widespread potential. They can be applied to industries that sell perishable goods or services. These include, but are not limited to, airline, health care, food service, entertainment, car rental, cruise ships, railroad, delivery service, utility, long-distance phone service, and broadcasting companies. Companies in many of these industries are beginning to explore the possibilities of yield management applications.

According to Robert Blattberg, marketing professor at Northwestern University, manufacturing plants can also apply yield management techniques. He explains that every minute a manufacturer is not producing is like a plane leaving with empty seats. Under yield management General Motors would be willing to sell a new car at a lower price if an order was placed in advanced since it allows them to manage their production more efficiently (Anonymous, 1992, Changing the Face, p. A2).

It is generally believed that yield management is a useful and appropriate technique when a firm is operating with relatively fixed capacity, when demand can be segmented, when inventory is perishable, when products are sold in advance, when demand fluctuates, and when production costs are high (Kimes, November 1989, p. 15). Exceptions occur when firms cater to one specific and homogeneous market segment, or when demand is very steady.

LYMS supporters agreed with Dyson (1989, p. 282) when he stated: "The truth is that yield management gives breaks to those who need them most (as shown by their price sensitive behavior), and ultimately will allocate resources more efficiently so that there will be more for all."

The following sections discuss material identified in the literature that could affect the success of the LYMS application. The intent is to provide general information that may be of interest when identifying CSFs. The sections are broken down into three areas: infrastructure, implementation, and program requirements.

Infrastructure Requirements

Infrastructure requirements relate to the organizational resources and structures required to support a successful LYMS. There are a variety of infrastructure factors generically attributed to successful information systems. PC Week interviewed dozens of companies involved in building or using ISs. People involved with some of the most successful systems felt that they succeeded because senior management had vision on how technology could help the company and sold the company on that vision. American Airlines did this by linking marketing with their technical staff to develop a culture that supported yield management. The commitment by upper management was strong. When cash was tight and the system was unperfected, management continued to support and invest (Scheier, 1989 p. 125).

Orkin (February 1988, p. 53) believed successful LYMSs need appropriate infrastructure in several areas. A successful LYMS requires good forecasting information that includes historical transient and group demand data on a daily basis. Successful systems need procedures for rate-setting and promotional packaging. Personnel must be trained for yield maximization and be provided incentives. At a higher level, organizational strategies and tactical plans are needed to move the company towards satisfying the right market mix. Orkin also suggested that successful systems must have general automation as well as feedback systems to properly assess their effectiveness.

Kimes (November 1989, p. 18) also suggested that successful LYMSs need a set of distinct rate structures, proper employee training, and strong systems integration. Systems integration is important to LYMSs because yield management requires dynamic interaction involving intelligence from operations, marketing, reservations, and sales. The LYMS must also be integrated with the lodging pricing and overbooking control systems.

In multi-unit organizations the LYMS must integrate well with the corporate-level IS. When multi-unit properties do not have ISs that keep up with the corporate-level IS, the unit level system tends to limit the effectiveness of the corporate level system, and vice versa (Pepper, 1990, p. 36).

The ability to gather, store, and analyze relevant historical data is crucial to yield management (Belobaba, May 1987, p. 66). Because of this, LYMSs are limited by the reservation history capabilities of specific property management systems (PMSs) (Relihan, 1989, p. 45). Employees must have access to required information and the data processing department must be able to handle the increased activity (Godwin, 1989, p. 8).

Implementation Requirements

System implementation has been the subject of study for a number of research efforts, but very few have studied the implementation of LYMSs. Certain problems and requirements are unique to its implementation. For example, decisions must be made about the initial rate structure.

Most researchers in this area feel it is important that either the needs of the user are taken into serious consideration or the users are actively involved in the design and implementation of the system (Deming, 1981; Ishikawa, 1981). Referring to decision support systems (DSSs), Keen and Scott-Morton (1978, p. 192) state: "The manager's reality is the one in which implementation takes place; the technology to be used must be adapted to that context and not imposed on it."

Jones and Hamilton (1992) studied the implementation of LYMSs by interviewing a number of hotel managers who were using yield management systems. Not one of them had implemented all aspects of yield management as defined by the authors. These aspects included: developing a yield culture, scanning and analyzing the environment, analyzing overall demand, establishing price-value relationships, identifying the market niche, determining appropriate market segments and business mix, analyzing the patterns of demand, tracking declines and denials, and evaluating and revising the system. Most properties, though, were tracking declines and denials, had segmented their markets more carefully, and were analyzing demand patterns more conscientiously.

Almost every manager felt that there were problems implementing yield management that related to people. In particular, there was a tendency to focus on the detailed aspects of yield management without understanding underlying concepts, and the systems did not integrate people into the yield management process very well.

Kasavana (1990, p. 70) suggested the key to successful implementation is to monitor reservations. Kimes (October 1989, p. 351) felt the biggest problems facing a firm during implementation related to data availability and accuracy.

Program Requirements

Program requirements are the operational and tactical behaviors that must be employed by the system and organization to support the lodging yield management process.

LYMSs should incorporate algorithms to address the problem of multiple night stays, the multiplier effect on revenue in other departments, and different booking lead times for different room types and market segments. Since yield management solutions must be constantly updated, it requires a dynamic approach. As new information becomes available solutions must be recalculated (Kimes, October 1989, p. 351).

The LYMS must be able to distinguish between elastic and inelastic demand. If not, the system will loose money for the company (Wardell, 1989, p. 76).

The LYMS should have some mechanism so volume buyers can be considered differently than one-time buyers (Feiertag, 1989, p. 16).

Companies Developing or Vending LYMSs

To begin investigating LYMSs, developers/vendors must be identified. The literature has revealed that the following companies are involved in LYMS technology (Bard 1991, p. 55; Eble, 1991; Salomon, 1990, p. 85; Wolff, 1989, Newcomer Yield Management, p. 106).

Aeronomics, Inc. 112 Governor's Square, Fayetteville, GA 30214, (404) 631-3032, Robert G. Cross, President.

Computerized Lodging Systems, Inc. 4800 Airport Plaza Drive, Suite 160, Long Beach, CA, (213) 421-2191, David W. Berkus, President.

Control Data Corp. 6 Skyline Place, Suite 819, Leesburg Pike, Falls Church, VA 22041, (703) 998-1835, Thomas M. McHugh, International Account Manager.

Delphi/New Market Software Systems Inc., Durham, NH, Bob Horgan.

Eloquent Systems Corp. Box 6235, Manchester, NH 03108-6235, (603) 627-9494, William H. Hunscher Sr., President.

Eric B. Orkin Associates, 10 Lamprey Lane, Durham, NH 03824, (603) 659-7224, Eric B. Orkin, President.

Hyatt International. One Tower Lane, Oak Brook Terrace, IL 60181.

Hotel Information Systems, 400 Ellinwood Way, Pleasant Hill, CA 94523, (415) 827-1212.

James C. Makens and Associates, Winston-Salem, NC, James C. Makens, President.

Laventhol and Horwath, 1845 Walnut St., Philadelphia, PA 19103, (215) 229-6100.

Lodgistix, Wichita, KA, Cassey Corser, Sales Representative.

Miracle, National Guest Systems Corp. Margaret Leitch, Director of Sales.

Revenue Dynamics, 28 Via Farallon, Suite 300, Orinda, CA 94563, (415) 253-1700, Robert C. Regan, President, Also, Joe Garvey, Pleasonton, CA

Revenue Technology Services, 404-399-2141, Gary Cambell.

Unisys Corporation, 2200 Renaissance Blvd. Suite 400, King of Prussia, PA 19406, (215) 278-5550, John S. Graham, Director of Marketing, Also, Patrick A. Barfield, Program Director.

Measurement of LYMS Success

The determinants of IS success in an empirical study are highly dependent upon the measures of success. Different measures are likely to identify different CSFs (Park, 1990).

Researchers and companies alike have found it difficult to accurately measure IS success. The benefits are often intangible, and neither subjective nor objective measures fully capture the impact. Nevertheless, measuring LYMS success is necessary to justify the system's usage and expense.

The system must have both organizational and technical validity. As Christensen (1987, p. 49) explained " ... a system which functions well technically (has technical validity) may not be a success unless it has organizational validity, i.e., is perceived to be useful and usable (of high quality)." Success measures must consider the system's technical qualities, the interface, its impact on the organization, and the organization's impact on the system.

Measures can be either objective or subjective. Examples of objective measures include: increases in profit or revenue directly related to system usage, system utilization, and increased productivity. Examples of subjective measures include level of user-satisfaction, measures of the perceived value of the system by its users, and increases in information quality (e.g. accuracy, reliability, timeliness).

Some variables can be measured in either a subjective or objective fashion. Examples include user decisional performance, cost-benefit analysis, and utility. Some IS researchers feel the use of several different surrogate variables enhance the accuracy of IS success evaluation while others are comfortable employing a sole variable.

More interesting is the variety of variables that have been employed. Delone (1988) measured system usage by tracking the amount of computer generated reports. Ein-Dor and Segev (1978, 1982) also measured system usage. Montazemi (1988) chose to measure user-satisfaction. King and Rodriguez (1978) analyzed contribution to decision performance as a measure of system success. Raymond (1985) measured user-satisfaction and system utilization. And, Park (1990) selected user-satisfaction, systems utilization, and the perceived contribution of the IS to the firm's success for his dependent variables.

Different measures often produce different results since the characteristics of each measure differ (Srinivasan, 1985). This makes it difficult to compare and contrast studies that have selected different measures of success.

Researchers have found that variables relating to the effectiveness of the IS depend upon the system's evolutionary stage (Keen & Scott Morton, 1978, p. 214). This component engenders the possibility that the most appropriate measures of success may change over a system's life-cycle. It also indicates that longitudinal studies may be of particular benefit.

Sprague and Carlson (1982, p. 162) have provided a summary comparison of IS evaluation methods, presented in Table 1. The most common IS evaluation techniques are shown, including: event logging, attitude surveys, cognitive testing, rating, weighing, system measurement, system analysis, cost-benefit analysis, and value analysis. These techniques are compared on the basis of their objectives, measures, treatments, experimental units, assignments of treatments, sampling techniques, analysis, and criteria techniques.

There is considerable debate in the literature about what types of IS success measures are best. Much of the discussion centers on whether it is most appropriate to use objective or subjective measures.

Table 1

A Summary Comparison of System Evaluation Methods

(Adapted from Sprague & Carlson, 1982, p. 162)

Model	Objective	Measures	Treatments & Experimental Units	Assignment of Treatments to Units Plan	Plan for Selecting Units	Analysis Criteria & Techniques
Event Logging	To log system events relating to impact on services	Events relating to services	Before & after implementation. Services	Block on services before & after	Judgmental selection	Qualitative comparison of logged events
Attitude Survey	To determine system impact on users attitudes on service	Questions on services	Before & after implementation. Users	Block on services before & after	Random selection	Chi-square comparison of response frequencies
Cognitive Testing	To determine system impact on decision processes	Role repertoire tests	Before & after implementation. Users	Test before & after system use	Related departmental managers	Comparison of test scores
Rating & Weighing	To determine system impact through service ratings	Ratings	Before & after implementation. Service Parameters	Block on services before & after - Block on evaluators	Judgmental selection	Compare sums of overall times & weight scores
System Measurement	To test null hypothesis of no difference between services	Time, quantities, and others	Before & after implementation. Services	Block on services before & after	All services or random selection	Wilcoxon signed rank comparisons
System Analysis	To determine impact on methods of service delivery	Service aspects	Before & after implementation. Services	Block on services before & after	Judgmental selection	Qualitative comparison of standard descriptions
Cost-Benefit Analysis	To determine impact on cost and benefits of service	Dollar value of system services	Before & after implementation. Cost/Benefit items	Effect of services on department	Judgmental or random selection	Compare cost-benefit ratios
Value Analysis	To determine whether or not to continue	Dollar value of services and system	Prototype System. Cost/Benefit items	Assign treatment to all groups	Judgmental selection	Are benefits within threshold?

Objective Measures

Objective measures are attractive to IS researchers because they involve less human bias and their quantitative interpretation is more direct than subjective measures. Objective productivity measures have been used to evaluate the impact of ISs on decisions, decision making, and the technical merit of the system (Sprague and Carlson 1982). Objective approaches listed by Sprague and Carlson in Table 2 include rating and weighing, system measurements, cost-benefit analysis, and value analysis. Rating and weighing, cost-benefit analysis, and value analysis may also be applied using subjective analysis techniques.

Lee (1989) suggested that objective measures like system utilization, utility, and decisional performance are more useful in laboratory settings than in field settings because they are difficult to implement. There are situations where objective measures are most appropriate, but, in general, they have been the subject of criticism for a variety of reasons.

Objective processes often exclude intangible, qualitative, and strategic benefits and have been criticized for this weakness (Hamilton & Chervany, 1981). It is difficult to identify costs and benefits of ISs since they contain many non-quantifiable characteristics preventing a straight-forward quantitative approach.

One problem with objective measures for decisional performance is the delayed effects of usage. It is also difficult to specify an acceptable measure of performance, and there are many factors that affect performance that are not related to the IS (Raymond 1987).

There is also the problem of voluntary verses involuntary usage. Objective usage measures may be useful when system usage is voluntary but many ISs are designed to force users to use them even if they prefer not to (Ives, Olson, and Baroudi, 1983). Management ultimatums, political pressure, or self-protection (justifying a poor decision) may induce employees to use a system (Lee, 1989).

Subjective Measures

Since objective measures often fail to account for intangible benefits, are difficult to measure, and because there is considerable evidence in the literature that subjective factors such as personality traits and attitude towards computers are related to system usage, most IS researchers use subjective measures to operationalize the concept of system success (Park, 1990).

The subjective approaches listed by Sprague and Carlson in Table 1 include event logging, attitude surveys, cognitive testing, rating and weighing, system analysis, cost-benefit analysis, and value analysis techniques.

In an analysis of a dozen or so studies, Christensen (1987) concluded that quality as perceived by users was a more powerful construct than the system's technical characteristics. User attitudes and perceptions are fundamental to system usage and output.

In Lee's (1989) literature review he found the most common measure of IS success to be user-satisfaction. Its prevalence makes it useful for comparisons against previous research. Lee asserted that it was important to use a broad-based measure such as user-satisfaction when the decision-makers have broad-based responsibility, like LYMS users.

Christensen (1987) found user-satisfaction to have several advantages over usage. In particular, it measures the extent to which the system matches user-expectations. The variable is also strongly associated with user attitudes, beliefs, and perceived social pressures. Christensen (1987) found social influence to be highly related to the creation of expectations and to the actual level of user-satisfaction. User demographics was found to only be moderately related to user-satisfaction.

Lee (1989) stated "... when the effectiveness of an IS is measured from the organizational outcome level, user satisfaction has been shown to be an appropriate measure. .... It has been regarded as an appropriate methodology since it can overcome the limitations of other methods have by measuring how users view their information systems rather than the technical quality of the system."

Hamilton and Chervany (December 1981) also concluded that user-satisfaction integrated many different criteria and provided the most useful assessment of system effectiveness.

A considerable amount of research has been devoted to the development of valid and reliable measures of the user-satisfaction construct (Christensen, 1987). Bailey and Pearson (1983) developed a 39 factor measure that was tested for reliability and validity by Ives, Olson, and Baroudi (1983). Raymond (1987) proposed a measure of user-satisfaction designed for small organizations. His user-satisfaction instrument was used in Lee's (1989) empirical study of CSFs for the effective management of ISs in small business organizations.

Summary

This section has reviewed the literature on LYMSs and related characteristics of general ISs. The yield management concept, as applied to LYMSs, was originally developed in the airline industry. Many articles focusing on airline yield management systems also relate to LYMSs, but the systems differ enough to warrant separate bodies of knowledge. LYMS literature is much less developed than airline yield management system literature and both suffer from information gaps because of their proprietary nature. (i.e. The systems are routinely used as competitive weapons.)

LYMSs were introduced, defined, and discussed from a historical perspective. Characteristics unique to yield management systems and unique to LYMSs were listed and discussed. LYMSs work best where capacity is fixed and capacity production costs are high. The systems are designed to maximize revenue and are particularly effective where inventory is perishable. They require fluctuating market demands, advance purchases, and markets that can be segmented. The systems usually operate in dynamic environments, must deal with the lodging multiplier effect, and should forecast well. A variety of forecasting techniques employed by LYMSs were discussed. Application characteristics included demands placed on the organization requiring special infrastructure, personnel, system, strategical, and tactical support.

LYMSs could become primary competitive weapons in the lodging industry, as airline yield management systems have in the airline industry. LYMSs have particular sets of problems that must be dealt with before the technology is perfected, but their potential for application is high.

The last topic reviewed in this section dealt with the measurement of LYMS success. This is important because appropriate success measures will become the study's dependent variables. The pros and cons were addressed for a variety of potential success measures. Systems having mandatory usage requirements should not be evaluated on the basis of usage. User-satisfaction was found to be a particularly robust measure, appropriate for this type of study, and tests have been developed and validated for this construct.

The next section reviews the CSF literature.

Critical Success Factors

Introduction to CSFs

The identification of critical success factors (CSFs) for ISs has had a relatively short but eventful history. First proposed in the early 1960s, the technique has been refined and embraced by numerous researchers and consultants.

Although not a particularly formal procedure, it has been used to identify information needs, to list and describe elements critical to program and system success, and to help define and focus management's responsibilities and efforts. One of the CSF approach's main attractions has been its pragmatic benefits. Researchers and consultants have often found direct and immediate applications for the results of their investigations.

This section defines CSF technology, discusses the history of its development and usage, reviews conceptual models and categorization schemes, looks at criticisms and alternative methodologies, reviews CSF benefits and applications, and provides a review of CSFs for general ISs and potential CSFs for LYMSs.

Historical Perspective of CSFs

CSFs have been widely applied as a methodology in IS research. Daniel first proposed CSFs in 1961 as a means to classify critical information needs of managers. This was precipitated from his observation of management's information crisis.

Daniel observed that managers were inundated with data in the form of business reports to the point where they could not work effectively. He felt the organization's success was tied to a limited number of areas and from this belief he developed the hypothesis that if certain critical factors were properly and successfully addressed the organization would be successful (Daniel, 1961).

Early IS researchers who assessed the implementation success of computer systems confirmed that certain factors were more related to success than others. Garrity (1963) found leadership quality, system support, management involvement, and the caliber of MIS staff to be related to a set of tangible and intangible system benefits. The McKinsey (1968) studies, based on extensive interviews, also found management support and user/management involvement to be important.

In 1970 Zani (1970, p. 88) discussed a concept similar to CSFs termed "key success variables." The idea was similar to Daniel's in that management cannot possibly deal with all the information they receive and must focus of a limited set of decisive factors to run their businesses well.

In 1972 Anthony (p. 148) discussed his use of the CSF concept as a tool in the design of management control systems. He suggested that management control systems must be tailored to the specific environment in which they are applied, that the CSFs must be identified, and that performance must be monitored with respect to the CSFs. He suggested that simple measures should be used to monitor CSFs and data should be supplied to information users in its most useful form.

It is generally considered that Rockart popularized the CSF approach in the field of MIS. Rockart (1979) recognized the value of engaging a limited set of factors to monitor and control business success and he found that executives were often adept at defining their own information needs. In 1982 Rockart and a research team at MIT (Massachusetts Institute of Technology) further developed the CSF methodology as an interview technique to assist managers. Shortly after Rockart popularized the CSF approach, researchers in MIS and other disciplines began to use the concept more intently. Many information researchers and consultants continue to use this technique to determine information needs.

Rockart teamed with Scott-Morton in 1984. Their research again supported the CSF concept as a useful tool for managers. Rockart and Scott-Morton (1984) found different sets of CSFs at the industry, organization, and managerial levels.

Munro and Wheeler (1980) used the CSF method to determine information needs for management control. Meadors and Mezger (1984) used the concept to select end-user programming languages. Shank, Boynton, and Zmud (1985) used the method to identify information needs for the development of a corporate information systems plan. And, Raymond (1985) used the CSF approach to identify CSFs involved with the implementation of ISs.

In the area of education, several researchers applied the CSF methodology to elucidate factors related to successful programs and successful program administration. For example, Burello, Johnson, and Kladder (1984) used the CSF technique in a special education administrative setting to identify CSFs at both the personal and organizational levels. Zadnik (1985) also used the CSF approach to determine the information needs of special education administrators. He was aware that CSF had been used in business and industrial settings and felt that it held promise as a tool for identifying critical program elements. Williams (1987) applied the CSF technique to Indiana Secondary School Principals in conjunction with the critical incident technique proposed by Flanagan (1954).

In the meantime companies began to employ the CSF method. This was likely the result of increased data processing and automated report writing. Managers needed to pinpoint the most important factors for the well-being of the business to reduce the time they spent sifting through data.

Up to this point, much of the CSF research efforts were exploratory in nature and tended to develop long lists of CSFs and practitioner models without regard for any particular theoretical base. In response to this void, Christensen (1987) tested a theoretically-based explanatory model of IS success. His work tested the theory of reasoned action which theorizes that rational people appraise the implications of their actions before they decide to engage (or not to engage) in a given behavior. Christensen's main research thesis was that a user's intentions to use a DSS is a function of the individual's attitude toward the specific IS and the subjective norm, represented by perceived social pressures. The findings of his work supported the theory of reasoned action and generally supported his theoretically-based model. Christensen's (1987) work is significant because it proved that the CSF approach is substantial enough to support theory. This review has not revealed any additional theoretically-based CSF research since his efforts. Possibly because researchers are not as interested in working to support well-established theory as they are in developing new theory.

In 1988 Rivard and Huff used the CSF method to identify factors associated with the development of computer applications by end-users. Delone (1988), and Montazemi (1988) used the CSF approach to identify factors involved with the implementation of ISs. And, in 1989, Rainer explored the CSFs related to successful executive information systems (EISs) using a multi-constituency approach.

Several recent literature reviews have found the CSF method to be one of the most popular approaches in the study of business ISs (Lee, 1989; Rainer, 1989). The method continues to be used because of its practical benefits.

Over the years, certain factors have proven to be highly correlated between a variety of ISs and their respective organizational successes. These include factors such as user-involvement, top management support, and adequate technical design. Depending on the research focus, researchers tended to either test factors pulled from the literature, to develop an entirely new list of factors using exploratory studies, or to combine these methods. The result of these efforts has been an ever expanding list of potential CSFs for the successful implementation and operation of Iss.

Definition of CSFs

Park (1990) suggested the concept of CSF is similar to Giovinazzo's (1984) concept of "focused" information processing. These concepts are similar because both concentrate on a set of data that is highly related to the organization's prosperity. As a process, the CSF technique is used to determine what factors are critical to the continued success of the business (Jenkins, 1985).

The definition used most often to define CSFs was written by Rockart in 1979 (p. 85) and states:

> Critical success factors are "... 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. If results in these areas are not adequate, the organization's efforts for the period will be less than desired."
> "... the critical success factors are areas of activity that should receive constant and careful attention from management. The current status of performance in each area should be continually measured, and that information should be made available (Rockart, 1979, p. 81)."

In Rockart's definition he refers to "the limited number of areas," but does not specify how many, which, or what type of areas qualify. Since no two organizations will approach or solve the same problems in exactly the same way, CSF researchers have collectively uncovered a great number of areas important to success. When Rockart refers to "areas" it is not clear whether he is using this term to represent "factors," or whether he is referring to areas that are composed of factors. A third problem with Rockart's definition is that he does not specify whether the areas or multiple factors must be statistically linked to the successful competitive performance or if the areas or factors can be related in some other fashion. Lastly, his definition does not specify how successful the firm must be, nor how to define success.

Notwithstanding these criticisms, Rockart's definition offers a base of comprehension to the general nature of CSFs and a flexible interpretation. For the purpose of this research effort the definition is tightened to incorporate only factors, rather than areas, focused on the success of the LYMS, rather than the firm. This helps to eliminate factors that may be correlated to success via exogenous or confounding variables and allows both factors and areas composed of factors to be examined.

Conceptualization of CSFs

Conditions Affecting CSFs

CSFs for successful ISs vary depending on the system, its users, organization, and environment. Rockart and Scott-Morton (1984) studied the implications of changes in information technology to the business organization and found different sets of CSFs at the industry, organization, and managerial levels. Previously, Rockart (1979) identified conditions that affected the CSFs of organizations including the industry's structure, the organization's strategy, demographic factors, environmental factors, and temporal factors. Because of CSF variability, the generalizability of CSF research may not be particularly strong across industries or even organizations. On this basis, it would be unreasonable to assume that CSF research should produce similar sets of factors.

Nevertheless, a small group of CSFs have proven significant across industries and organizations indicating there may be a core set of CSFs that are highly generalizable. Upon further investigation, a core set of CSFs may be found to exist at the various levels of organization, as well. More research is needed and studies need to specify the types of variables found, strength of relationships, settings, systems, measures of success, and the nature of methodological models employed for inter-comparisons studies.

One exogenous variable that has received considerable attention is the IS maturity level. It has been identified as an important confounding element and many researchers feel it should not be ignored. Some have used system age as the operationalized measure of IS maturity (Delone, 1988; Raymond, 1985) but as Lee (1989, p. 62) points out, it is an unrealistic assumption that the maturity of an IS is positively and directly correlated to its age. Systems differ in the rate they move from one stage of maturity to another. Some systems mature quickly, while others mature rather slowly. Because of this phenomenon, IS stage theory, based on life cycle theory, has been proposed as a more appropriate measure of maturity. Stage theory is discussed in more detail in the section entitled "stage theory," in this chapter.

CSF Development Models

Several conceptual models have been proposed portraying CSF development within the organizational framework (Ligon, 1990; Zadink, 1985).

Zadink (1985, p. 18) proposed the CSF Development Model, shown in Figure 4. It

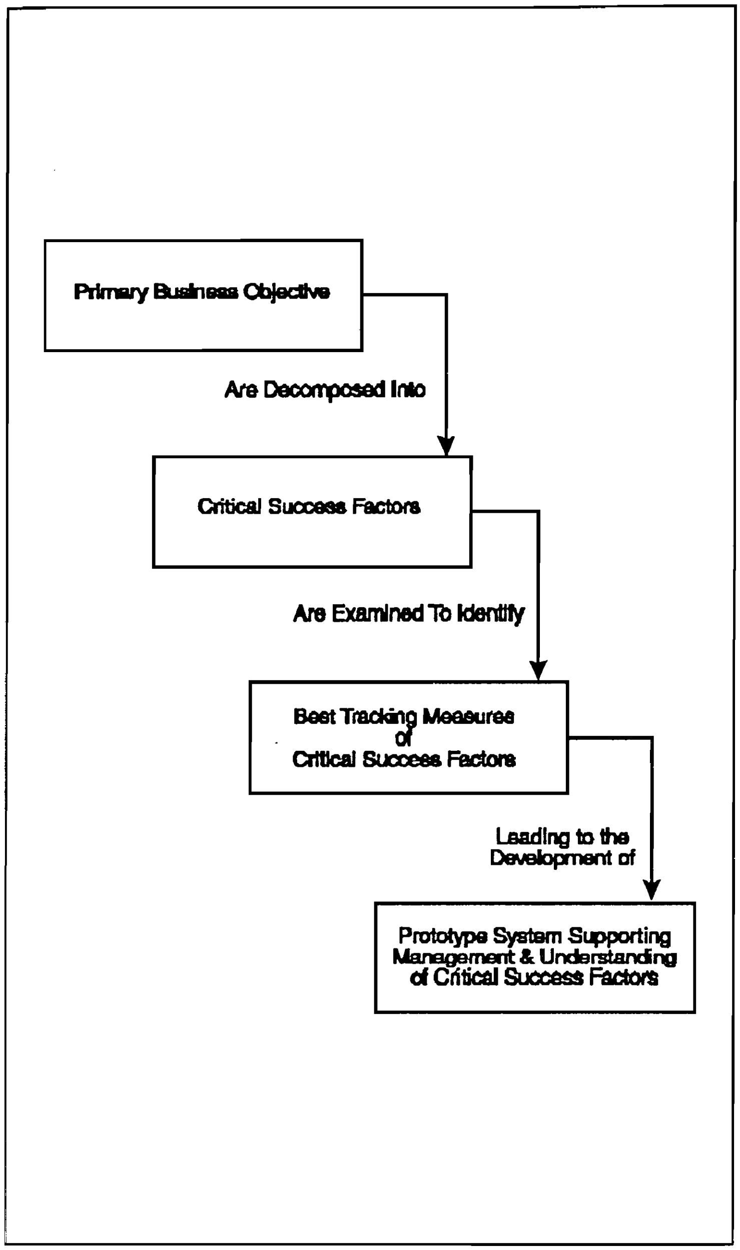


Figure 4
Zadnik's CSF Development Model
(Adapted from Zadnik, 1985, p.18)

illustrates how CSFs are decomposed from business objectives, examined to identify tracking measures, and then structured to develop a system supporting the understanding and management of CSFs.

Ligon (1990, p. 65) improved and expanded upon Zadnik's model with another CSF Development Model, shown in Figure 5. Ligon's model improves upon Zadnik's model because it presents CSFs as decomposed from business goals rather than business objectives. It expands upon Zadnik's model because it is a seven step model rather than four, beginning with organizational values and ending with organizational success. Ligon's seven steps cover a broad range of organizational structure and activity, from philosophical to physical, intent to action, managerial to technical, and from strategic to operational (Ligon, 1990).

Ligon begins his conceptual flow chart with organizational values because members of the organization share values which are the foundation of human activity and behavior. Values embed all important attributes of the organization at the highest level. From organizational values, goals are determined that exemplify the organization's purpose and intent. Goals, in turn, determine CSFs. These are factors that must be attended to for the goals to be achieved, whether they are subordinate goals or underlying facilitating processes. Goal achievement is at risk if the CSFs are not attended to. CSFs then determine system models; the means for describing the system designed to monitor and control the CSFs. These models are primarily for organizational use, rather than system implementation. System models determine system specifications; the technical description for system components. System specifications

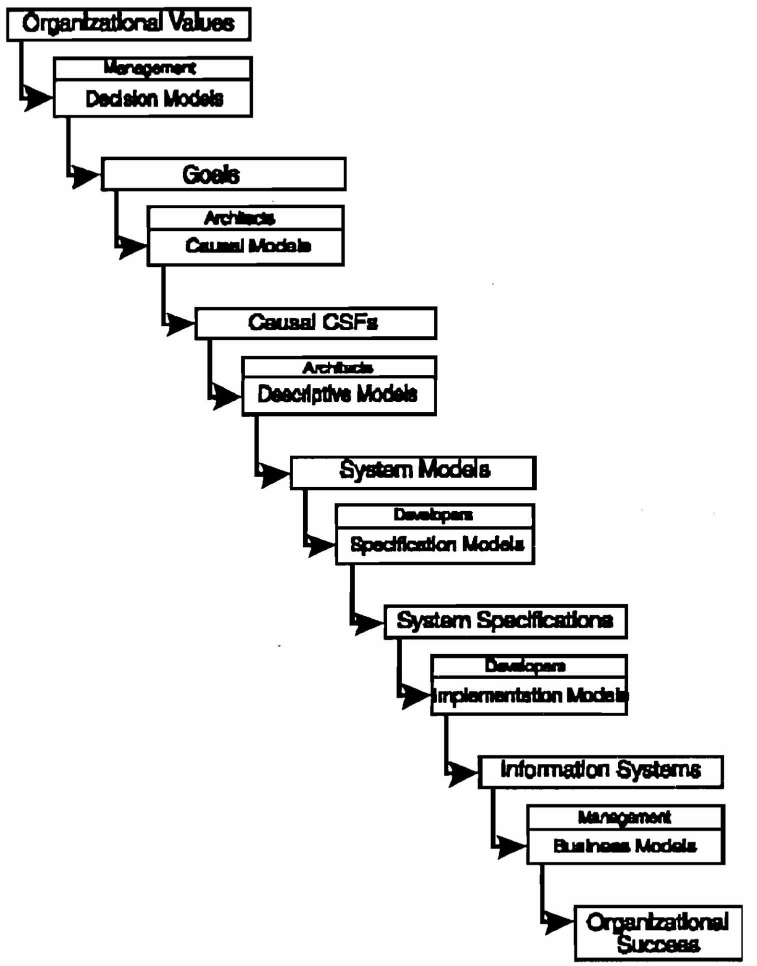


Figure 5
Ligon's CSF Development Model
(Adapted from Ligon, 1990, p. 67)

subsequently determine the implemented, or actual system. If the system does what it is designed to do, it should generate a measure of organizational success.

Ligon (1990) suggested organizational goals should be derived from organizational values using decision models. These may include worth assessment, analytical approaches, brainstorming, Delphi, simulation, cross-impact analysis, forecasting, and group decision making. CSFs should be derived from organizational goals. System models should be derived from CSFs using descriptive models such as narratives, diagrams, storyboards, video animation, and architectural descriptions.

The linkages between the flow levels follow a functional input-process-output model and have differing strengths. For example, Ligon suggested that linkages between goals and CSFs is very strong while linkages between ISs and organizational success is relatively weak. Ligon's (1990) thesis involves the development and application of a casual modeling and analysis that links goals and CSFs, but only the most simple aspects of his work are adaptable to this study.

CSF Categorization Models

A variety of categorization models have been proposed for CSFs. Some have been developed from observation and experience and others have been developed from empirical data analysis. Factor analysis has been commonly employed as an analytical technique for developing CSF categorization schemes. Since there are several schemes in the literature, they will be presented from the simple to the complex in terms of number of categories.

The dualistic approaches, or those approaches that included only two dimensions, include Keen and Scott-Morton (1978), Ein-Dor and Segev (1978), Zahedi (1987), and Lee (1989). These researchers suggested factors could be divided into quantitative and qualitative variables.

Ein-Dor and Segev (1978) suggested CSFs could be categorized on the basis of controllability. Controllable factors are factors that the IS department can directly manipulate, like the amount of support or training it might offer. Uncontrollable factors are factors that cannot be directly manipulated by the IS department, like the number of employees in the organization, the profitability of the company, or the external environment.

Zahedi (1987) proposed a concept similar to Ein-Dor's and Segev's, terming the categories internal and external. Internal factors relate to the internal operation of the IS department while external factors relate to operations external to the IS department.

Lee's (1989) research identified 11 factors from prior studies and he categorized them into two broad categories including organizational perspective and user perspective.

In general, the dualistic approaches are over-simplistic and tend to assume an "us-verses-them" perspective. Ginzberg (1980) proposed a three category framework with classes that included quality of implementation, user-system fit, and organizational fit. Ginzberg's approach offers a slight improvement over the dualistic approaches because it added the dimension of time with its implementation category, but it still takes an "us-verses-them" attitude.

Dickenson et al. (1984) also categorized CSFs into three groups that included inherent, developmental, and functional. Inherent CSFs are part of a company's basic functionality. Developmental CSFs are more strategic and relate to the long-term competitive positioning. Functional CSFs are more operational and relate to the short-term success of the firm. Dickenson's approach takes a broader perspective but tries to combine abstract management concepts with concrete organization features in the same model.

Liang (1986) proposed a well designed categorization scheme. His categories are exhaustive, exclusive, and delineated at the same conceptual level. They included system, task, user, and environment groups. System included factors such as quality, design strategy, and level of user involvement. Task included factors such as information complexity and job complexity. User included factors such as cognitive styles, attitudes, expectations, and experience. Environment included factors such as stress, power, policies, and management support.

Lee's (1989) literature review of exploratory CSF research relating to the successful implementation of ISs listed work by Mason and Mitroff (1973), Jenkins (1977), and Dickson, Senn, and Chervany (1977). Lee (1989) reduced factors disclosed by these researchers into four general dimensions including: the information system, decision maker, organizational context, and task characteristics. Lee's dimensions are essentially the same as Liang's (1986) proposal.

Other CSF categorization schemes tended to focus on expanding the user category. For example, Lucas (1981) identified five categories including client actions, attitudes toward system, decision style, personal or situational variables, and technical characteristics and qualities of the system. This is shown in Figure 6. The first four categories relate directly to the user.

Client actions included factors such as management support, and user involvement. Attitudes toward system included factors such as general attitudes. Decision style included factors such as cognitive style and complexity of user. Personal or situational variables included factors such as age, sex, education, and tenure. Technical characteristics and qualities of the system included factors such as accuracy, reliability, and interface.

Christensen (1987) also focused on the user and developed his model based on Fishbein's (1967) theory of reasoned action. Christensen's model, shown in Figure 7, included variables such as user attitudes, involvement, intentions, demographics, and subjective norms.

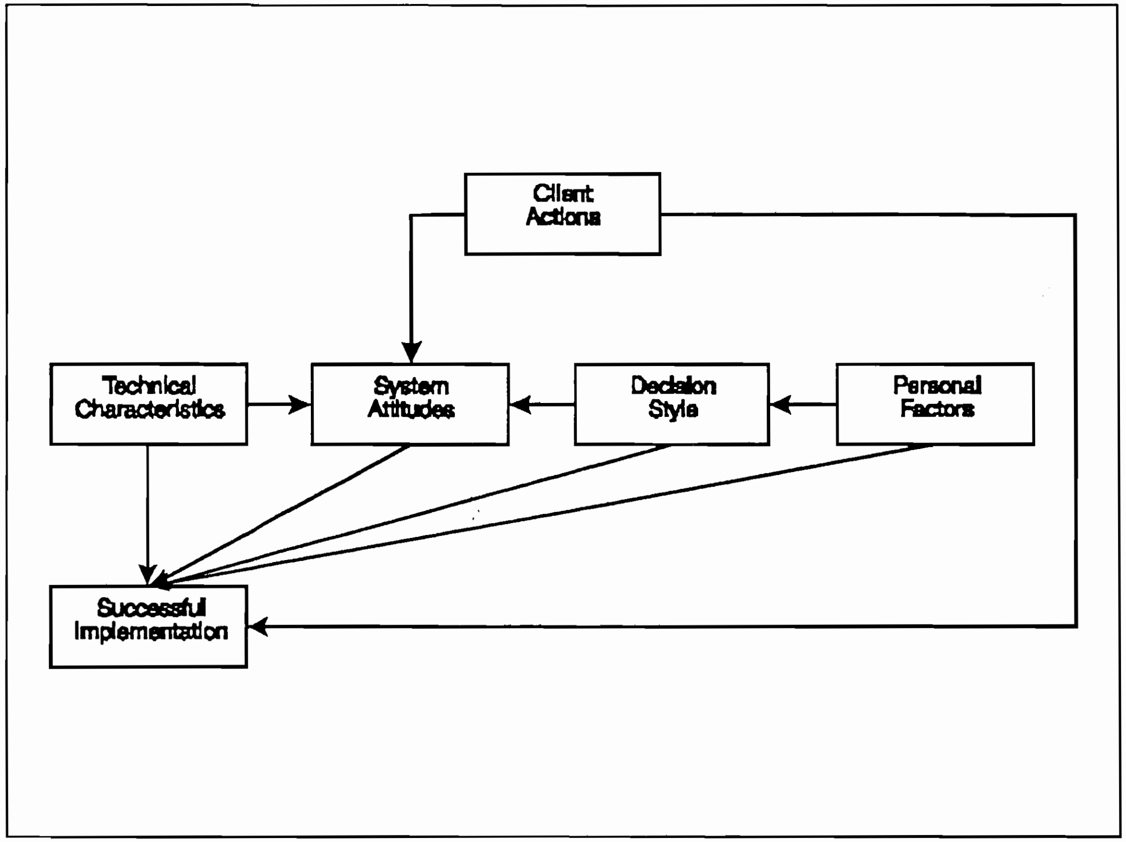


Figure 6
Lucas's Hypothesized Implementation CSF Model
(Lucas, 1981, p. 103)

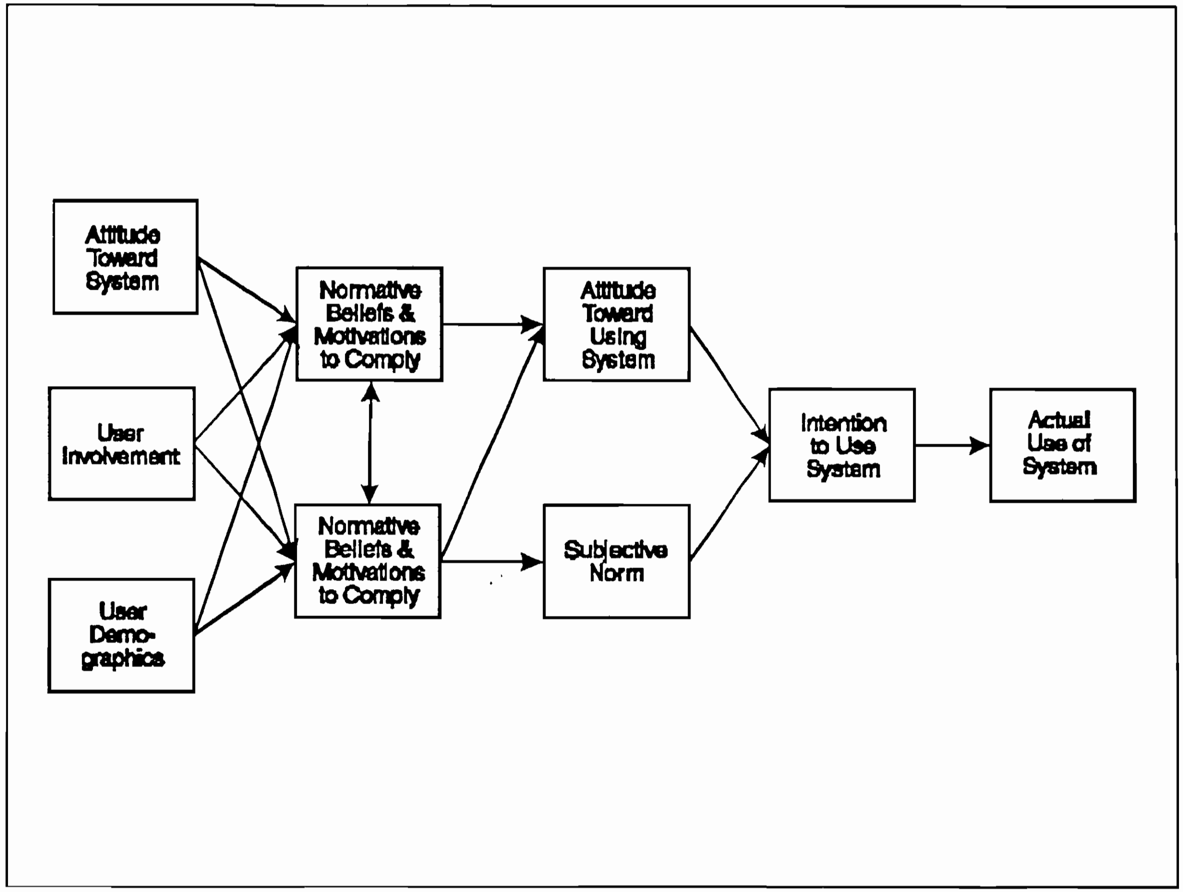


Figure 7
Christensen's Hypothesized User-Oriented DSS CSF Model
(Christensen, 1987, p. 77)

Many other theoretical models could be employed to explain the user variable. One of the most frequently suggested by those who are advocates of the process approach is Lewin/Schein's unfreezing, moving, and re-freezing theory of change (Lewin 1952, Schein, 1961). This model was tested and supported for IS usage by Zand and Sorensen (1975).

Another model with IS application potential is the Kolb/Frohman consulting process. It includes 1) scouting (matching the capabilities of the change agent with the client's needs), 2) entry (building climate and conditions for change), 3) diagnosis (problem analysis and assessment), 4) planning (priorities and goals), 5) action (application of the plan to the problem), 6) evaluation (assessment of the change effort), and 7) termination (end of relationship). This model was tested by Ginzberg (1974, 1979) and also found to support IS usage.

Christensen (1987) reported on a line of research that could be used with the CSF approach as well. It involves looking at ISs from an innovation perspective. Curley and Gremillion (1983) suggested five characteristics by which an organization's level of innovation can be described. These include: relative advantage, the degree to which an innovation is thought to be better than its predecessor; compatibility, the degree to which an innovation is thought to be consistent with the organization; complexity, the degree to which an innovation is thought to be difficult to understand or use; trialability, the degree to which an innovation may be experimented with on a limited basis; and observability, the degree to which the results of an innovation are noticed by others. According to several studies, between 49% and 87% of the variance in the rate of IS adoption was explained by these five variables.

As can be seen, the CSF approach is very broad and flexible. A number of categorization schemes and subsequent models can be developed and tested. Depending on the researcher's interest and the results of past studies, CSF schemes may be broad, like Liang's, or specific, like Christensen's, or Kolb/Frohman's work. Since this research effort entails the examination of a system that has had very little prior research, a broad approach was employed.

The best categorization scheme for the purposes of this study is an adaptation of Liang's (1986) work. Because Liang did not distinguish between organizational (internal) and external environments, his model is expanded to include the categories of system, task, user, organizational environment, and external environment (see Hypothesized CSF Relationships for LYMS, in chapter three).

Rockart's CSF Methodology

Part of Rockart's (1982) success for the popularization of the CSF approach resulted from the development of a CSF methodology. Rockart (1982) and a research team at MIT developed the CSF methodology as an interview technique to assist managers in determining factors most critical to their success. As previously mentioned, much of the CSF appeal stems from its high degree of practitioner level benefits.

The Rockart methodology utilizes a prescriptive procedure for its implementation. It is conducted in several phases. In the first phase, the executive's goals and potential CSFs are discussed in an interview format to determine the company's strategic objectives. In the second phase, the list of potential CSFs are expanded and analyzed to determine which could be combined or eliminated to produce a list of useful CSFs. In the third phase, a second or third interview is used to operationalize the CSFs. Measures and procedures are identified to monitor and report on each CSF. A system is then developed to track, measure, and manage the CSFs.

Part of the practitioner level of success for the CSF method results from the rapid internalization of the concept by managers. This can be attributed to several reasons. The CSF development method is highly interactive and direct. It is simplistic and intuitive to users. The method is also very functional and practical, particularly in the way it streamlines information and fulfills user needs.

Criticisms of CSFs

The CSF approach is not without its criticism. Ligon (1990), who recommended using a causal-based method to identify critical success factors, believed Rockart's CSF method contains weaknesses that surface when the method is applied.

> "Rockart's critical success factor method has been the most successful user-oriented approach. It addresses requirements at the pragmatic level. However, the CSF method lacks a certain discipline, is difficult to situate in proper context, and provides weak links to the semantic and technical information levels" (Ligon, 1990, p. 38).

Ligon's (1990) primary criticism with the traditional CSF approach was that its application lacked rigor and specificity.

> "The words critical success factors themselves imply that they could be goals, strategies, or many other things -- any area of activity which could be critical to

> success. But, activity alone does not necessarily have value. If activity is to contribute to success, it must be purposeful and channeled toward accomplishing a goal. Areas of activity is an even more abstract concept than activity alone. It is even more difficult to relate to physical information system parameters. This lack of a sharp focus has deprived the CSF method of much of the power which it could have had for developing organizational information systems. It does have the advantage over business system planning and strategic systems planning in that it can be done quickly with less managerial effort" (Ligon, 1990, p. 38).

Christensen (1987) correctly noted, without rigor and specificity the CSF researcher is confronted with an almost limitless number of potentially relevant factors.

The CSF approach suffers from other criticisms as well. Some of these have to do with Rockart's methodology, some with past research efforts, and some with the underlying complexity of the systems that the CSF approach attempts to describe and control.

Rockart's method may be seen as imprecise and unscientific (Davis, 1979; Park, 1990). Others have noted that the methodology has no normative model and therefore does not allow for an objective evaluation of the approach (Davis, 1979). And, Boynton and Zmud (1984) found it difficult for some managers to describe their information needs using CSFs.

From a research perspective, there have been considerable inconsistencies among CSF investigations. As discussed in the section entitled "Conditions Affecting CSFs," CSFs vary depending on the system, user, organization, and environment. CSF research efforts have used samples from within industries, across industries, from within organizations, across organizations, for large firms, and for small firms. There have also been differences in terms of timing, geography, and demographics. Understandably, these are difficult to avoid in independent cross-sectional studies, but CSF research may be particularly sensitive to these types of variations.

There is also great variety in measuring instruments. Jarvenpaa, Dickson, and Desanctis (1985) considered this a consistent problem with MIS research and added that many measuring instruments have problems with reliability and validity.

Factor selection has been criticized. Factors are often selected as a matter of convenience, availability, or because they can be easily measured, and without regard to theoretical considerations (Ginzberg, 1974; Keen, 1974). When factors are selected from literature they may not include the best or most appropriate CSFs for the system under study. On the other hand, testing the same factors with different systems helps to determine if a set of common core factors exist between studies.

System failures are important to help develop CSFs. Differentiating successes from failures is a powerful technique that can shed light on the most important variables relating to the success of the IS. Variables that contribute to the failure of a given system can be semantically converted into a success factor. Unfortunately, most practitioners are more interested in communicating their successes than their failures and most journals are only interested in publishing successes.

Ives and Olson (1984, pp. 586-602) reviewed a number of articles identifying CSFs. They concluded most of the articles lacked the rigor required to produce sets of well-defined results. They felt that more controlled experimental, longitudinal, and field studies were required to establish linkages between CSFs and the success of IS implementation. There was also concern that unidentified exogenous variables were present that confounded relationships.

Lee (1989, p. 8) believed that most of the inconsistent results with CSF research was a result of not controlling for important confounding variables. These included, but were not limited to, differences in ISs, organizational complexity and organizational maturity (Nolan, 1979; Tait & Vessey, 1988). Some of these variables can be controlled by appropriate sample selection methodologies and others can be controlled by the proper selection of CSFs.

One inherent problem with CSF studies is the size and complexity of ISs and their settings. Factor studies of large IS projects can become overwhelmed since they require a multidisciplinary approach crossing many departmental lines (Pyle, 1986, p. 183). It is possible that part of the attraction and success of the CSF approach in the MIS literature is related to the flexibility and comprehensiveness of the factors. Reducing some of the problems discussed in this section while retaining the power and flexibility of the CSF approach might be best achieved through modification of the CSF technique.

Non-CSF Approaches

There are a variety of potential non-CSF approaches to the implementation and operation of successful ISs. Most of these are designed to identify the information needs of managers and must be adapted if used for this study. The non-CSF approaches identified in the literature included the following (Bastie & Jung, 1984; Christensen, 1987; Ginzberg, 1975, 1979; Ligon, 1990; Magal, 1987; Rockart, 1979):

1. Null approach
2. By-product approach
3. Key indicator system
4. Total study process
5. Business systems planning

6. Strategic systems planning
7. Application transfer team method
8. Executive applications survey
9. Requirements, needs, and priorities method
10. Information Engineering
11. Requirements Languages
12. Structures Analysis and Design
13. Computer-Aided Software Engineering
14. Knowledge-Based Systems
15. Task Taxonomy

In Rockart's 1979 article several of these methods are discussed in comparison with CSFs. Overall, Rockart felt that the CSF approach was the most effective and efficient technique available.

The null approach takes the attitude that management activities are so dynamic and complex that it is not possible to determine information needs. Information is produced and communicated by complex verbal and written exchanges without regard to form or needs. The null-approach ignores the fact that management requires a steady stream of business information.

The by-product approach does not directly identify management information needs but takes the position that information is produced from a variety of ISs that are not necessarily designed to produce specific information. It is a concept, like the null approach, that is limited because it cannot be operationalized.

The key indicator system is a process that begins by identifying key financial "health" indicators. "Health" information is then collected and presented to management in an attractive, graphics-based, exception reporting format. The key indicator system is similar to the CSF approach but limited because it focuses on core financial data, and according to Rockart's

(1979) analysis, fails to supply management with other important information.

The total study process involves interviewing a large sample of managers to understand the business, determine information needs, and to understand the capabilities of the IS. A gap analysis is then performed and the spread between management's information needs and the existing IS represents the target information. The main drawback with this method is that it is very time consuming and expensive and therefore impractical (Rockart, 1979).

Business system planning and strategic systems planning are subsets of the total study process and suffer from the same problems, according to Batiste and Jung (1984).

The applications transfer team approach is useful only after the initial requirements are known. It attempts to establish the cost/benefit relationship of information and information needs. Like the total study process approach, it requires considerable resources to implement.

The executive applications survey attempts to match information requirements definitions with characteristics of applications software. The procedure is more appropriate for system design than for system implementation or operation.

Batiste and Jung (1984) proposed the requirements, needs, and priorities method as an alternative approach that overcomes many of the limitations and drawbacks of other methods. They describe their "RNP" method as "... understanding the processes present in operating a business, and the factors that are critical for success in those processes, and the obstacles that prohibit or impede the attainment of success" (Batiste & Jung, 1984). They recommended that executives were interviewed, the discussions and insights analyzed, the findings formulated into requirements, needs, and priorities, and then presented to the executives. The requirements, needs, and priorities method appears to be a restatement of the CSFs approach.

Ligon (1990) compared several other non-CSF approaches to the CSF method based on user-oriented criteria. The results are shown in Table 2. These methods included business systems planning, strategic systems planning, information engineering, requirements languages, structured analysis and design, computer-aided software engineering, knowledge-based systems, and task taxonomy. Based on four of his user-oriented criteria, the CSF approach showed the best overall support for the combination of task/user organization, organizational needs, support for learning, and understandable models.

According to Ligon (1990) strategic planning approaches do not provide support for organizational needs or learning, and only weak support for the user and task. Software engineering approaches do not support any of these categories, but like all of the approaches listed on Table 2, they provide, at least, a weak understandable model. Knowledge-based systems and the task taxonomy matrix approach provide better support for user-oriented criteria than the strategic planning and software engineering approaches, but the critical success factor approach is strong in three out of four of the criteria examined. It provides strong support for organizational needs, learning, and modeling.

Table 2

Comparison of Information Requirements Methods Based On User-Oriented Criteria

(Adapted from Ligon, 1990, p. 40)

Approaches	Task/User Organization Support	Organizational Needs Support	Support for Learning	Understand-able Models
Strategic Planning Approaches				
Business Systems Planning	Weak	None	None	Weak
Strategic Systems Planning	Weak	None	None	Weak
Information Engineering	Weak	None	None	Weak
Software Engineering Approaches				
Requirements Languages	None	None	None	Weak
Structured Analysis and Design	None	None	None	Weak
Computer-Aided Software Eng.	None	None	None	Weak
Other Approaches				
Knowledge-Based Systems	None	Strong	Strong	Weak
Task Taxonomy Matrix	Strong	Weak	Weak	Weak
Critical Success Factors	None	Strong	Strong	Strong

Benefits of the CSF Approach

The CSF approach has been widely embraced because it has proven to be beneficial in a variety of aspects. Rockart (1979, pp. 23-24), referring to his CSF method, stated:

> "First, it [the CSF method] helps the manager to determine those factors on which he/she should focus management attention. The process helps insure that these significant factors will receive careful and continuous management scrutiny. Second, the process forces the manager to develop good, adequate measures for each of these critical factors and to seek reports on each of these measures. Third, the identification of critical success factors allows a clear definition of the amount of information which must be collected by the organization and tends to limit the costly collection of more data than is necessary. Fourth, the identification of CSFs to move an organization away from the trap of building its reporting and information system primarily around data that is 'easy to collect.' Rather, it focuses attention on that data which might otherwise not be collected, but which is significant for the success of the particular management level involved. Fifth, the process acknowledges that some factors are 'temporal' and that CSFs are manager-specific. This suggests that the information system should be in constant flux with new reports being developed as needed to accommodate changes in the organization's strategy, environment, or organization structure. Rather than changes in an information system being looked upon as an indication of 'inadequate design' they must be viewed as an inevitable and productive part of the process of information systems development. Finally, the process provides a simple four-step sequence for the development of information systems. This is a 'top-down' approach starting with the definition of CSFs. The second step is the recognition of those measures which indicate progress (or lack of it) with regard to particular CSFs. The third step is the design of reports which will provide information on the current status of each measure to the manager. Finally, only at this point, does one concern oneself with 'the MIS' -- which, after all, is only a system for gathering and transforming data."

Other researchers have also found the CSF approach to be beneficial. Boynton and Zmud (1984) found the CSF approach to provide support for the planning process. They found it helpful for developing insight into the supply and analysis of information that impacts a firm's competitive position. They also found it to be intuitive and well-received by top management. Park (1990, p. 64) found the CSF approach a viable tool to enhance communications in the strategic planning process. This finding is in synchrony with the strategic planning emphasis of LYMSs and supports the proposal for investigating the implementation and operation of LYMSs using a CSF approach.

Park (1990) studied the characteristics and usage of computerized ISs in small apparel and textile companies. He found empirical evidence relating the ability of the firm to address its CSFs to the success of the firm's IS, as measured by system utilization.

In a convincing study, Jenster (1987) found companies that identified CSFs and implemented their usage, through proper measurement, feedback, and management, received a higher return on equity when compared to companies that did not employ the CSF technology.

Applications of CSFs

The CSF approach has a wide set of potential applications. While there is some disagreement about its best usage, there is general consensus that it is useful for determining information requirements and for information planning activities (Boynton & Zmud, 1984; Magal, 1987; Park, 1990). Boynton and Zmud (1984) regard the CSF approach as an effective framework for information resource planning, particularly useful for high-level management. They feel the CSF approach serves as a normative information needs model and is more valuable for information planning activities than for IS design.

Since the CSF approach is an appropriate and useful tool for information planning activities, it is also a good candidate for LYMS application since a considerable amount of information planning activity is involved with the implementation and operation of LYMSs. Still, there are additional considerations.

One of Christensen's (1987) conclusions to his behavioral-theory research was that successful implementation of DSS models required attention to CSFs, rather than to devising a multi-stage implementation processes. He concluded this on the basis of data analysis that supported his DSS implementation success model, although implementation of the DSSs he studied did not require major organizational change.

In contrast to DSSs, the implementation and operation of LYMSs involve more than one functional department and require the adoption of a revenue maximization philosophy by much of the organization. Thus, major organizational changes are a distinct possibility and a multi-stage implementation process may be appropriate. For this reason stage-theory, also known as life-cycle theory, should be examined and controlled for in LYMS research.

Stage-Theory

Information systems, like organizations, pass through different developmental stages. In organizations the term life-cycle is most often used to describe the naturally occurring stages of inception, growth, maturity, decline, and regeneration. This term is not generally applied to ISs because many researchers believe that ISs do not have natural decline and regeneration stages. Thus, the term stage-theory is used to label this phenomenon as it relates to ISs.

The maturity level of the IS has been identified as an important confounding variable and should not be ignored by researchers.

> "After the system has been used for some time, and it demonstrates its worth, it may be adopted by the organization, i.e., it is institutionalized. The highest level of commitment, however, is internalization, which occurs only when users are convinced that the system really helps them and therefore establish a psychological ownership to it. This distinction between levels of commitment should be kept in mind while employing usage indicators in the empirical study" (Christensen, 1987, p. 18).

Some researchers have used age as the operationalized measure of IS maturity (Delone, 1988; Raymond, 1985) but as Lee (1989, p. 62) pointed out, it is an unrealistic assumption that IS maturity is positively and directly correlated to its age. The preferred operationalized measure of maturity is based on a valid and reliable stage-model with clear boundaries that can be easily described and understood.

Nolan's stage model is probably the best known and one of the most frequently used models for describing and managing IS development. He was the first in MIS literature to propose that ISs develop or evolve through various stages as they age. Nolan's original model was based on case studies of three government organizations and used the information department's budget curve as a surrogate variable for IS development.

Nolan (1973) described the stages as 1) initiation, 2) expansion, 3) control, and 4) maturity. These differ by IS applications, management techniques, organization structures, and user roles. Stage one (initiation) is characterized by the automation of low-level operational systems. Data is primarily centralized transaction data and most processing is done in batches. Stage two (expansion) is characterized by the rapid expansion of computer applications. Applications are more sophisticated and may include decision support. Stage three (control) is characterized by increased control over IS activities to reduce duplication, improve coordination, and cultivate consistency. It follows from the rapid expansion of stage two and is an attempt to manage the proliferation of IS application out-growths. Stage four (maturity) is characterized by a well-structured IS department, advanced applications, and formalized structures. Often the mature IS structure is more rigid and less adaptable to innovation than at other stages.

In 1979 Nolan expanded on his model proposing six stages instead of four. The six stages included: initiation, expansion, control, integration, data administration, and maturity.

Nolan's models have been found attractive to practitioners for planning and control guidance, but there is little evidence that his information center budget curve is indicative of developmental stages. Lee (1989) reviewed efforts to validate Nolan's models and found the following:

Lucas and Sutton (1977) studied a set of government organizations and found their budget curves unqualified to act as a surrogate variable for system growth because computing expenditures were relatively linear. King and Kraemer (1987) found fault with the expenditure budget approach because many variables affect information center budgets including the environment, competing departments, managerial growth strategies, and the organization's learning curve. They stated that no one variable could serve as a suitable surrogate for such a complex interrelationship. Dury (1983) tested Nolan's growth benchmarks with 144 firms and was unable to classify ISs into the six stages. Benbasat and Dexter (1977) worked with Nolan's model and could not find any support for the information center budget curve. Lee

(1989) criticized Nolan's models because he failed to provide measures that could be operationalized.

Another difficulty has arisen since Nolan (1973, 1979) proposed his models. The models he developed in the early seventies and expanded in the late seventies were not designed to model organizational environments where end-users predominate. Since the early eighties, end-users have become much more common in the business environment. This is primarily due to the increased power of personal computers (PCs). It is common to find PCs in the nineties with more power than mini-computers of the early eighties. This trend will no doubt continue as the price and size requirements for computing power drops. The increased power offers highly accessible, friendly, graphic-based platforms to the average business employee. Decentralized end-user computing does not appear to follow the same stages as the centralized main-frame computing modeled by Nolan.

End-User Stage-Theory Models

Several end-user stage-theory models have been proposed and many of them have been tested and used in MIS research to control for the confounding effects of stage-growth. The models disclosed in the literature range from two to five stages.

Brown and Bostrom (1988) proposed a two stage end-user model that includes initiation and integration stages. Initiation is characterized by low formalization and high complexity of the end-user computing environment. Integration is characterized by high centralization, high formalization, and low complexity. Huff, Munro, and Martin's operational measures were used for the Brown and Bostrom model, but it is hardware-based and does not properly incorporate software elements.

Lee (1989) proposed and used a two-stage model that includes operational control and integration stages. It is not practical for general IS applications because it failed to consider the initiation stage.

Henderson and Treacy (1986) developed a three stage model for the end-user environment. Their model includes initiation, integration, and mature stages. This model fits well with Christensen's (1987) description of how the organization adopts the IS before it is actually internalized (see Stage-Theory, in this chapter). When the system is first introduced into the organization it is in the initiation stage. Once it becomes institutionalized it is in the integration stage, and after it is internalized it is in the mature stage.

Huff, Munro, and Martin (1988) proposed a five stage end-user model. Their model included isolation, stand-alone, manual integration, automated integration, and distributed integration. This model is also hardware based and, like Brown and Bostrom's (1988) model, fails to incorporate software elements.

The best model for the purpose of this study is an adaptation of Henderson and Treacy's (1986) model. Its categories are exhaustive and exclusive, can be applied to hardware and software elements, and are descriptive of the stages a LYMS would likely incur based on the researcher's knowledge of these systems. For clarification, the labels are renamed to be more in-line with Christensen's explanation of the system adoption process. These labels include implementation, integration, and internalization (see Stage-Theory Model for LYMS in chapter three).

End-User Classification

Another aspect to end-user computing that could affect the evaluation of system success is the evaluator's relationship to the system. It is possible that users who are most involved with the system are likely to rate the system higher than those who have a more distant relationship. In order to control for this variable, an end-user classification scheme is required.

There are several different proposals for classifying end-users (Levine, 1986; Codasyl End-User Facilities Committee, 1979; Martin, 1982; Rockart & Flannery, 1983). Two models were found to be of particular interest. The Codasyl schema is one of the simplest and is potentially useful for this study. The Codasyl group proposed categorizing end-users into indirect, intermediate, and direct end-users. Indirect end-users are users who use computers and computer output exclusively through other users. Intermediate end-users are users who use computer reports but do not directly interact with computers. They specify their business information requirements and depend on other people to build them. Direct end-users are users who directly interact with computers.

The Codasyl classification schema is rather broad and each of these categories can be broken down further. Rockart and Flannery (1983) refined the direct end-user category into non-programming, command level, end-user programmers, functional support personnel, computing support personnel, and data processing programmers. Non-programming end-users interact with the computer through highly structured software created and managed by others. Command level end-users use command-language software that allows them to tailor reports and make simple inquiries. End-user programmers use command and programming languages for their own personal information needs. Some of their applications may be used by others but it is more of a by-product of satisfying their own information needs. Functional support personnel are informal programmers who support other end-users. They often become informal centers of systems design and programming expertise within their functional area. End-user computing support personnel are programmers who are paid to support other users in a variety of computing activities. Data processing programmers are programmers who are specialized in a particular programming area and write programs professionally.

Programming Quality Categorization Scheme

Feigenbaum (1961) proposed a categorization scheme that may be useful to help users evaluate system quality. The scheme is based on the degree of discompliance from a system that has no programming faults. It uses four category levels including: critical, major, minor, and incidental. Critical represents a degree of discompliance that makes the product non-functional or dangerous to life, or property. Major represents a level of discompliance where the product fails to accomplish its intended function. Minor is a level of discompliance where the product completes only part of its intended function. Incidental is a level of discompliance where the product completes its function, but still contains some minor flaws.

CSFs of Information Systems

CSFs may be identified from several different sources. Rockart (1979) suggested they may be identified from industry, organization, environment, and temporal sources.

The CSF categorization scheme proposed for this study includes system, task, user, organizational, and environmental variables. This scheme matches well with Rockart's identification of CSF sources. Temporal factors may be accounted for by using situational variables under the proposed CSF categorization model and by employing the proposed CSF stage-theory model which controls for the implementation, integration, and internalization stages.

There have been many studies attempting to identify independent variables relating to IS success including: Baroudi, Olson, and Ives, 1986; Benbasat and Schroeder, 1977; Benbasat and Taylor, 1978; Cerullo, 1980; Cheney and Dickson, 1982; Delone, 1988; Ein-Dor and Segev, 1978; Ginzberg 1974; Huber, 1983; Ives and Olson, 1984; Keen and Scott-Morton, 1978; Lee 1989; Liang, 1986; Lucas, 1978; Magal, 1987; Pyle, 1986; Rainer 1989; Rockart, 1982; Sanders and Courtney, 1981; Trait and Vessey, 1988; and Yen, 1989. These and other studies have focused on a variety of IS types, from general MISs to more specialized DSSs and EISs. Some have looked only at the implementation portion of system development and others have studied the entire developmental cycle. Some researchers have developed their factors from original research and others have selected their factors from past studies. Some researchers developed and listed factors using the case study approach and others tested the significance and predictive strength of factors using quantitative approaches. Some researchers identified a few significant factors and others identified a large number of factors.

Yen (1989) compared two database query languages, focusing on human factors and found three significant CSFs. Rockart (1982) examined the CSFs of IS specialist and identified four factors. Keen and Scott-Morton (1978) suggested five factors may have substantial impact on the success of general ISs. Pyle's (1986) research focused on the CSFs of user-based implementation projects in MISs and listed six potential factors. Magal (1987) studied CSFs relating to the success of information centers and found 26 factors. Cerullo (1980) sampled a set of Fortune 1000 IS managers identifying more than 28 factors related to MIS implementation. Rainer (1989) performed seven case studies on EISs and found 27 factors related to implementation and 43 factors related to operation. Ginzberg (1974) researched 14 factor studies and identified 140 different factors reported to have significant correlations with implementation success. Only three of these factors appeared in more than four studies. These factors included top management support, well-defined measurable objectives, and complexity of the techniques and models.

Because of the great variety of research interests and analytical approaches, factors identified in this literature review are presented in two formats. The first format exhibits sets of CSFs by studies. Many of these factors were identified as related to system success, but were not tested statistically. The first format takes a historical approach by explaining how factors were developed and describes the results. The second format exhibits CSFs by categories. It utilizes the proposed CSF categorization and stage-theory models to categorize CSFs disclosed in the literature.

During the review of these factors there is no attempt to differentiate between factors that may be substantially and significantly related and those that are not.

Example IS CSFs By Studies

Although there is no clear agreement in the literature as to what factors lead to successful implementation, Delong and Rockart (1986) identified the following CSFs for the implementation of EISs.

1) Commitment and informed executive sponsor.
2) An operating sponsor.
3) A clear link to business objectives.
4) Appropriate IS resources.
5) Management of data problems.
6) Management of organizations resistance.
7) Management of spread and system evolution.

Magal (1987) performed an empirical investigation of CSFs applicable to information centers. His review found several exploratory investigations that disclosed lists of CSFs related to information centers (Brancheau, Vogel and Wetherbe, 1985; Leitheiser & Wetherbe, 1985; Marks, 1985; Sumner, 1985a; Sumner, 1985b). Magal developed a summarized list of those CSFs that included the following, in order of importance.

1. Competent Staff.

2. Communication with users.
3. Top management support.
4. Reliability of applications developed.
5. End-user training.
6. Information center staff's understanding of user's business and problems.
7. Training for information center staff.
8. Organizational acceptance of information center.
9. Standardized hardware and software.
10. Liaison function with end-user department.
11. Support right software packages.
12. Cost effective solutions.
13. Manage end-user expectations.
14. Promotion of information center service.
15. Atmosphere for users.
16. End-user commitment to the information center concept.
17. Define information center mission.
18. Establishing career paths for information center staff.
19. Establishing priority criteria for work.
20. Provide services to distributed sites.
21. Control procedures to insure standards, policies, etc. are adhered to.
22. System performance.
23. Monitor and coordinate end-user development.
24. User's understanding of data processing.
25. Response to requests.
26. Establishing a chargeback criterion.

Magal (1987) reduced these 26 factors to five using factor analysis. The summarized factors include: 1) commitment to the information center concept, 2) quality of information center support services, 3) facilitation of end-user computing, 4) role clarity, and 5) coordination of end-user computing. Magal's (1987) research also revealed most important CSFs had little variation across Nolan's four stages of information center growth. He mentioned that it was possible his study failed to differentiate factors among stages because the reliability coefficients of two out of five of the composites were low and one composite had a very small sample size.

Delone (1988) reviewed exploratory studies on the implementation and operation of ISs in small business firms. From this he adopted the following nine CSFs.

1) Use of external programming support.
2) Level of CBIS planning.
3) Top management knowledge of computers.
4) Top management involvement.
5) Personal acceptance.
6) Sophistication of computer controls.
7) Age of the computer operation.
8) Level of computer training.
9) The type of computer use (on-site/off-site).

Only the variables "top management knowledge of computers" and "type of computer use (no-site/off-site)" were supported by Delone's field study.

Lee (1989) also researched factors affecting the implementation and operation of ISs in small business firms. He categorized the CSFs into two broad categories, including: organizational strategic and control perspective, and user perspective. The following eleven factors were identified.

1) External programming vs. internal programming.
2) In-house vs. service bureau.
3) Sophistication of computer controls.
4) Number of administrative applications.
5) High ranking MIS function.
6) Presence of system analysis.
7) Intensity of information requirements analysis.
8) Management computer experience.
9) User involvement.
10) Training.
11) Interactive applications.

A separate opinion survey by Lee (1989) found the following factors in order of their rated importance:

1) Technical knowledge of users.
2) Technical expertise available to users.
3) User involvement.
4) Top management support.
5) Planning and control.
6) External vs. internal programming.
7) Interactive applications.
8) Number of administrative applications.
9) In-house vs. service bureau.
10) Rank of IS managers.

Rainer (1989) performed an exploratory study on the CSFs of EISs using a multiple constituency approach that involved seven case studies. He looked at CSFs from the perspectives of user, vendor, and consultant. The following set of factors were found to relate to the implementation of EISs.

Group I - Factors for Company Executives
1) Have an executive sponsor.
2) Provide top management support.
3) Manage organizational resistance.
4) Link business objectives to the EIS.
5) Appoint an operating sponsor.

Group II - Factors for Developer/Vendors
6) Control and define costs.
7) Arrange for supporting data to be managed.
8) Manage the spread and evolution of the EIS.
9) Use an evolutionary development approach.
10) Install a complete, not a partial system.
11) Provide a support team.
12) Customize software where necessary.
13) Have an appropriate I/S staff.
14) Use a consultant.
15) Maintain a liaison with users.
16) Utilize existing hardware and software.
17) Use the appropriate technology.
18) Do not design an overly complex system.
19) Develop a friendly user interface.

20) Introduce during a turbulent period.

Group III - Managing the Firm's Executives
21) Manage executive expectations.
22) Deliver the first version of the system quickly.
23) Provide a benefits statement.
24) Develop as a group system.
25) Deliver a good product the first day.
26) Sell the concept before the technology.
27) Learn about the company.

The following set of factors were found to relate to the successful operation of EISs.

Group I - Desirable EIS Characteristics
1) Easy to use.
2) Has an adaptable interface.
3) Moderate to minimal training required.
4) Easy to obtain hard copies.
5) Reliable.
6) Promotes continuity in the firm.
7) Fits well with existing information systems.
8) Information is accountable.
9) The platform is valid for future use.
10) Information is secure.
11) The system is adaptable to new software technology.
12) Response time is fast.
13) Low maintenance.

Group II - Information Quality
14) Accurate information.
15) Relevant information.
16) Timely information.
17) Reliable information.
18) Current information.

Group III - EIS Functions
19) Daily, weekly, monthly, yearly forecast.
20) Trend analysis.
21) Inventory control.
22) Cost/benefit analysis.
23) Access to operational data.
24) Exception reporting.
25) Status access.

26) Decision support.
27) Tickler files.
28) Early warning system.
29) Multiple methods to find information.
30) Standardized definitions or terminology across the organization.

Group IV - System's Impact on Organization
31) Increases profits.
32) Improves interdepartmental communication.
33) Better sales decisions.
34) Decrease paper flow.
35) Saves time.
36) Reduces employee workload.
37) Goal achievement focus.
38) Improves mental model of organization.

Group V - Outcomes
39) Improves executive's image of developer/vendors.
40) Improves executive's image of the IS department.
41) Improves employee's image of computer-based technology.
42) Gives developer/vendor more access to executives.
43) Gains commitment from employees.

IS CSFs By Categories

The second format organizes factors described in the literature around proposed CSF categorization and stage-theory models. Factors are listed in separate categories for clarification purposes. This divide-and-conquer principle is a powerful technique and has been the basis for many engineering successes (Ligon 1990, p. 72). Nevertheless, there are relationships among factors that must be analyzed using a holistic approach. Variables may be identified and discussed separately, but the successful application of CSFs should consider these interactions. The areas examined include evolutionary stages, system, task, user, organizational, and environmental variables.

Evolutionary Stages

Many studies have attempted to control for system developmental levels. Park's (1990) investigation into the characteristics and usage of IS in small apparel and textile companies found the evolutionary stage of the firm's IS affects CSFs. Stage-theory was also found to be related to the firm's IS activities. Raymond (1985) found that small firms operating ISs differed in ways consistent with Nolan's (1973) stage hypothesis.

Lee (1989) found differences for the management of small firms whose ISs were in different stages of development, although no differences were found across industries. The important CSFs in the early stage of development were top management support and user involvement. The important factors in the later stages of development were top management support, user involvement, vendor support, internal programming, and detailed information requirements analysis.

System Factors

System factors include variables such as quality, design strategy, and level of user involvement. Most system factors disclosed in the literature centered around the implementation phase of systems development.

Cerullo (1980) sampled a set of Fortune 1000 information system managers. More than 28 implementation factors were identified. The most important factors included user's attitude towards system development, development-personnel's training in the systems approach, user's involvement in planning the IS, developer's technical expertise, user's involvement in system analysis, design, and implementation, user's ability in making their information needs known, and the use of database management systems.

Based upon Cerrullo's (1980) work, variables in this area relate to the system itself, such as level of sophistication; to the task (task-alignment), such as availability of information; or to the user (user-alignment), such as user-involvement in the system design. These findings support the concept that although factors can be categorized into independent areas, they are often highly interrelated.

Lucas (1981), after summarizing the results of nine empirical studies, found system quality to be an important factor. Park (1990, p. 127) in his sample of small apparel and textile companies found that firms with successful ISs had higher levels of IS sophistication. In the same study, Park (1990) found the level of user input into the system design to be significantly related to system success.

The idea that the system must be well aligned to the user is observed in a number different studies. The McKinsey (1968) studies were based on extensive interviews and found user involvement to be important. Keen and Scott-Morton, (1978) found early user commitment and involvement to be important. In fact, many MIS research studies have demonstrated the level of system success can be increased by involving end-users in the planning and development stages (Cerullo, 1980; Lee & Steinberg, 1980, pp.19-25; Lucas, 1974, pp. 59-67; Maish, 1978, pp. 39-51; Rockart, 1979, pp. 81-93, Rockart, 1982, pp. 3-13; Schonberger, 1980, pp. 13-20; Senn, 1984).

This finding is a result of several influences including higher satisfaction, user information needs, and improved system/user interfacing. Lucas (1975) questioned 2000 users and concluded that the prime reason that ISs fail is due to behavioral problems that are not addressed in the design and management of the systems. Cutis, Krasner, & Iscoe (1988) found that problems occurred when application domain knowledge was lacking, when requirements fluctuated or conflicted, and when communications and coordination broke down. It was found necessary to have a shared understanding of the overall system. A clear sense of mission was helpful and fluctuations were minimized when market demands were the force behind the development rather than political pressures. Users want systems that are easy to learn, easy to understand, and easy to use, and they are more likely to receive this when involved in the system's design and development (Yen, 1989).

Montazemi (1988) also identified significant factors relating to user-alignment. These include the presence of a systems analyst, intensity of information requirements analysis, user involvement, user computer literacy, presence of an interactive interface, and degree of decentralization. Several of these factors point out the need for user support services. This finding was also confirmed by Lee (1987) who found hardware support, software support, and data support, to be critical to the long-run success of end-user computing.

The third consequential area in system factors was task alignment. When the system does not provide its users with what they need or desire for their decision-making, it will not be used (Ackoff, 1967; Hall, 1973). Keen and Scott Morton (1978) found the system must be provided with clear problems to direct work efforts towards. Morse and Laurence (1984) asserted that the system must be able to provide the data required by its users. Park (1990) found the perceived quality of computer reports, and the sophistication level of the computer hardware to be important CSFs. In a more profound sense, he found the level of matching between a firm's computer applications and the firm's CSFs to be related to the level of IS success. In another words, the system should perform the tasks that are most related to the organization's success.

Task Factors

Task factors includes variables such as information complexity and job complexity. It is highly related to the system and user, interfacing the two. Training is included in this category because, from the user's perspective, it tends to reduce the information and job complexity.

The IS is most successful when the tasks demanded of it are aligned to the user's needs and the system's abilities to satisfy those needs. Keen and Scott Morton (1978) observed the value of data increase as the format, language, and detail was aligned the needs and wants of the client. They also found higher IS success as the ease and right of access increased and as the time of information delivery better matched the time it was required.

Shultz and Slevin (1975) found the system's effect on job performance, adequacy of task support, urgency and importance of the task, and quality of user training to be related to the likelihood that users would use the system.

Locating and extracting the right data can be one of the most difficult tasks for computer users. Because of this, training support and hands-on access are critical to the long-run success of end-user computing (Lee, 1987). In Lee's 1987 research he found that both end-users and MIS practitioners felt that training was an important CSF.

The general service orientation of the IS staff was found to be an important factor to task completion by Rockart (1982). This may involve support in the form of training or direct assistance with task completion. It is not unreasonable to expect that an organizational culture supporting IS task activities would also be related to IS success. DeLone (1988) proposed that there was a relationship between management's computer experience, the control over computer usage, computer training, and worker independence to IS success.

User Factors

User factors include variables such as cognitive styles, attitudes, expectations, and experience. Some user factors, such as expectations and attitudes, are considered so important to IS success that they are used as dependent variables.

Christensen (1987) concluded that cost-effective and technically well-designed ISs often fail because of human and organizational problems. For example, research has shown systems to fail as a result of resistance to change (Markus, 1981, 1983; McLean, 1976).

Park (1990) found user characteristics important to the success of the firm's IS activities. He found the level of user-satisfaction related to user characteristics. For example, the higher the level of computer expertise, the more satisfied the user.

Lucas (1981) summarized the results of nine empirical studies which indicated situational and personal variables correlate to system use, where usage is voluntary.

Christensen (1987) has done extensive research in the area of user factors as they relate to successful DSS implementation (see Christensen's model, in this chapter). He concluded that cognitive style does not correlate directly with implementation success, but acts as a moderator. He found that DSS usage intentions were positively associated with usage behavior, positively associated with the individual's attitude toward using the DSS, directly related to the user's normative beliefs associated with usage, and only weakly related to subjective norms.

Organizational Factors

Organization factors include variables such as stress, power, policies, and management support. Many organizational factors have been found to be related to IS success.

Pyle's (1986) research on CSFs for MIS implementation listed six potential factors, most of which were related to the organization. In his literature review, he found top management support, a well institutionalized MIS, sufficient project resources, business demographics, training, and involvement of key groups to be important. Using factor and regression analysis, four factors proved to be significant at the $p \leq .05$ level, accounting for 54.92% of the variation between the factors and successful system implementation. They included project resources in the form of business expertise, MIS personnel allocated to the project as a percent of MIS personnel requested, organization size in terms of annual gross sales, number of employees, and middle management involvement during implementation.

Raymond (1985) found user-satisfaction was higher in firms that developed a greater percentage of their MIS applications internally, operated applications in-house, implemented a large number of administrative applications, implemented interactive applications, and had a high ranking MIS function. Park (1990) found the level of IS activity, to be of importance to the firm's IS development.

Organizational factors that tended to be reiterated in the CSF literature include IS personnel, top-management support, supporting culture and politics, organizational structure and organizational size.

With respect to IS personnel, DeLone (1988) proposed that organizational CSFs should include management and staff with relatively high computer experience levels, separate information department, and proportionally more IS personnel.

Park's (1990) investigation into the characteristics and usage of computerized ISs in small apparel and textile companies also found the relative number of IS personnel in relation to the company's total number of employees to be an important CSF for the respective firm's

MIS function.

Many studies have shown top-management support to be an important CSF. Lucas (1981) summarized the results of nine empirical studies indicating top management support correlated to system usage. Lee's (1987) exploratory research into the implementation and management of an environment facilitating direct end-user access to corporate databases found that MIS practitioners believed that MIS support, top management support, and planning were among the most important CSFs. Miles (1983) also found planning to be an important CSF. One of five factors Keen and Scott Morton (1978) found to have substantial impact on the success of IS projects was top management support. Garrity (1963) assessed the implementation success of computer systems and found quality of leadership, support, management involvement, and caliber of MIS staff to be related to a set of tangible and intangible system benefits. McKinsey (1968) found management support and management involvement to be important to IS success. Rockart (1982) found human, organizational, financial resources, and the vision of the organization's leaders to be critical variables. And lastly, Christensen (1987) found several international studies on the implementation success problem indicating management involvement, user involvement, system champions, and correct political climate were important elements.

Politics and cultural environments must be favorable for users to engage in system use. Markus (1983) and Keen (1981) proposed the political and power structures of the organization were important CSFs. Morse and Laurence (1984) found organizational culture and organizational service to be important. Murrey (1983) felt there must be good communication between the IS staff and users.

Organizational structure also appears to have bearing on IS success. Leifer (1988) and Baker (1987) felt that not only must there be a commitment by the organization's CEO, but there must be a match between the organization's structure and the IS department's structure. Park (1990) found that firms with successful ISs had higher levels of IS sophistication and Keen and Scott Morton (1978) found that companies with an institutionalized MIS group had higher IS success rates.

Organizational size is considered an important variable and has motivated many researchers to concentrate exclusively on either small or large firms. Lee (1989) suggested several problems associated with the implementation and management of ISs that are unique to small business firms. Small business firms have less resources, less formalized processes, and less technical expertise. Because of these differences organizational size is considered an exogenous variable that should be controlled. Rockart's (1982) interviews with IS specialist led him to identify the organization's size and maturity as important exogenous variables as well.

Environmental Factors

Environment includes factors such as competition, economic, and political variables. The only literature on external culture found in this review was from Lee (1987). Lee (1987) suggested that IS success was related to the benevolence of the external business environment.

LYMSs and CSFs

LYMSs possess a combination of general and unique IS characteristics. Because of this, a portion of the CSFs for LYMSs are expected to be unique to this system. No research was uncovered that specifically examined CSFs for LYMSs using a CSF approach, but potential CSFs can be interpreted from the body of literature.

The first area of discussion will explore potential LYMS CSFs interpreted from the literature. The second area is a synopsis of a conversation with Mark Eble, a LYMS consultant (1991). While he helped to shed light on special factors relating to LYMSs, more research is required to improve upon the CSF knowledge base.

Kimes (October 1989) suggested that several potential areas may become sources of problems for the successful implementation and operation of LYMSs. These areas include customers, employees, incentive systems, training, system organization, and executive commitment. She also suggested that booking and sales patterns must be relatively predictable by market segment.

A strong PMS is considered important to develop an overbooking policy and to compute elasticity of demand. The information system should incorporate the manager's knowledge of a market segment's time sensitivity as well (Relihan, 1989).

Relihan (1989) believed the biggest problems for the successful implementation and operation of LYMSs resulted from poor inventory controls and poor sales tools within the existing property management and central reservation systems. For example, a limited set of rates and crude uses of length-of-stay controls can be counter-productive to yield management. Jones and Hamilton (1992) felt that successful LYMSs need a market-responsive company and more than just a sophisticated inventory-control system.

Another potential problem is that guests may become alienated. Although the general public is accustomed to changing airline prices, they are not accustomed to hotels that frequently change prices. If a client expects a particular price range and is confronted with a significantly higher rate, managerial experience tells us there is a good chance that he or she will book with a competitor. With LYMSs, prices could vary enough to cause considerable market place confusion. As more and more lodging properties adopt yield management, it is likely that customers will begin to accept the technology.

Like guests, employees may also become estranged. Employees who do not feel comfortable with computer-based ISs can experience problems with the LYMS. Efforts must be made to insure employees who are affected by the system feel comfortable. It helps to have employees who are flexible and willing to help make the system a success, but not all employees have these qualities.

Training can help employees understand the system. Knowing how it works, how it affects their jobs, and how to use it properly, goes a long way towards making everyone feel more comfortable.

In addition to training, incentive systems must be redesigned to encourage employees to work for the system's objectives and not against them. Under traditional incentive programs, group-sales employees may find yield-management recommendations work to their disadvantage (Kimes, November 1989). Reward systems for managers must also be designed to encourage working towards yield management objectives.

Employees may resent the system because it encroaches into their domain of responsibility. For example, yield management systems will remove much of the pricing responsibility previously held by reservationists and front-desk employees. As Kimes (November 1989) suggested, one method to combat this problem is by allowing workers latitude in using their own judgment.

The organization of the LYMS is also an important consideration. Most organizations using yield management will have at least some elements of the system at the property level. This is because group business is normally controlled at this level and must be incorporated there. If possible, LYMSs should be tied to the central reservation system. Another organizational problem is deciding which department will be responsible (Kimes, November 1989). One suggestion is to involve all of the departments on an equal basis.

Lastly, a commitment from top management is required. This is known as "ownership" or "championing." This element was also found important for the successful implementation of EISs (Rainer, 1989).

Mr. Eble (1991) of Chicago suggested that implementing and operating LYMSs are difficult for a variety of reasons. Top support is sometimes difficult because managers don't always understand yield management. Also, it may be difficult to demonstrate LYMS performance because of external variables.

Eble suggested that culture is important. Sometimes double standards exist. Managers may be evaluated on average occupancy or average rack rate while the corporate level managers use yield management measures. He mentioned two main components to yield management: rate manipulation and stay pattern management, and stated that the "magic bullet" was forecasting. Eble suggested two important questions to ask: Does it help management make better decisions? And, are you better off for using it?

Summary

This section reviewed the literature on CSFs. The CSF approach has many practical benefits and enjoys widespread service. It has been used to identify information needs and elements critical to the success of managers, programs, and systems. The technique has been found to be intuitive, well-received, a good tool for improving communication, and particularly supportive of the planning process. These characteristics fit well with the nature of LYMSs.

CSF technology was introduced, defined, and discussed from a historical perspective. Because it is not a particularly formal process, it was conceptualized based on information found in the literature search. CSFs fit between, and are highly related to, organizational goals and the systems that support those goals. As part of the conceptualization process, CSF were categorized and a model was adapted.

Alternative (non-CSF) methodologies were listed, compared, and discussed. Research indicated the CSF approach was the best suited technique for this empirical study. In addition to its explicit qualifications, its widespread use provides a base of IS studies for comparisons.

To control for potential confounding variables, several additional topics were introduced and conceptualized. Stage-theory was submitted to control for differences in evolutionary stages of the system's development cycle. The proposed stage-theory model was adapted from research employing end-user stage-theory models. End-users were also classified on the basis of their working relationship with the system to control for system proximity attitudes.

Since the study will focus on CSFs, CSFs of general ISs were listed and discussed using two different formats. One took a historical approach and the other a categorical approach; listing potential factors using the CSF categorization scheme. Lastly, potential CSFs of LYMSs were derived from the literature and discussed.

Table 3 summarizes CSFs found in the general IS literature. Since many of the factors disclosed in the review suffer from the phenomenon of "factor proliferation," an attempt was made to reduce them into factors that would be more critically related using Ligon's (1990) statement: "... would help to achieve, ..." verses "... is necessary for achievement ...." This also keeps the factors more in-line with Rockart's (1979, p. 85) definition which states "... the limited number of areas ...." General factors have been labeled "measures," since they may be used as operationalized variables for the critical factors. The number of references for each factor in the review is listed next to the factors in parenthesis.

Table 3

Summary of General IS Factors Identified in Literature Review

Category	Factor (count)	Measure(s)
Evolutionary stages	Management (3)	System evolution management
System	System design (32)	Sophistication of software, Sophistication of hardware, Ease of use, Interfaced well with existing system, Decentralized, Range of applications, Interactive programs, User involvement, Platform valid for future use, Designed internally, Intensity of IRA, Well-defined mission
	System quality (10)	Reliable, Cost effective, Performance, Fast response time, Low maintenance, Gives vendors more access to executives, Improves image of IS vendors
	Data management (3)	System data management, supporting data management
	Promotion (1)	Promotion
	Age (1)	Age

(*) = Number of references.

Table 3, continued

Summary of General IS Factors Identified in Literature Review, continued

Category	Factor (count)	Measure(s)
Task	Objectives (14)	Well-defined, Measurable, Linked to business objectives, Linked to user needs, Urgency, Affect on job performance
	Training (10)	Role clarity, Quantity, Quality
	Functions (9)	Forecasts, Trends analysis, Inventory control, Cost/benefit analysis, Exception reporting, Status access, Decision support, Early warnings
	Control (8)	Established priorities, Policies, Information accountability, Information security, Standard terminology and definitions, Worker independence
	Information (8)	Accurate, Relevant, Timely, Reliable, Current, Report quality
	Interface (7)	Friendliness, Complexity, Adaptability, Multiple ways to find information, Easy information access
	Atmosphere (1)	Atmosphere
User	User commitment (14)	Involvement, Communicates, Shared understanding
	User attitude (5)	Acceptance, System beliefs, Normative beliefs
	User competence (3)	Understanding of data processing, Technical knowledge

(*) = Number of references.

Table 3, continued

Summary of General IS Factors Identified in Literature Review, continued

Category	Factor (count)	Measure(s)
Organizational Environment	Top management support (49)	Operating sponsor, Sufficient IS resources, Career path for IS staff, Business expertise dedicated to project, Communication with users, Change management, User expectations management, Commitment, Involvement, Level of planning, Knowledge of computers, High ranking MIS function, High ranking MIS staff, Supporting data in managed, Introduced during turbulent period, Supporting culture, Involvement of key groups
	IS staff support to user (25)	Quality and competence of IS staff, Communication with users, Change management, User expectations management, Understanding, of user problems, Training, Liaison function, Responds to user requests, Coordination, Level of planning, Well institutionalized, Personnel allotted to project, Relative number of IS personnel
	Quality of vendor support (12)	Costs well-defined, Complete system installed, Good support team, Customized software if needed, Consultant provided, Appropriate technology used, Expectations managed, System delivered quickly, Benefits statement provided, Quality product delivered, Concept sold before technology, Learned about company, Training is systems approach
	Demographics (6)	Number of employees, Sales, Structure matches
External Environment	Support (5)	Consultants
	Benevolence (2)	Benevolence

(*) = Number of references.

Table 4 is a summarization of factors relating to LYMSs. This material has been developed from the literature review of both the LYMS and CSF sections. The LYMS factors have been categorized and listed in a fashion similar to the summary tables for the general IS factors. Like Table 3, Table 4 includes categories for system, task, user, organizational environment, and external environment factors.

By comparing the summary data of Tables 3 and 4, several points may be noted. As would be expected, more references occurred for the general IS factors than for the LYMS factors. There were no references to the evolutionary stages for LYMS factors, possibly because of the smaller literature base. Both summaries had more references for system design than for system quality, with proportionally more design references in the LYMS literature. This might be attributed to the particular researcher's interest in explaining how the system works, or the system may be more design dependent. Task functions were stressed more in the LYMS literature review, than in the general IS literature review. This also may be due to more researcher interest, but it is most likely because LYMSs are more function specific. Both summaries show that task objectives had a relatively high number of references. Linking tasks to business objectives and user needs appears to be important for all types of systems. Both summaries listed task references to training, control, and information. Proportionally, training was not mentioned as often in the LYMS literature review and interface was not mentioned at all. The user category was the same for both summaries. User commitment, attitudes, and competence may be equally important for all types of systems. Counts for top management support were very high with both summaries, but the LYMS literature review was more specific, listing top

Table 4

Summary of LYMS Factors Identified in Literature Review

Category	Factor (count)	Measure(s)
Evolutionary Stages		
System	Design (17)	Organization, Incorporate expert knowledge, Integrated with PMS, Integrated with corporate IS, Incorporate feedback, Incorporates no-show and cancellation data, Centralized data, User considered, User involved
	Quality (3)	Good data organization, Organizational validity, Technical validity
Task	Functions (27)	Compute elasticities of demand, Segments demand characteristics, Price manipulation, Good forecasting, Dynamic calculations, Accounts for multiplier effect, Accounts for multiple night stays, Controls rate mix, Controls overbookings, Distinct rate structures, Broad rate structures, Volume buyers considered differently, Decision support
	Objectives (7)	Maximizes revenue, Long-term focus
	Control (6)	Overbooking policies, Worker independence (decision-making latitude)
	Information (4)	Organized, Accurate, Reliable, Available
	Training (4)	Training

(*) = Number of references.

Table 4, continued

Summary of LYMS Factors Identified in Literature Review, continued

Category	Factor (count)	Measure(s)
User	Commitment (7)	Incentives, Willingness, Flexibility
	Attitude (3)	Behavior towards system, IT culture
	Competence (1)	Comfort level with IT
Organization Environ.	Top-management support (16)	Commitment, Incentives, Involve all departments, Championing, Planning, Yield management knowledge, Yield management culture, Vision for IT, Investments in IT, Develops yield management strategies, Manages change process
	Marketing support (15)	Sales tools, Market responsive, Incentives, Rate mix strategies, Formalizes rate structures, Broad rate structures, Overbooking strategies, Markets in ethical manner
	Existing ISs (13)	Strong PMS, Strong corporate IS, Guest history databases, Quality data, Provides feedback, Provides day-by-day data, Provides no-show & cancellation data, Centralized data
	Operations support (7)	Inventory controls, Market responsive, Satisfy right market mix, Incentives, Monitors reservations
	IS support (1)	Can handle increased activity
External Env.	Customer Behavior (11)	Advanced purchases, Advanced bookings, Can be segmentation, Tolerance to differential pricing, Fluctuating demand
	Agent Behavior (5)	Tolerance to differential pricing, Not undermining system

(*) = Number of references.

management, marketing management, and operations management support. Proportionally, IS support was not counted as frequently in the LYMS literature review as it was in the general IS literature review. This may be due to the lack of IS staff in many lodging units. Strangely, vendor support was not counted at all in the LYMS literature review, a factor that one would expect to encounter. External environment appears to be more significant for LYMSs than it is for general ISs. Apparently, researchers consider LYMS performance to be quite sensitive to the external environment. This finding would be in-line with the nature of LYMSs.

Fourteen variables extracted from the general IS literature review were identified as potential as dependent variables. These were identified because they represent a potential impact on the organization as a result of LYMS usage. The variables include: increased revenue, increased profits, improved interdepartmental communication, better sales decisions, decreased paper flow, time saved, better decisions, reduced employee workloads, focused goal achievement, improved mental model of organization, improved image of IS department, improved image of computer technology, and commitment gained from employees.

Two questions extracted from the LYMS literature review could be used as dependent variables. "Does it help management to make better decisions? And, "Are you better off for it?" (Eble, 1990). And, two factors could be used as dependent variables including unified goals and strategies of marketing and operations departments, and strengthened communication between marketing and operations departments.

The next chapter develops and outlines the study's research methodology.

CHAPTER THREE
RESEARCH METHODOLOGY

In this chapter the study's research methodology is developed and described. The objectives of this study are 1) to determine what relationships exist between successful LYMSs and controllable independent variables in the form of CSFs, and 2) to add to the body of IS knowledge in an applied service industry setting. The research methodology presented in this chapter was designed to meet these objectives by answering the research question while controlling for variance, as suggested by Kerlinger (1986).

This chapter was divided into sections corresponding to steps of the research methodology design. Table 5 summarizes the research design strategy and specifies the particular criteria or focus for each decision or activity point. Each topic listed in the table is presented and described in this chapter.

Selection of LYMS as the Topic of Study

As discussed in chapter one, LYMS was first selected as the topic of study because it crossed the researcher's areas of interest. LYMSs were expressly designed for the lodging environment and appeared to have considerable potential to increase revenue and profits for a variety of lodging operations.

The strongest reasons for proceeding with this topic were the researcher's continued

Table 5

Research Strategy

Research Decision/Activity	Research Criteria/Focus
Selection of LYMS as the topic of study	Crosses researcher's areas of Interest
Preliminary review of literature	Evaluation of topic and its feasibility
Phone interviews and reviews with system developers	Determination of industry interest and feasibility of topic
Main review of literature	Development and anchoring of study
Determine extent of LYMS populations	Establish LYMS population parameters
Selection of CSF methodology	Best suited methodology for study
Development of research question	Hypothesis proposition
Methodological decision for cross-sectional field study	Time and money constraints, realism, external validity, and relatively large effect size
Identification of potential system success constructs	Identify set of valid and reliable dependent variables
Identification and organization of potential CSF variables	Identify extent and nature of independent variables and organize them
Identification of potential confounding variables	Identify variables that may affect relationship between dependent & independent variables
Questionnaire construction	Item selection, operationalization of variables, measures, interval scales, format, wording, and administration.
Pre-test of questionnaire	Questionnaire content analysis and validation
Choice of empirical setting	Representiveness, sample homogeneity, sample sizes, generalizability
Data collection	Questionnaire mailings and follow-ups
Data description and empirical analysis	Data purification. methodological objectives, reliabilites, construct validities, factor, correlation, and other statistical analysis
Discussion of findings	Discussion of research findings and study limitations
Conclusions and summary	Theoretical, managerial, and methodological implications. Suggestions for future research

interest in the subject, lack of previous research, industry need for this type of information, and gap in the body of IS knowledge. LYMSs are complex, appear to have considerable impact on the organization, and present ample challenges for successful design, implementation, and operation.

Preliminary Review of Literature

The preliminary literature review evaluated approximately 35 articles and papers. The LYMS topic was relatively new in 1991 and this was reflected in its literature base. There was little historical material, but considerable material relating to LYMS characteristics. Researchers and readers were primarily interested in understanding the nature of yield management, the systems, their components, and how they worked. There were many references about how the organization was impacted by yield management and how employees needed to adapt to yield management practices.

The preliminary literature review provided little information regarding the extent of LYMS development. Only one reference even indicated that any had been installed. This was viewed as an opportunity since as a new class of ISs, they were a natural candidate for studies involving the identification of their CSFs. The preliminary literature review became the basis of a draft proposal presented in December 1991. Since relatively little literature existed on the systems, developers who were identified in the literature were contacted and interviewed over the phone to help evaluate the project's feasibility from an industry perspective.

Interviews with System Developers

Three LYMS developers were identified in the preliminary review of literature. These included Mark Eble, Eric Orkin, and Joseph Garvey. The first person contacted was Mark Eble (1991). He was working for Laventhol and Horwath, and actively involved in developing and marketing a LYMS designed by Eric Orkin. Eble expressed interest in any research that could help identify CSFs. At the time he was involved in his own LYMS research to help validate the system's usefulness. Eble discussed the system with the researcher at length and encouraged any type of study that would benefit the industry.

Next Eric Orkin was contacted who also expressed interest in LYMS research. At the time, he believed about one percent of lodging operations that could afford LYMSs were currently using or considering a system. This indicated a relatively small user-base, but Orkin felt enough had been installed to provide the researcher with a study population.

The last developer was Joseph Garvey. Mr. Garvey was also involved in marketing his system and, at the time, had about 20 active installations. Mr. Garvey believed that LYMSs could be built that did not require much involvement on the part of the lodging property's management team. This approach, he stated, made implementation much simpler with no loss of performance. Mr. Garvey also expressed interest in research on LYMSs and felt that most of the other developers would be willing to participate in a project to identify CSFs.

All three developers were provided with a draft proposal. They continued to express interest in the project and felt that research in this area would benefit their efforts to develop and sell systems, help users to adopt systems, and generally assist their fledgling industry.

Main Review of Literature

The main review of literature began in December of 1992 and continued through April of 1993. The preliminary literature review was expanded to include ISs in general, airline yield management systems, and additional LYMS literature. Databases from Dialog, Knowledge Index, Virginia Tech, and Texas Tech University were scanned for information on these topics and approximately 500 citations were identified that warranted evaluation. These articles and papers were reviewed and approximately 200 references were used in the development of this dissertation.

The main review of literature anchored, developed, and positioned the study. IS theory was explored, categorization schemes were adapted, and IS factors were disclosed that applied to the study and its methodology. The main literature review was presented in this paper as chapter two.

Extent of LYMS Population

At this point in the research it was important to determine the extent and nature of the

LYMS population. If just a few systems were installed, the research effort would be limited to those units and could continue only if permission to study them was secured. The number of installed LYMSs would also impact the type of research to be conducted. For example, survey research would be inappropriate if just a handful of systems were operational.

Before determining the extent of the LYMS population, the definition and characteristics of LYMSs had to be examined. A working LYMS definition was required to separate systems that were authentic LYMSs from those that were not. It was possible for non-LYMSs to be marketed as LYMSs because of the advertising hype that surrounded these systems.

Definition and Characteristics of LYMSs

LYMS characteristics were considered important to evaluate the applicability of the systems to particular organizations, to determine which organizations were employing LYMS features, and to determine the extent to which organizations had employed system elements.

LYMS was defined as an electronic computer-based system that formalizes the measurement and manipulation of internal and external microeconomic lodging variables to allocate specific lodging capacities to specific market segments at prices that maximize the firm's total revenue.

LYMSs characteristically require heterogeneous markets that can be segmented, and customers who are willing to book in advance. Market demands must fluctuate and the system must respond appropriately. Sufficient rate categories must exist allowing the LYMS to adjust prices without causing market segments to overreact.

Forecasting is considered a critical component and good yield management systems should produce accurate forecasts. Ideally, LYMSs should predict quantities and booking lead times by room types and market segments. Booking patterns should be optimized when neighboring days affect revenue because of multiple night stays. Volume buyers should be treated differently than one-time buyers and all revenue producing departments should be included in yield calculations.

A supporting infrastructure may be important to the successful LYMS operation. Personnel, guest history databases, strategies, tactics, and feedback must be fashioned and organized to support the system. Top management should be supportive and lodging personnel flexible. The guest history database should provide information on a day-by-day basis. The LYMS should be well integrated with the local property management system (PMS) and the corporate level reservation systems. And, organizational strategies must be developed that encourage communication between the marketing and operations departments.

LYMS sales tactics must support the property's marketing and sales strategies and it is important to develop appropriate marketing mixes. Promotional packages should be available when recommended by the LYMS. Overbooking strategies should be designed to maximize revenue over the long-term and feedback should allow management to evaluate system and organizational performance.

People were also identified as a component important to system success. Without their cooperation, the system will be compromised. Customers may be confused with the varying rates. Middle agents may feel threatened and alienated. Travel managers may be able to partially defeat the system. And, employees may override the system.

Incentive strategies should encourage employee support. Workers may suffer from morale problems or changes in the reward system if those changes negatively impact they way they are accustomed to being rewarded. Training is considered important for smooth LYMS implementation. And, yield management systems may not function well in some cultures.

Jones and Hamlin (1992) suggested that management should develop a yield culture, scan and analyze the environment, analyze overall demand, establish price-value relationships, identify the market niche, determine appropriate market segments and business mixes, analyze the patterns of demand, track declines and denials, and evaluate and revise the system.

Identification of LYMS Developers

The initial list of developers extracted from the literature review included:

Aeronomics, Inc.
Computerized Lodging Systems, Inc.
Control Data Corp.
Delphi/New Market Software Systems Inc.
Eloquent Systems Corp.
Eric B. Orkin Associates
Hyatt International. One Tower Lane, Oak Brook Terrace, IL 60181.
Hotel Information Systems
James C. Makens and Associates.
Laventhol and Horwath
Lodgistix
Miracle, National Guest Systems Corp.

Revenue Dynamics
Revenue Technology Services
Unisys Corp.

To this list, major hotel chains were added as potential developers. They included:

Best Western
Howard Johnsons
Ramada
Days Inn
Red Carpet
Holiday Inn
Travelodge
Forte
Westin
Sheraton
La Quinta
Super 8
Red Coach
Marriott
Scottish Inn
Hyatt
Econolodge
Hilton
Four Seasons
Stouffers
Intercontinental
Embassy Suites
Hampton Inn
Motel 6
Choice International

Each company was called and asked 1) if it was using a LYMS, 2) to describe the yield management features of its system, and 3) if it knew of anyone else using such a system. As the inquiry progressed it became evident that systems differed with respect to the yield management features they offered. The elements that seemed to separate the developers who felt they had authentic yield management systems from those who just claimed to use some yield management features were: 1) automated forecasting and 2) automated price adjustments and/or the automated opening and closing of rate categories. The following lists represents the results of that inquiry.

Aeronomics, Inc. - Major provider of LYMS technology, but did not provide technology at the unit level. In another words, Aeronomics provided chains with LYMS technology, but not directly to individual units. Referred to several chains they had worked with.
Computerized Lodging Systems, Inc. - Active with approximately 100 installations.
Control Data Corp. - Sold to Revenue Technology Services
Delphi/New Market Software Systems Inc. - Did not provide true LYMSs (no automated forecasting).
Eloquent Systems Corp. - Out of business. (Had one product at Royal Sonesta that was pulled due to high maintenance cost. Their system used expert system technology.)
Eric B. Orkin Associates - Active with approximately 200 installations.
Hyatt International - Active with about 10 installations.
Hotel Information Systems - Sells for Orkin.
James C. Makens and Associates - Not currently involved with LYMS.
Laventhol and Horwath - Out of business. (It was selling and maintaining Orkin's system.)
Lodgistix - Name changed to Focus Hospitality Group. No installations.
Miracle, National Guest Systems Corp. - Did not provide a LYMS product.
Revenue Dynamics - Active with approximately 30 installations.
Revenue Technology Services - No customers at present time.
Unisys Corp. - Only one customer (Disney). Centralized system only.
Best Western - No installations.
Howard Johnsons - No installations.
Ramada - No installations.
Days Inn - No installations.
Red Carpet - No installations.
Holiday Inn - Active with approximately 200 installations.
Travelodge - No installations.
Forte - No installations.
Westin - No installations at property level. Only a centralized system.
Sheraton - Active with approximately 50 installations.
La Quinta - No installations of true LYMS (no automated forecasting).
Super 8 - No installations of true LYMS (no automated forecasting).
Red Coach - No installations.
Marriott - Active with approximately 200 installations.

Scottish Inn - No installations.
Econolodge - No installations.
Hilton - Active with approximately 50 installations.
Four Seasons - No installations.
Stouffers - No installations.
Intercontinental - Active with 3 installations using Orkin's system (Opus II).
Embassy Suites - Active with approximately 30 installations under Promus.
Hampton Inn - No installations.
Motel 6 - No installations.
Choice - No installations.

Developer added to list by referral.

Hospitality Software Systems - Found to be PMS/RMS provider and did not provide true yield management.

Final list of authentic LYMS developers:

1. Computerized Lodging Systems, Inc. - Approximately 100 installations.
2. Eric B. Orkin and Associates - Approximately 200 installations.
3. Hyatt International - Approximately 10 installations.
4. Revenue Dynamics - approximately 30 installations.
5. Holiday Inn - Approximately 200 installations.
6. Sheraton - Approximately 50 installations.
7. Marriott - Approximately 200 installations.
8. Hyatt - Approximately 50 installations.
9. Hilton - Approximately 50 installations.
10. Promus - Approximately 30 installations.

Selection of CSF Methodology

The CSF approach was selected as the primary research methodology for this study because it has been widely embraced, shown to be practical and beneficial, and was considered superior to alternative methods for this type of research.

A variety of non-factor approaches were reviewed in the section entitled 'Non-CSF Approaches" in chapter two and the benefits of the CSF approach were found to outweigh the benefits of non-CSF approaches for the purposes of this study. It has considerable practical-level benefits, as discussed in the section entitled 'Benefits of the CSF Approach" in chapter two and it is the most common factor approach used in the research of IS design, implementation, and operation. As such, it provides a large database of general IS factors to compare and contrast with LYMSs.

Boynton and Zoomed (1984) regarded the CSF approach as an effective framework and normative model for information resource planning activities, particularly useful for high-level management. It was intuitive, well-received, helped to define information needs, and limited costly information collection. Park (1990, p. 64) found the CSF approach a viable tool for enhancing communications in the strategic planning process. These findings are in harmony with the strategic emphasis of LYMSs and help make the CSF approach a viable methodology for increasing the understanding of successful LYMS design, implementation, and operations.

Development of Research Question

Investigating CSFs for a new type of information system allowed for many possible research questions. For example, questions arose about the relationships between CSFs and system success. Questions arose regarding the similarities and differences between LYMSs and other types of ISs. And, questions arose about how CSFs should be categorized.

Because of resource limitations, and because respondents will not complete lengthy questionnaires, all questions could not be addressed in this particular study. The most pressing and logical research objective for an original study investigating the CSFs of LYMSs was to determine what relationships existed between successful LYMSs and controllable independent variables in the form of CSFs. This question is presented in its research question and null formats as:

R1: What relationships exist between variables identified as potential CSFs and LYMS success?

$H_0$1: No relationships exist between variables identified as potential CSFs and LYMS success.

This research question and subsequent hypothesis match the first objective of this study because they directly address the identification and testing of controllable independent variables against LYMS success. By evaluating these variables against system success, critical success factors may be identified.

The second objective of contributing to the body of IS knowledge is addressed by the completion and publication of this research.

Methodological Decision for Cross-Sectional Field Study

It is possible to approach IS research using a variety of methodologies. The list includes, but is not limited to: experimental study, quasi-experimental study, action study, case study, descriptive survey, analytical survey, cross-sectional study, and longitudinal study. Each methodology has its advantages and disadvantages.

Experimental studies provide the most control. Operational definitions are, typically, very specific and highly objective. Their major weakness is the lack of strength of independent variables that results in small effect sizes and low external validities. The effects of experimental manipulations in controlled experiments are generally weaker than the effects between variables in field conditions (Kerlinger, 1986).

Experimental research is not an appropriate methodology to study CSFs of new ISs because there are many independent variables and a strong need for external validity. The design, implementation, and operation of LYMSs are too complex to simulate under laboratory conditions. The ex-post facto nature of the study's empirical setting also separates this from experimental research. i.e. There is no direct control over the independent variables, thus, the use of experimental, or quasi-experimental methodologies, does not meet the objectives or needs of this study.

Action and case studies are types of exploratory field studies. They are strong in realism and strength of variables, and often lay the groundwork for hypotheses development and testing.

Action studies are interesting and potentially profitable, but lack generalizability and, more importantly, rely on the ability of the researcher to be intimately involved with the organization: its people, resources, and processes. Unless the researcher has already acquired such a position, along with an acceptance by the organization to conduct his or her research, it is not a feasible methodology.

The case study approach has been used successfully for CSF research. Rainer's (1989) case study on the identification of CSFs for executive information systems (EISs) involved seven cases. Valuable information resulted from this approach, but because of the limited number of cases, its generalizability is weak.

Action and case studies suffer from a plethora of variables, excessive variance, lack of precision, and lack of generalizability (Kerlinger, 1986), but are very useful when little is known about the topic and the focus is the identification of independent variables.

Another type of field study, that does not suffer as much from the weaknesses of exploratory field research, is the hypothesis-testing field study. The hypotheses-testing field study is appropriate when the objective is to identify the effects of independent variables (Van Horne, 1973). It is not as powerful in identifying independent variables as exploratory field research, and does not provide as much control over variables as experimental research, but it has several advantages. It is thought to enhance the external validity of findings (Cook & Campbell, 1979) and is strong in realism, significance, strength of variables, theory orientation, and heuristic quality (Kerlinger, 1986).

The review of literature and preliminary research provided the study with enough theory, exploratory information, hypotheses, and independent variables to properly perform a hypothesis-testing field study. Since it is one of the most generalizable forms of research, its application is appropriate, based on the objectives of this study.

As stated in the section entitled 'Delimitations of the Study" (chapter one), temporal and resource restrictions precluded the use of a longitudinal study. Therefore, a cross-sectional approach was used.

This research study would be best classified as a hypotheses-testing cross-sectional non-experimental field study, employing survey techniques. It is non-experimental because it employs "... systematic empirical inquiry in which the scientist does not have direct control of independent variables because their manifestations have already occurred or because they are inherently not manipulable" (Kerlinger, 1986, p. 348). It is cross-sectional because the data collection is performed during a single time period, rather than over multiple time periods. It is a field study because it is "... non-experimental scientific inquiry aimed at discovering the relations and interactions among sociological, psychological, and educational variables in real social structures"(Kerlinger, 1986, p. 372).

Field studies may be categorized into two types: exploratory and hypotheses-testing (Festinger & Katz, 1953, pp. 75-78). This research study is the hypotheses-testing type and employs survey techniques to capture data. Samples are randomly selected from the population under study and data is collected using personal interviews, telephone interviews, and mail questionnaires.

Christensen (1987), suggested there are three principle approaches to IS research including the prescriptive, process, and factor approach. The prescriptive approach is based on field experience and observations. It is usually informal and uses logic rather than empirically derived data (Nutt, 1986). The process approach looks at system implementation and operations as dynamic processes and often breaks them down by stages. The factor approach emphasizes explanation and prediction. It is usually analytical; more focused and more rigorous than prescriptive and process approaches to IS research (Lucas, 1981).

Identification of System Success Constructs

The measurement of LYMS success formed the study's dependent variables. To measure LYMS success: system qualities, its impact on the organization, and the organization's impact on the system should be considered.

Fifteen factors were derived from the literature review that could be operationalized as dependent variables. These included: increased revenue, increased profits, improved interdepartmental communication, better sales decisions, decreased paper flow, time saved, better decisions, reduced employee workloads, focused goal achievement, improved mental model of organization, improved image of IS department, improved image of computer technology, commitment gained from employees, and unified goals and strategies between the marketing and operations departments.

Quality, as perceived by the users, was found to be a more powerful construct than technical considerations (see Measurement of LYMS Success, chapter two), and user-satisfaction was considered to be the most appropriate measure of system success when usage is not voluntary. Since LYMS users are not discretionary users, system success cannot be measured in terms of utilization (Ein-Dor & Segev, 1981; Ein-Dor, Segev, & Steinfield, 1981; Lucas, 1981).

A user focus is also justified because the long-term survival of an organization is dependent upon the satisfaction of its client's needs and the quality of any product or service must ultimately be determined from the client's perspective (Pyle, 1986, p. 4). In other words, the user is the recipient of the product's benefit package and will ultimately determine if the LYMS is employed.

Bailey and Pearson (1983) developed a user-satisfaction instrument (see Appendix A) that has been shown to be valid and reliable by several independent researchers. The authors suggested couching the factor descriptions in the user community's specific vocabulary. They also suggested omitting factors not relevant to the interest of the specific situation and redefining the factors in situation specific terms. Some possible difficulties included the need to insure the user community of anonymity and the need to make it clear that responses should reflect present rather than past conditions.

Identification and Organization of Potential CSFs

Potential CSFs were identified from the review of literature presented in chapter two and through interviews and surveys of vendors, developers, and system users.

Many potential CSFs appeared repeatedly in the IS literature, but not all were appropriate for this study because some did not fit the nature of LYMSs. For example, the level of matching between a firm's computer applications and the firm's CSFs appeared to be related to the level of IS success. By definition, the LYMS's single application is directly related to the firm's goal of revenue maximization and there are no matching alternatives to test. In another example, Keen and Scott-Morton (1978) found the IS must be provided with clear problems to direct work efforts towards. This condition, like the previous one, cannot be tested because of the singular focus of revenue maximization.

Many of the factors disclosed in the general IS literature could be tested and information about them could contribute to general IS theory. Some of them included vendor support, number of MIS staff, top management support, top management computer expertise, user computer expertise, user involvement, and user training. A complete listing of potential CSFs identified in the literature review have been summarized in Tables 3 and 4 in chapter two.

Since this was the first research effort to identify and test CSFs for LYMSs, it was necessary to identify potential CSFs from industry's perspective as well as from the literature review. A multi-constituent approach was used to identify potential CSFs from industry personnel. This approach was necessary because more than one group of people work with and benefit from LYMSs. Vendors/developers and users were identified to be significantly involved with LYMS design, implementation and operation. It was therefore useful to include both of these groups in this investigation.

CSF Interviews and Surveys

The LYMS vendors and developers were first contacted by phone and then in writing (Appendix B) and asked to participate in the survey. A follow-up letter (Appendix C) was sent a few weeks later and they were again called and asked to commit to the project.

The general format was to first secure their cooperation, and then send them a list of critical success factors developed from the literature (Tables 3 and 4) with a CSF form (Appendix D) to add any CSFs they felt were missing. Tables 3 and 4 and the CSF forms also included a cover letter (Appendix E). After the developers had responded they were again contacted by phone for further discussions on CSFs. The developers were then requested to send the cover letter, Tables 3 and 4, and the CSF form to two of their properties for the general managers, marketing managers, reservation and operation managers to look over and respond to, but the process worked better when the researcher sent the CSF forms directly. Users were also contacted by phone after they had time to review the list of factors and respond. Seven out of the ten developers participated in this phase of the research project in varying degrees.

Results of CSF Interviews

Developer #1

The first developer interviewed was particularly beneficial to the study. This developer had just completed interviewing approximately 150 users. The purpose of these interviews was to generate criteria for the development of a substantial upgrade to the existing LYMS. The type of employees interviewed included general managers, marketing directors, reservation managers, and operations managers.

The developer responsible for obtaining and compiling this information was given a copy of the potential critical success factors compiled from the review of literature (Tables 3 and 4). The developer then reviewed and confirmed the content validity of the factors listed on these tables. She stated 'It was good to have an opportunity to review the tables because their contents reaffirmed our internal research."

The developer added the following factors.

Success factors that related to the LYMS itself.

1. Ease of use design.
2. Rapid system response time.
3. System integrated with reservation and PMS.
4. Ease of access for all users (LAN based).
5. Utilize expertise in development of system.

Success factors that related to the LYMS users themselves

1. Complete training on system usage.
2. Understanding of yield management concepts.
3. Sufficient time to analyze information.

Success factors that related to the organization where the LYMS is used.

1. Supported by all levels of management.
2. Willingness to invest in a system.

Success factors that related to the external environment.

1. Hotel's pricing must be competitive in the local market.

None of the units were contacted that used this developer's system because the developer had already interviewed them and included the results in the material listed above.

Developer #2

The second developer interviewed listed the following factors. He thought that the following items were important.

1. A good guest-history database.
2. Good forecasting techniques.
3. Sophisticated optimization models and techniques.
4. All revenue departments were taken into consideration.
5. Good reports.
6. Audit trails.
7. What-if analysis.

Only one of his units agreed to participate. That unit added the following factors.

1. The system should have some built-in 'intelligence."
2. The system should be well integrated with the PMS and central reservations.
3. The system must be able to deal well with group business.

Developer #3

The third developer had the following suggestions.

1. The LYMS should not make it difficult for customers to purchase rooms (i.e. make reservations).
2. PC platforms should be used because they make the system more flexible.
3. User interfaces should be graphical and easy to understand.
4. Training should encourage users to buy-in to the system and the concept.

Unit users of developer number three's system suggested the following:

1. A good system should be able to deal with unexpected events.
2. It should allow management to make final decisions.
3. Long-term goals should be manageable through the system.

Developer #4

The fourth developer had the following suggestions.

1. Pricing is best done from a centralized source.
2. Reports need to be based on real-time information.
3. All functional areas should be involved.
4. The system must be able to adapt to changes.
5. Long-term pricing structures should be managed through the system.

Its units suggested that a good LYMS should:

1. Improve on manual occupancy predictions.
2. Provide an English-like query system.
3. Combine the qualities of a good reservation manager with those of a good marketing manager.
4. Feel comfortable to its users.

Developer #5

The fifth developer suggested that the system should

1. Be flexible.
2. Take manager's opinions into account.
3. Include good training.
4. Consider the length of customer stay.
5. Take revenue from all departments into account.
6. Take all costs into account.

Its units suggested that:

1. The system be good at predicting demand.
2. Consumers be accepting of yield management practices.
3. The system be well integrated with the PMS.
4. The system be flexible.
5. The system be transparent to the user.
6. The system be continually maintained and upgraded.

Developer #6

The sixth developer suggested that in addition to Tables 3 and 4 the system should

1. Minimize complex and contradictory pricing.
2. Take the corporate strategy into account.

3. Include the value of the property to the customer when it computes its price structure. (e.g. age of property, location, type of customer, etc.)

This developer did not want any of its units to be contacted.

Developer #7

The seventh developer did not provide any additions to Tables 3 and 4.

One of its units suggested that:

1. Revenues should increase with use of the system.
2. The system should provide a means to evaluate the increase in revenue.

The other developers either declined to participate or simply never responded to repeated attempts to secure their cooperation. Of the seven units that participated in this phase of the research, it became clear that two of them did not wish to continue with the study. Thus, from the original list of 10 developers, only five showed any interest of participating in the second phase of the project.

Critical Factor Test

CSFs are often selected as a matter of convenience and without regard to theoretical considerations. Since this study involves a new type of IS, factor selection cannot be based on convenience and, like all research efforts, should include theoretical considerations, whenever possible.

To keep with the spirit of Rockart's (1982) and Daniel's (1961) CSF conceptualization, it was defined as a limited number of areas or variables in which satisfactory results will ensure success. To control for the tendency of factor proliferation, a test was employed that was developed from Ligon's (1990) research into causal-based factor identification.

Ligon's (1990) primary criticism with the traditional CSF approach was that its application lacked rigor and specificity. Instead of using a supporting CSF approach, often expressed as "would help to achieve," he suggested relating goals to CSFs in a more critical manner, expressed as "is necessary for achievement."

Ligon (1990) stated that goals should determine CSFs. For example: as determined during the identification of system success constructs, LYMS users are not discretionary users and system success cannot be measured in terms of utilization. Instead, other measures must be employed such as revenue maximization, decision quality, and user-satisfaction (Ein-Dor & Segev, 1981; Ein-Dor, Segev, & Steinfeild, 1981; Lucas, 1981). On this basis, critical factors would be factors that must be attended to for revenue maximization, quality decisions, or user satisfaction to be achieved, whether subordinate goals or underlying facilitating processes. The linkages between these elements should be strong enough so that they can be measured and that revenue maximization, decision quality, or user satisfaction would be at risk if the critical factors are not monitored and worked.

To apply the adaptation of Ligon's (1990) work, each potential CSF was first analyzed in terms of its relationship to system goals. This was done by asking the questions "Does it relate to any of the subjective measures that were used to define by LYMS success? (See

Development of Dependent Variables, in this chapter.) Secondly, the potential CSF was evaluated in terms of its role in achieving system goals. Was the factor critical for the achievement of any of the subjective measures used to define LYMS success? If both of these questions were answered positively, the factor was determined to be a valid potential CSF.

CSF Categorization Scheme

To assist in eliciting, developing, and managing CSFs, a categorization scheme based on material identified in the literature review (see CSF Categorization Models, chapter two) was employed. More specifically, Liang's (1986) categorization scheme was blended with Lee's (1989) categorization scheme.

Liang (1986) proposed a four category scheme including system, task, user, and environment categories. Lee (1989) proposed a similar scheme but limited the environment category to the organizational. To serve the needs of this study, Ligon's (1986) environment category was broken into organizational and external environments and combined with Lee's work. With this modification, the proposed CSF categorization model included the categories of system, task, user, organizational environment, and external environment. System includes factors such as quality, design strategy, and level of user involvement. Task includes factors such as information complexity and job complexity. User includes factors such as cognitive styles, attitudes, expectations, and experience. Organizational environment includes factors such as stress, power, policies, and management support. And external environment includes factors such as customers, government regulations, politics, and economy.

Potential CSFs for LYMSs

To develop the list of independent variables, all potential critical factors listed in Tables 3 and 4 were combined with the additional factors provided by the interviews and surveys of system vendors, developers, and users. Those factors have been summarized in Table 6 entitled "Combined Summary of Potential LYMS Factors."

Identification of Potential Confounding Variables

Ives and Olson (1984) advocated more controlled experimental, longitudinal, and field studies to establish linkages between CSFs and IS success. They reviewed a number of articles that applied the CSF approach and felt most lacked the rigor required to produce sets of well-defined results. There was specific concern that unidentified exogenous variables were present that confounded relationships. Lee (1989, p. 8) also believed that most of the inconsistencies with CSF research resulted from not controlling important confounding variables. On the advice of these researchers, variables that might confound the relationships between the dependent and independent variables were identified during the literature review and through conversations with vendors and developers.

Table 6

Combined Summary of Potential LYMS Factors

Category	Factor	Measure(s)
Evolutionary Stages	Stages	System evolutionary stages
System	Design	Organization, Incorporate expert knowledge, Integrated with PMS, Integrated with corporate IS, Integrated with RS, Incorporate feedback, Incorporates no-show and cancellation data, Centralized data, User considered, User involved, Sophistication of hardware, Sophistication of hardware, Flexibility/Adaptability of hardware, Ease of use, Interactive program, Platform valid for future use, Designed internally, Well-defined mission, PC/LAN based, Includes optimization models, Graphical interface, Continuous upgrades,
	Quality	Good data organization, Organizational validity, Technical validity, Reliable, Cost effective, Performance, Response time, Low maintenance, Image of LYMS vendors, Access to executives
	Data Management	System data management, Supporting data management, Supports guest-history database,
	Maintenance	Continuous maintenance
	Age	Age

Table 6, continued

Combined Summary of Potential LYMS Factors, continued

Category	Factor	Measure(s)
Task	Functions	Compute elasticities of demand, Segments demand characteristics, Price manipulation, Good forecasting, Dynamic calculations, Accounts for multiplier effect, Accounts for multiple night stays, Controls rate mix, Controls overbookings, Distinct rate structures, Broad rate structures, Volume buyers considered differently, Decision support, Trends analysis, Inventory control, Cost/benefit analysis, Exception reporting, Early warnings, Decision support, What-if analysis,
	Objectives	Maximizes revenue, Long-term focus, Measurable, Well defined, Linked to business objectives, Linked to user needs, Urgency, Affect on job performance, Considers group business, Competitive pricing, Simple pricing, Deals with unexpected events, Allows for long-term pricing strategy, Allows for centralized pricing, Considers length of stay, Includes revenue and costs from all departments, Minimal contradictory pricing, Pricing considers value of property to customer,
	Control	Overbooking policies, Worker independence (decision-making latitude) Information accountability, Information security, Standard terminology, Worker independence, Management makes final decision, Means to evaluate system effectiveness
	Information	Organized, Accurate, Reliable, Available, Timely, Relevant, Current, Report quality, Good reports, Audit trails,
	Interface	Friendliness, Complexity, Adaptability, Multiple ways to find information, Easy information access, Easy to sell rooms, Graphical interface, English-like query, Transparent,
	Atmosphere	Working environment atmosphere
	Training	Training, Role clarity, Quality, Quantity, Encourages buy-in to concept

Table 6, continued

Combined Summary of Potential LYMS Factors, continued

Category	Factor	Measure(s)
User	Commitment	Incentives, Willingness, Flexibility, Involvement, Communication, Shared Understanding
	Attitude	Behavior towards system, IT culture, Acceptance, Normative beliefs
	Competence	Comfort level with IT, Technical knowledge, Understanding of data processing, Understands yield management, Time to analyze reports

Table 6, continued

Combined Summary of Potential LYMS Factors, continued

Category	Factor	Measure(s)
Organization Environment.	Top-management support	Commitment, Incentives, Involve all departments, Championing, Planning, Yield management knowledge, Yield management culture, Vision for IT, Investments in IT, Develops yield management strategies, Manages change process, Sponsor, Sufficient resources, Career path for IS staff, Management of change, Communication with users, Involvement, Level of planning, Knowledge of computers, Supporting culture, Key groups involved, Willingness to invest,
	Marketing support	Sales tools, Market responsive, Incentives, Rate mix strategies, Formalizes rate structures, Broad rate structures, Overbooking strategies, Markets in ethical manner
	Existing ISs	Strong PMS, Strong corporate IS, Guest history databases, Quality data, Provides feedback, Provides day-by-day data, Provides no-show & cancellation data, Centralized data
	Operations support	Inventory controls, Market responsive, Satisfy right market mix, Incentives, Monitors reservations
	IS vendor support	Can handle increased activity, quality and competence of IS staff, communication with users, Change management, User expectation management, Understanding of user problems, Training, Liaison function, Response to requests, Coordination, Level of planning, Relative number of IS personnel, Personnel allotted to project, Costs well-defined, Complete system installed, Good support team, Consultant provided, Appropriate technology used, System delivered quickly, Benefits statement provided, Quality product delivered, Concept sold before technology, Training uses systems approach
	Demographics	Number of employees, Sales, Structure matches
External Env.	Customer Behavior	Advanced purchases, Advanced bookings, Can be segmentation, Tolerance to differential pricing, Fluctuating demand
	Benevolence	Benevolence
	Agent Behavior	Tolerance to differential pricing, Not undermining system

Elements suspected of confounding CSF research include system developmental stages (see next section), user to system relationships, and certain biographic organizational characteristics.

Stage Theory

Stage-theory models were covered in the sections entitled "Stage-Theory" and "End-User Stage-Theory Models" in chapter two. From the variety of models presented, an adaptation of Henderson and Treacy's (1986) model was found to be best suited to the needs of this study. Its categories were exhaustive and exclusive, could be applied to hardware and software elements, and were descriptive of the stages a LYMS would be likely to incur. For clarification, as shown in Figure 8, the labels were renamed to be more in-line with Christensen's explanation of the system adoption process (see Stage-Theory, chapter two). To this end, initiation was re-labeled implementation; integration, remained the same, and mature was re-labeled internalization.

Implementation was defined as an on-going process that includes: the development of the system from conceptualization, through the feasibility study, systems analysis and design, programming, training, conversion, and installation of the system (Lucas, 1981, p. 14). LYMS implementation may be especially difficult because of system complexity and organizational impact. Internalization begins at the point when users are convinced that the system really helps them and they establish psychological ownership (Christensen, 1987). Integration was

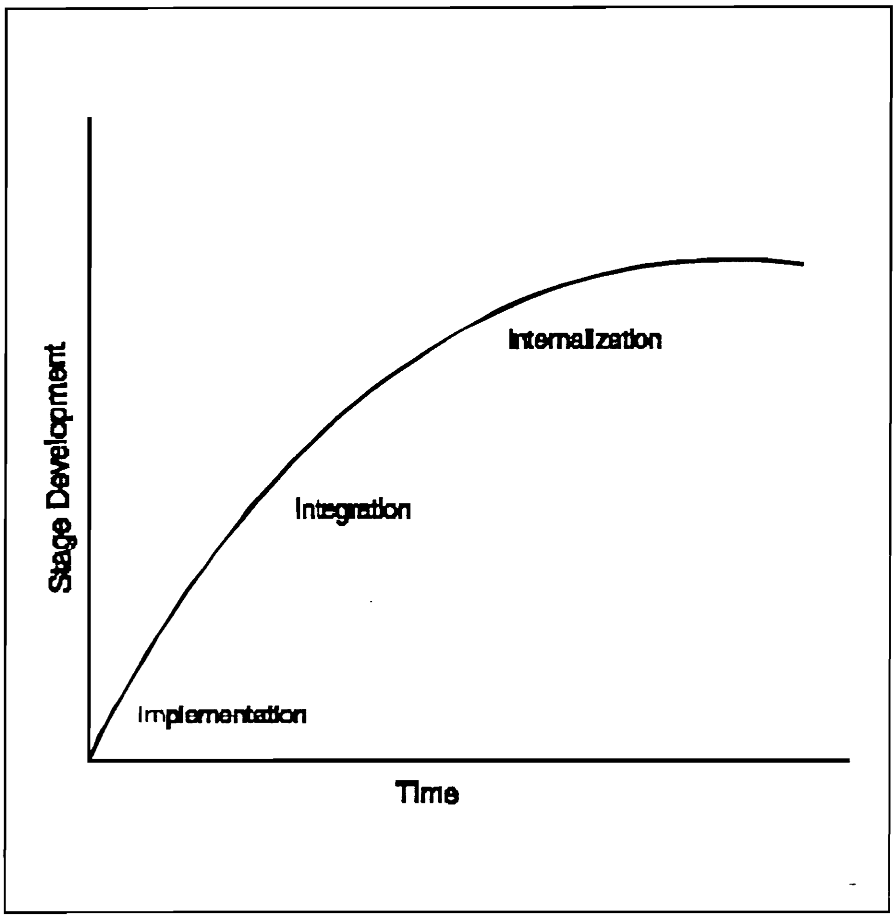


Figure 8
Stage-Theory Model for LYMS
(Adapted from Henderson & Treacy, 1986, p. .38)

the time period between the end of implementation and beginning of internalization.

User's Relationship to System

Another variable that could affect the evaluation of system success is the user's relationship to the system. The Codasyl (1979) group proposed categorizing end-users into indirect, intermediate and direct end-users. Indirect end-users used computers and computer output exclusively through other users. Intermediate end-users used computer reports but did not directly interact with computers. They specified their business information requirements and depended on other people to fulfill them. Direct end-users directly interacted with computers.

Preliminary research indicated there was a direct relationship between the end-user relationship and the employee's job position. As a result, job position could be used as a measure of the end-user relationship. In most cases, general managers and marketing directors were found to be intermediate end-users, and front office and reservation managers were found to be direct end-users.

Other variables that could be used to describe the relationship between the user and the system were the user's level of computer skills and the degree to which the user was involved in system design.

Business Characteristics

Organization size has been the most frequently identified confounding organizational variable and has often been used as the basis for sample delimitations. This variable may be measured on the basis of sales, number of employees, or both. The U.S. Small Business Administration defined small businesses differently for manufacturing and service industries. The literature indicated that for service organizations, the number of employees did not serve well as a measure of organizational size because it often varies with the organization's level of service. Instead, gross revenue was used.

Service organizations were classified as small if the average gross revenue of the most recent three years was less than $3.5 million (U.S. Small Business Administration, 1989). This number was subject to change because of inflation, but it had not been officially adjusted for lodging properties since 1989 (U.S. Small Business Administration, 1993).

Lodging organizations are slightly more complex than most businesses when evaluating size because they are often structured as multi-unit organizations. It is not uncommon to find individual properties classified as a small business operations and the chain they are connected with classified as a large business operation. Thus, the size of lodging operations should be evaluated on two levels: the unit and corporate level.

Another important variable that could affect the success of the LYMS was the type of business operation. Lodging properties may be categorized by their service levels, locations, and types of guests. A property categorization scheme developed from research at Virginia

Tech's Center for Hospitality Research was adapted for this study and it may be viewed in Appendix F (Virginia Tech, 1993).

Controlling for profit verses non-profit organizations was not necessary because LYMS are geared toward revenue maximization and all of the businesses surveyed were profit organizations.

Questionnaire Construction

Development of Dependent Variables

The dependent variables were formed by combining appropriate elements from Bailey and Pearson's IS User-Satisfaction Instrument (Appendix A) with the measures of system success identified in the literature review (chapter two).

The set of potential dependent variables relating to system success derived from literature review were as follows:

1. Increased revenue.
2. Increased profit.
3. Better sales decisions.
4. Decreased paper flow.
5. Reduced employee workloads.
6. Focused goal achievement.
7. Improved image of computer technology.
8. Commitment gained from employees.
9. Are you better off for it?
10. Unified goals and strategies of marketing and operations departments.
11. Strengthened communication between marketing and operations departments.

The set of potential dependent variables relating to system success derived from Bailey and Pearson's IS User-Satisfaction Instrument were as follows:

1. Convenience of access: The ease or difficulty with which the user may act to utilize the capacity of the computer system.
2. Accuracy: The correctness of the output information.
3. Timeliness: The availability of the output information at a time suitable for its use.
4. Reliability: The consistency and dependability of the output information.
5. Completeness: The comprehensives of the information content.
6. Format of output: The material design of the layout and display of the output contents.
7. Volume of output: The amount of information conveyed to a user from computer-based systems. This is expressed not only by the report or outputs but also by the volume of the output contents.
8. Relevancy: The degree of congruence between what the user wants or requires and what is provided by the information products and services.
9. Security of data: The safeguarding of data from misappropriation or unauthorized alteration or loss.
10. Documentation: The recorded description of an information system. This includes formal instructions for the utilization of the system.
11. Expectations: The set of attributes or features of the computer-based information products or services that a user considers reasonable and due from the computer-based information support rendered within his organization.
12. Perceived utility: The user's judgment about the relative balance between the cost and the considered usefulness of the computer-based information products or services that are provided. The costs include any costs related to providing the resource, including money, time, manpower, and opportunity. The usefulness includes any benefits that the user believes to be derived from the support.
13. Confidence in the system: The user's feelings of assurance or certainty about the systems provided.
14. Job effects: The changes in job freedom and job performance that are ascertained by the user as resulting from the modifications induced by the computer-based information systems and services.
15. Flexibility of system: The capacity of the information system to change to change or to adjust in response to new conditions, demands, or circumstances.
16. Integration of system: The ability of the system to communicate/transmit data between systems servicing different functional areas.

These dependent variables were combined and operationalized to provide a relevant and accurate measure of system success. Twenty-seven items were used in the survey instrument (Appendix K) to measure system success. These were later reduced to 23 constructs using reliability analysis. All of these variables were operationalized using Likert Scales to provide the interval measures required for the statistical tests that were used.

Development of Independent Variables

CSFs listed in Table 6 were used to develop survey questions representing the independent variables. Likert scales were employed to measure these variables because, as previously mentioned, they provided interval measures that could be used by a variety of statistical techniques.

Because user expectations vary for different systems, the simple identification of a user's feelings about his or her system was, at first, not considered sufficient to determine the relative strengths of system factors across systems. Therefore two measures were used. First the user was polled as to how important a particular CSF was in general and, secondly, the user was polled as to how well the same CSF performed with respect to his or her system. The first question provided a measure of the level of importance the user attributed to a particular CSF and the second question provided a measure of the level of CSF performance for the user's particular system. The product of these two measures was to provide a measure that reflected the level of a particular independent variable's importance and performance, but it was later determined that quality alone was a better measure of system success than quality and importance. For a full explanation see "Development of Independent Variables," in chapter four.

Since the independent variables needed to be defined, the exact meaning of each CSF was carefully explained in a highlighted portion above the two measures to minimize any misunderstandings (Appendix K).

The independent variables were classified into the five basic categories defined in the literature review that included: Questions About System Factors, Questions About Task Factors, Questions About User Factors, Questions About Organizational Factors, and Questions About the External Environment.

Development of Confounding Variables

Potential confounding variables were extracted from the literature review and operationalized in the survey instrument. They included the employment position of the user, level of involvement in system design, level of computer skills, type of property, size of property, length of time with the system, and comfort level with the system.

Surveys were sent to the general or assistant manager, director of marketing, rooms manager, and reservations manager to control for the different types of end-user relationships. Likert scales were used to measure involvement in system design and user computer skill levels. Several measures were required to identify the type of property including the service level, location, and type of guest. The size of the property was measured by number of rooms, number of employees, and the property's average annual revenue over the last three years. Questions relating to the comfort level and time with the system were included to help identify the evolutionary stage of the systems for each property.

Construction of Questionnaire

The questionnaire was initially written over a period of several weeks. It was divided into sections to help guide the respondents and written using a format that would be easy to follow and complete. The most difficult questions were placed towards the beginning of the instrument so they would not be as likely to stop the respondent from completing the questionnaire.

The first part of the questionnaire was an introduction to, and explanation of, the purpose and importance of the project, including the deadlines for completion and how to return it. This portion of the survey also provided a tracking number in the form of the return address so the researcher could identify non-respondents.

The second part of the instrument asked questions about the respondent, including employment position, system design involvement, computer skill level, and number of years working with computers.

The next section asked questions about the property including questions about the type of property, its location, number of rooms, number of employees, number of system support personnel, number of hotel properties in the company, increase in revenue, and increase in profit since implementation of the LYMS.

The fourth section asked questions about the yield management system itself. This section used a table comprised of fourteen measures of system success, primarily derived from Bailey and Pearson's IS User-Satisfaction Instrument (Appendix A). It also included four questions to help identify the evolutionary stage of the system.

The fifth section asked questions about how the yield management system affected the user and the property. Eleven questions were included in this section and they were also used to help evaluate the level of system success.

With one exception, the next six sections in the survey formed the basis of the CSF measures. They include "Questions About System Factors, Questions About Task Factors, Questions About User Factors, Questions About Organizational Factors, and Questions About the External Environment." The one exception was a category on the seventh page of the survey to help break-up the monotony of the many CSF measures and was entitled "Questions About System Functions." This section listed 19 functions that the yield management system might perform. Its purpose was to help determine which functions were employed and to explore (at a later date) the relationship between the number of functions employed and system success.

Once the questionnaire was written, it was presented to academics, who had worked as managers and department heads in the lodging industry, and to the system developers (see Appendix G) for their evaluations.

Approximately one month was spent improving the wording and formatting of the questionnaire. Changes included, but were not limited to, improvements with: 1) new categories for identifying the property locations and service levels, 2) a better example for "full-time equivalent workers," 3) including "Revenue" as well as "Yield" for the titles, 4) a specific deadline for survey completion, 5) better definitions of certain CSFs, and 6) the re-locations of certain questions.

The survey was evaluated by approximately 20 persons including the five committee members who supervised the dissertation project. In addition to the changes mentioned above, some items were removed and some were added.

Pre-Test of Questionnaire

After the questionnaire instrument had been developed, evaluated, and improved upon, it was subjected to a pre-test. Twelve users were identified through the system developers and sent copies of the survey to fill out and comment on (see Appendix H). Nine of these were returned and the instrument was further refined.

Some of the changes that resulted from the pre-test included: 1) adding a category for convention properties, 2) simplifying some of the wording in the CSF section, 3) clarifying whether average annual gross revenue referred to rooms only or to all departments, 4) adding a variable relating to communication between reservations and sales, 5) expanding the definition for the "Atmosphere" CSF, 6) deleting a variable that measured the approximate cost of the system, and 7) adding an option allowing respondents to check if they don't know how to answer, have no opinion, or simply don't know enough about the system to answer.

One important conclusion resulting from the pre-test prompted the decision to customize the survey instrument for each system. Developers used a variety of names for their LYMSs so, to keep the questionnaire as friendly as possible, the names the users were most familiar with for the various systems were utilized.

There were also systems where one or more of the variables were not necessary to include because the correct response was constant. For example, the number of hotel properties (units) in a chain is constant and some of the systems had no user involvement in the development of the system. Whenever a variable could be removed because the developer provided the information, it was.

The resulting, and most generic, questionnaire instrument is depicted in Appendix K.

Choice of Empirical Setting

This study was limited by the number of LYMS on the market and more specifically by the number of vendors and developers that were willing to participate in the research effort. By the time the survey instrument was completed only three developers were willing to continue. From the five that had agreed to participate after the end of the first phase of the project, one developer felt it was too close to revamping its system to receive any benefit from the study and the other felt that the survey was repetitious of a survey that they had just finished.

Of the three remaining developers, two agreed to allow the researcher to use their names and the third allowed the researcher to survey, but not to connect the project back to the developer. These systems will be referred to as systems one, two, and three respectively. System one operated 209 units, system two 34 units, and system three 95 units.

System one was operating in a variety of properties types and sizes. System two was also operating in a variety of property types and sizes, but differed from systems one and three because it required a high level of interaction with managers and department heads. The developer referred to it as a highly open system. System three was designed to be used with smaller properties. Most of the properties using system three were smaller than 200 rooms.

The basic unit of analysis for this study was the LYMS. LYMSs were the most appropriate unit of analysis because each system was different and had its own set of particular characteristics. The study's sub-unit of analysis was the lodging properties using the LYMSs. Properties were broken down by type of user to control for end-user relationships and employment positions. The users surveyed included the lodging unit managers, the director of marketing, the front desk manager, and the reservations manager.

Since there were not a particularly large number of units to be surveyed, no sampling was performed; instead, the entire populations of the three systems were surveyed. Each property was contacted by phone to obtain the names and correct titles of the general manager, director of marketing, front desk manager, and reservations manager. Custom cover letters on university letter-heads were generated using the mail-merge feature of a word processor and souvenir pencils accompanied the survey. A sample copy of the letter is shown in Appendix I.

Data Collection

The first round of surveys was sent out March 1, 1994 to systems one and two. Eleven hundred and twenty first-class air-mail envelopes were sent. Each package included a cover letter, the survey, a self-addressed return envelope, and a souvenir pencil with an engraving that stated "I PARTICIPATED IN THE XXX SURVEY." The "XXX" referred to the specific name of the system being surveyed. The souvenir pencils, like the custom cover letters, were sent to help increase the response rate.

Two hundred and eighty questionnaires for system three were sent out 34 days later (April 4th, 1994). The mailing for this system was delayed because of the time involved in obtaining the list of properties, calling each property, recording and preparing the information for printing, and ordering and receiving the souvenir pencils, printing, packaging, and mailing the questionnaires. Many of these properties were smaller and less luxurious than the properties surveyed using systems one and two. As a result, many properties using this system did not have separate people performing the functions of manager, director of marketing, front-desk operations, and reservations manager. Since the developer of this system would not allow the survey to be associated with itself, the cover letter was not as motivating and the response rate was not as high as with the first two systems.

The entire data collection process is presented in chapter four.

Data Description and Empirical Analysis

Data Description

Once the surveys were returned the data was checked and purified. The purification process involved reviewing surveys to insure they possessed the appropriate data. This work was primarily performed during the data entry process. After the data had been entered they were checked and surveys were eliminated that had too many missing variables, or where the respondent indicated that he or she could not answer many of the questions. The question of "how many missing variables were too many?" is addressed in chapter four. Histograms describing the missing and "I don't know" data are presented in chapter four along with the exact procedures used to identify useable surveys.

Descriptive data and definitions for each variable are presented in chapter four and as an appendix.

Empirical Analysis

Evaluation of System Independence

A Mann-Whitney U-test was used to determine if the three systems should be evaluated independently or as one system. The Mann-Whitney U-test was used to do this because the data did not follow a normal distribution and could not be transformed. The data were checked to determine if they met assumptions of the Mann-Whitney model before the procedure was applied. This process, as well as all of the procedures used in the data analysis, are explained in detail in chapter four.

Comparison of Non-Respondents to Respondents

After the three systems were determined to be independent of each other, the respondents were compared to the non-respondents. This was also performed using the Mann-Whitney U-test and took two different approaches. The first approach involved collecting biographic and geographic data on those properties that failed to respond.

Non-respondents were selected by using a random number table. The data collected were compared to the respondent's sample after they were evaluated to determine if they met the assumptions of the Mann-Whitney model.

In the second approach respondents were compared to non-respondents by using late-respondents as surrogate variables for the non-respondents. The Mann-Whitney U-test was used to compare the differences between the distributions of the two samples. Model assumptions for these data had already been evaluated.

Development of Dependent Variables

The next step was to identify the appropriate dependent variables. At first this was done using correlation and factor analysis. The logic was that since the dependent variables were selected to measure the same phenomenon, correlation analysis should be used to identify the variables with the largest correlations to the other potential dependent variables. In the case that the appropriate measure of system success involved more than one factor, factor analysis was used to identify the variables that explained the largest amount of variance for each factor. This was done for each system. Before these procedures were applied, the data were analyzed to determine if they met the model assumptions of factor and correlation analysis. A Scree test was performed for each factor analysis as an additional test to confirm the number of factors identified.

Post-hoc tests suggested that this was not the best way to develop the dependent variables. Several alternative methods were tested by comparing the average correlations between the dependent and independent variables. This process is explained in detail in chapter four. The results indicated that it was better to identify which variables to remove rather than to identify which variables to keep. Four variables were removed using reliability analysis.

Reliability and Validity Assessment

Reliability and validity tests were applied to the sets of dependent variables.

Cronbach's alpha was computed to evaluate reliability and factor analysis was used to evaluate construct validity. Factor analysis was used to evaluate construct validity by determining if the variables were measuring a single phenomenon, or more than one phenomenon. Content validity was evaluated through subjective analysis. These procedures are explained in detail in chapter four.

Factor Score Weighting of Dependent Variables

After the reliability and validity of the dependent variables were evaluated, the variables were collapsed into a single standardized weighted regression factor score using factor analysis. This was done by setting a principal components model to extract one factor and to weight its scores. A regression factor score was developed for each system to serve as a single dependent variable against which the independent variables could be tested.

Evaluation of Confounding Variables

The next step was to evaluate the potential confounding variables that had been identified in the literature review and during interviews with vendors/developers and users. This was done by evaluating the correlations between those variables and the single dependent variable: the weighted regression factor score of the system success constructs. Variables that varied significantly in relation to system success indicated that additional analysis must be performed to either isolate or control them. The process and results of these procedures are presented in chapter four.

Development of Independent Variables

After the confounding variables were identified, the independent variables were developed. At first this was done by multiplying the factor's importance measure by its quality measure. Alternatives were tested based on the principle that the best method to develop values for the independent variables would produce variables that would be more highly correlated to the dependent variable. The results indicated that the quality dimension alone was the best variable to serve as the independent variable. Logic also supported these findings which are discussed in chapter four.

Assumptions of Pearson Product-Moment Correlation Coefficient Model

Once the independent variables were developed the assumptions for use of the Pearson product-moment correlation coefficient model were addressed. The data were plotted to determine whether there were non-linear relationships and to evaluate for scedasticity. This was done for all the dependent and independent variables to determine if they were good candidates for correlation analysis.

Correlation Analysis

For the final analysis, correlation analysis was preferred over regression and other statistical models because the relationship between each independent and dependent variable had to be examined in isolation of all other independent variables.

Consider the following example. The independent variables representing top management support and training could be highly intercorrelated because top management is often responsible for providing funds to hire trainers. In a regression model, if the two were highly intercorrelated, one of them would be relatively insignificant in contributing additional information about the variance of the dependent variable. In a stepwise regression model, for example, the variable with the lowest partial correlation would be dropped, and in a straight regression model it would be highly insignificant.

If the top management variable was dropped because of its intercorrelation with training, an important CSF could be erroneously removed because top management support may involve much more than just training support. They may, for example, be responsible for developing a strong culture required to support the system. If, on the other hand, training was dropped because of its high intercorrelation with top management, an important variable may be erroneously removed, if training was, in fact, important to system success.

CSFs should be viewed as links in a chain. Any missing link could cause the system to fail and one CSF cannot necessarily be substituted for another. Thus, the most appropriate final analysis in this research effort was to examine the correlation strengths and levels of significance between the dependent and independent variables. Correlation strengths and levels of significance were used to determine if the independent variables were related to system success for the three systems in general and for sub-sets of the data to isolate the identified confounding variables.

The .05 level of significance for alpha error was used throughout this research effort because it is generally accepted by researchers in the social sciences as a reasonable level. This was the level used to reject the null hypotheses that the independent variables were not correlated to system success. A .30 level of correlation was used to identify CSFs because this level represents approximately half of the variation that would be viewed as a minimum required to make stricter decisions affecting people. According to Berger (1988), when a correlation greater than r=.4 can be established, a test instrument may be of value towards improving employee selection decisions and would be considered as having criterion validity by most U.S. courts authorities.

A r=.4 represents a level of correlation accounting for 16% variance between two variables, whereas r=.3 represents 9%. The lower value of 9% is a reasonable requirement for identifying CSFs since it would be better to err in favor of identifying a non-CSF than to err by rejecting a valid CSF. It also seems reasonable because many variables could be involved in system success and it might not take much correlation to be vital to the system.

Discussion and Conclusions of the Findings

The last chapter discusses and makes conclusions on the study's findings. The findings are broken down into two parts. The first part describes and discusses the findings that were directly related to the testing of the research hypothesis. The second part describes the findings that were not directly related to the testing of the research hypothesis. These findings resulted from testing the confounding variables and from comparing the findings in the first part to general ISs.

Implications to practitioners and implications to researchers are presented next. Suggestions are given to practitioners about how they might make best use of the CSFs that were identified. Suggestions are provided to researchers about how they might benefit from the work done in this study. Limitations of the study are then reviewed and, lastly, suggestions are given for future research on the topic in the form of research questions.

CHAPTER FOUR
DATA DESCRIPTION AND ANALYSIS

This chapter describes the data and explains how they were analyzed to test the hypothesis of this research project. SPSS was used exclusively for the data descriptions and analysis.

Data Collection Process

Three systems were surveyed. System one was comprised of 209 units, system two of 34 units, and system three of 95 units. The original list of properties for system one included 220 units, but 11 were found to not be using the system for a variety of reasons. Some had changed ownership, some had just come on-line and could not report, and some were not using the system because they chose not to. All properties listed by the developer of system two were surveyed. Only one property listed by the developer of system three was excluded because it had changed ownership and was not using the system.

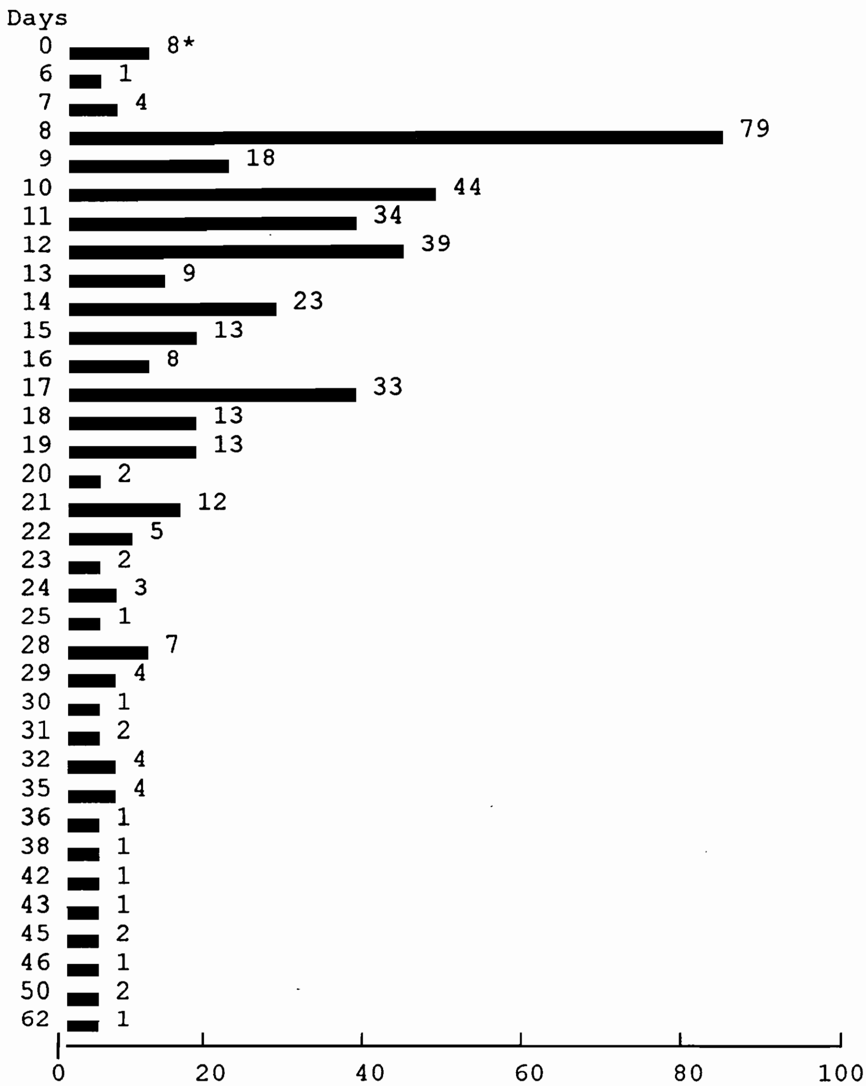
Questionnaires packets were sent out March 1, 1994 to systems one and two. As described in chapter three, 1120 first-class air-mail packages were mailed that contained a cover letter, the survey, a self-addressed return envelope, and a souvenir pencil.

Two hundred eighty questionnaires were sent out April 4, 1994 to the units using system three. Many of these properties were smaller and less luxurious than the properties surveyed using systems one and two and did not have separate personnel performing the functions of manager, director of marketing, front-desk manager, and reservations manager. The developer of this system did not want to be associated with the survey so the cover letter was not as motivating and the response rate was not as high as it was with the first two systems.

A follow-up post card was mailed two weeks after each mailing to encourage those who had not filled out the survey to do so (Appendix J).

As the questionnaires were received the data were entered into a special template designed to eliminate the possibility of entering data into an incorrect variable. This template was written by the researcher using a text-based database management system called askSam and validity checks were made to catch entries that occurred outside of the range of permissible values for each variable.

Three hundred and twenty surveys were received from the respondents of system one. Thirty five surveys were received from the respondents of system two. And, forty one surveys were received from the respondents of system three. Figure 9 depicts the survey arrival times by days from mailing.



Valid cases 396 Missing cases 0

*Note: Surveys designated as zero days in arrival times were *useable* surveys acquired during the pre-test phase.

Figure 9
Survey Arrival Times
(Days From Mailings by Number of Surveys Received)

Determination of Usable Surveys

During the pre-test phase it was discovered that some of the users might have very little knowledge of the system. For example, there were frequent cases of front office managers who did not work with the LYMS and were therefore not familiar with it. Because of this, the questionnaire was designed to identify those people by adding a place to check if the respondent did not know, or had no opinion on how to respond.

Variables where the respondent stated that he or she did not know how to respond or had no opinion (or could not answer) were added to variables where there was no response at all (missing data). The total number of missing or "I don't know" variables is listed by number of respondents in Figure 10.

Several steps were taken to determine how many missing or "don't know" variables reflected enough lack of familiarity with the system to drop the respondent. First, the completed surveys were examined. Several areas were found to be commonly skipped or checked in the "don't know" boxes. There was evidence that even a relatively knowledgeable respondent could leave out or not know more than 20 out of the 120 variables to be answered. For example, many respondents did not have access to financial information or were unwilling to provide it. Many had not been with the property long enough to know when the first LYMS was installed or how long the current system had been in operation. Many respondents were not sure which of the 19 System Functions listed were in actually in use because they only worked with a few of the system's

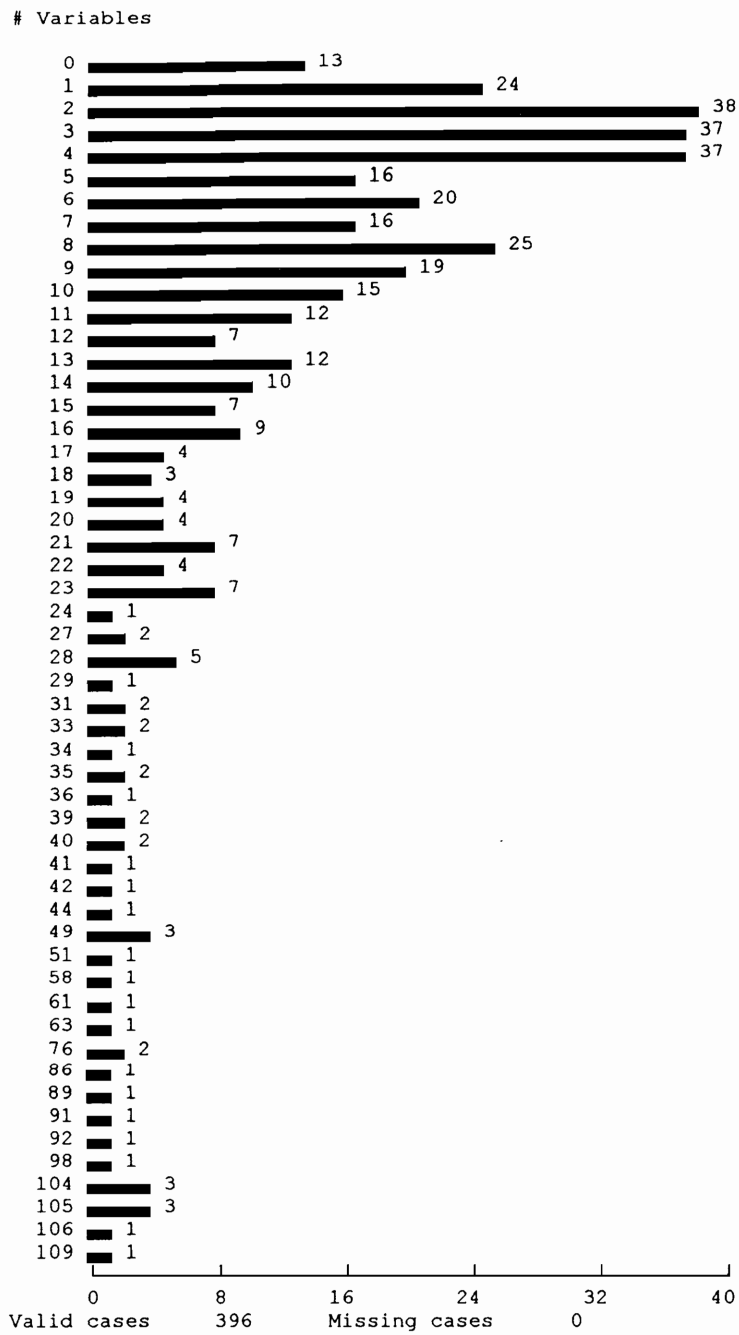


Figure 10
Number of Missing or "Don't Know" Variables (By Respondents)

functions. And, many respondents were not able to answer some of the independent variable questions because they were not familiar with those particular aspects of the system. The most frequently omitted questions were the ones about changes in revenue and profit since the system was installed.

The histogram depicting the number of missing and/or "don't know" variables by respondents (Figure 10) was examined and a natural break was found at the 29 level. Thus, it was determined that more than 28 missing and/or "don't know" variables would constitute an unacceptable level and those respondents were removed from the study for lack of sufficient knowledge about the system and/or the lack of willingness to complete all of the questions.

This action resulted in the removal of 38 cases, leaving the study with 358 usable cases. Seven of the respondents removed were general or assistant managers. Eleven were marketing directors, 14 were front office managers, and six were reservation managers.

The response rates are compared for each property in Tables 7 and 8. Table 7 shows the response rates of the three systems for all surveys and Table 8 shows the response rate for the three systems for usable surveys.

Table 7

Response Rates for All Surveys by System

System	Number of Properties	Number of Users	Properties Responding	Users Responding
1	209	870	180 (86%)	320 (37%)
2	34	139	19 (56%)	35 (25%)
3	95	260	32 (34%)	41 (16%)

Table 8

Response Rates for Usable Surveys by System

System	Number of Properties	Number of Users	Properties Responding	Users Responding
1	209	870	173 (83%)	291 (33%)
2	34	139	19 (56%)	32 (23%)
3	95	260	25 (26%)	35 (13%)

Data Purification

Descriptive statistics were first examined for all three systems together. This was done as part of the process of purifying the data: i.e. making sure there were no systematic mistakes in coding, formatting, or re-formatting the data.

During the initial examination of the descriptive statistics, it was discovered that some variables had been left out in the process of converting the ASCII data file into a SPSS system file and the values of some other variables had been truncated. These were corrected and all of the variables were triple checked to make sure that the conversion process from the ASCII file to the SPSS system file was correct and accurate.

Once the researcher was satisfied that all the data had been transposed from the surveys to the SPSS system file as accurately as possible, the descriptives for each system were examined individually.

Data Descriptions

Some new variables were computed from the original variables. For example, the variable USAGE was computed as the sum of the number of "System Functions" that the respondent designated as "Used." The variable NINE was computed as the number of variables where the respondent marked "Don't Know." The variable BLANK was computed as the number of variables the respondent left blank. And, the variable TOTAL was computed as the sum of the number of NINE and BLANK variables. NINE and BLANK variables were set to be treated as missing variables by SPSS.

The independent CSF variables were originally computed by multiplying the respondent's concept of the particular CSF's importance by the respondent's evaluation of the quality of his or her system for the same CSF. This was later changed and only quality was used as the independent variable. (See Development of Independent Variables in this chapter.) To better understand the coding please refer to the following excerpt from the survey instrument.

Questions About System Factors

Design refers to the general sophistication, integration, flexibility, adaptability, and efficiency of the revenue management system's hardware and software.

I believe the design of hardware and software for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important

The design of hardware and software of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good

The coding ranged from 1 to 7 with 1 as 'Extremely Unimportant" and 'Extremely Poor" and 7 as 'Extremely Important" and 'Extremely Good." 'No Opinion" and 'Don't Know" were assigned the value of 9 and treated as missing values, but have been omitted from the example above because of space limitations. The first question in the DESIGN CSF example related to its importance and was given the label DESIGN1. The second question of the example related to the design quality of the system and was given the label DESIGN2.

Table 9 identifies each variable by its name, provides the question number (in the order it appears in the survey), lists the type of variable, gives the possible numeric values for the variable, and provides a short definition. For the full definitions of the CSFs see the survey in Appendix K.

Histograms depicting the descriptive statistics for the three systems were printed and examined in detail. In general, the data exhibited considerable skewness and platykurtosis (flattened distributions). According to Stevens (1992, p. 255), kurtosis should equal 3 for normal distributions. Greater values indicate leptokurtosis (peaked distributions) and lessor values indicate platykurtosis (flattened distributions).

Several attempts were made to normalize the data using transformation processes. Rummel (1970) suggested that skewed data can be transformed using the one of the following formulas (Stevens, 1992, p. 252).

1) Xt = arcsin (Xo)**.5.
2) Xt = log (Xo/(1-Xo)).
3) Xt = .5 log ((1 + Xo)/(1- Xo)).

Where Xt is the transformed data distribution and Xo is the original data distribution. All attempts to transform the data proved fruitless.

Table 9
Survey Variables Defined

Label	#	Type	Value(s)	Definition
SYSTEM	N/A	Control	1	Lodging yield mgt. system one
			2	Lodging yield mgt. system two
			3	Lodging yield mgt. system three
DATE#	N/A	Control	0-99	Days until arrival
TRACK	N/A	Control	1-232	System one units
			300-396	System three units
			400-434	System two units
POSITION	1	Control	1	General or assistant manager
			2	Director of marketing
			3	Front office manager
			4	Reservations manager
INVOLVE	2	Control	1	No involvement
			2	Slight involvement
			3	Moderate involvement
			4	High involvement
SKILL	3	Control	1	Computer skills less than beginner
			2	Computer skills equal to beginner
			3	Moderate computer skills
			4	High computer skills
COMPYR	4	Control	0-99	Years working with computers
PROPS	5	Control	1	Limited service property
			2	Mid-priced property
			3	Full-service property
			4	Luxury property
PROPL	6	Control	1	Highway property
			2	Airport property
			3	Downtown property
			4	Industrial park property
			5	Suburban property
			6	Convention property
			7	Resort property
ROOMS	7	Control	0-9999	Number of rooms
UNITS	8	Control	0-9999	Number of units in company
FTEW	9	Control	0-999	Number of full-time equivalent workers
FTES	10	Control	0-99	Number of FTE computer staff

Table 9, continued

Label	#	Type	Value(s)	Definition
REV	11	Control	0-999	Average annual revenue (3 yrs.) in millions
REVCHG	12	Dependent	-98-+98	Percent change in revenue
			99	No idea
PROCHG	13	Dependent	-98-+98	Percent change in profit
			99	No idea
EXCLVL	14	Future		Employees get excited about new products
			1	Highly disagree
			2	Moderately disagree
			3	Slightly disagree
			4	Neither agree nor disagree
			5	Slightly agree
			6	Moderately agree
			7	Highly agree
SUPLVL	15	Future	1-7	Employees supportive of innovation
UNDLVL	16	Future	1-7	Employees find new technology easy
TSTLVL	17	Future	1-7	Employees willing to test products
FINDLVL	18	Future	1-7	Employees interested in new products
INVLVL	19	Future	1-7	Employees involved in system design
RELIABLE	20	Dependent		System is (un)reliable
			1	Extremely un(reliable)
			2	Quite un(reliable)
			3	Slightly un(reliable)
			4	Neither un(reliable) nor (reliable)
			5	Slightly (reliable)
			6	Quite (reliable)
			7	Extremely (reliable)
			9	Can't say
COMPLETE	21	Dependent	1-7,9	System is (in)complete
ACCURATE	22	Dependent	1-7,9	System is (in) accurate
RELEVANT	23	Dependent	1-7,9	System is (ir)relevant
TIMELY	24	Dependent	1-7,9	System is (un)timely
ADAPTABL	25	Dependent	1-7,9	System is (un)adaptable
FRIENDLY	26	Dependent	1-7,9	System is (un)friendly
USEFUL	27	Dependent	1-7,9	System is (un)useful
FLEXIBLE	28	Dependent	1-7,9	System is (in)flexible
SECURE	29	Dependent	1-7,9	System is (in)secure

Table 9, continued

Label	#	Type	Value(s)	Definition
ACCESS	30	Dependent	1-7,9	System is (hard/easy) to access
INTEGRAT	31	Dependent	1-7,9	System is (poorly/well) integrated
MANUALS	32	Dependent	1-7,9	System is (poor/good) manuals
REPORTS	33	Dependent	1-7,9	System is (poor/good) reports
YIELDYR	34	Control	0-9	Years property used yield mgt. system
SYSYR	35	Control	0-9	Years property use current system
COMFORT	36	Control		Not comfortable with system
			1	Highly disagree
			2	Moderately disagree
			3	Slightly disagree
			4	Neither agree nor disagree
			5	Slightly agree
			6	Moderately agree
			7	Highly agree
ESSEN	37	Control	1-7	Feel system is essential
RESSALE	38	Dependent	1-7	Improves communication between reservations and sales
OPRMKTG	39	Dependent	1-7	Improves communication between operations and marketing
SALESDEC	40	Dependent	1-7	Improves sales related decisions
MYLOAD	41	Dependent	1-7	Reduces my workload
EMPLOAD	42	Dependent	1-7	Reduces my employee's workload
GOAL	43	Dependent	1-7	Helps property focus on goals
IMAGE	44	Dependent	1-7	Improved my image of computers
COMMIT	45	Dependent	1-7	Employees are committed to system
BETTER	46	Dependent	1-7	Property is better off with system
OVERALL	47	Dependent	1-7	Has met overall expectations
IMPACT	48	Dependent	1-7	Has positively impacted my job
DF	71	Control		Demand forecasting
			1	Use feature
			2	Don't use feature
			9	Don't know
AMS	73	Control	1-2,9	Automated market segmentation
APMDC	74	Control	1-2,9	Adjusts prices as market demand changes
ARAD	75	Control	1-2,9	Accounts for revenue from all departments

Table 9, continued

Label	#	Type	Value(s)	Definition
AOMNS	76	Control	1-2,9	Accounts for and optimizes multiple nights
CRS	77	Control	1-2,9	Controls rate structure
CRSM	78	Control	1-2,9	Controls rate structure mix
OCRCR	79	Control	1-2,9	Opens and closes rates to control room inventory
CO	80	Control	1-2,9	Controls overbookings
OROG	81	Control	1-2,9	Optimizes rates offered to groups
CWCO	82	Control	1-2,9	Considers what competition offers
PDST	83	Control	1-2,9	Provides decision support tools
PEMAW	84	Control	1-2,9	Provides early market activity warnings
PWIA	85	Control	1-2,9	Provides what-if analysis
PCBAS	86	Control	1-2,9	Provides cost-benefit analysis of sales
ISMSS	87	Control	1-2,9	Incorporates specific marketing and sales strategies
AEMI	88	Control	1-2,9	Allows employee and management input
PTAR	89	Control	1-2,9	Provides trends analysis reports
TVBDI	90	Control	1-2,9	Treats volume buyers different than individuals
USAGE	N/A	Control	0-19	Number of functions used
DESIGN1	49	Independent		Hardware design for LYMSs in general is
			1	Extremely unimportant
			2	Quite unimportant
			3	Slightly unimportant
			4	Neither unimportant nor important
			5	Slightly important
			6	Quite important
			7	Extremely important
			9	No opinion
QUALITY1	51	Independent	1-7,9	Quality for LYMSs in general is
DATA1	53	Independent	1-7,9	Data management for LYMSs in general is
MAINT1	55	Independent	1-7,9	Maintenance for LYMSs in general is
COMPCOM1	57	Independent	1-7,9	Computer to computer interfaces for LYMSs in general is
FUNCTIO1	59	Independent	1-7,9	Functions for LYMSs in general is

Table 9, continued

Label	#	Type	Value(s)	Definition
OBJECTI1	61	Independent	1-7,9	Objectives for LYMSs in general is
CONTROL1	63	Independent	1-7,9	Control for LYMSs in general is
INFOQUA1	65	Independent	1-7,9	Information quality for LYMSs in general is
USERCOM1	67	Independent	1-7,9	User to computer interface for LYMSs in general is
ATMOS1	69	Independent	1-7,9	Atmosphere for LYMSs in general is
TRAIN1	71	Independent	1-7,9	Training for LYMSs in general is
ATTITUD1	91	Independent	1-7,9	Attitude for LYMSs in general is
COMMIT1	93	Independent	1-7,9	Commitment for LYMSs in general is
UNDER1	95	Independent	1-7,9	Understanding for LYMSs in general
COMPETN1	97	Independent	1-7,9	Competence for LYMSs in general is
DECISIO1	99	Independent	1-7,9	Decision-making latitude for LYMSs in general is
TOPMGT1	101	Independent	1-7,9	Top-management support for LYMSs in general is
MARKET1	103	Independent	1-7,9	Marketing support for LYMSs in general is
SALES1	105	Independent	1-7,9	Sales support for LYMSs in general
OPER1	107	Independent	1-7,9	Operations support for LYMSs in general is
RESV1	109	Independent	1-7,9	Reservations support for LYMSs in general is
EXIST1	111	Independent	1-7,9	Existing ISs for LYMSs in general is
SUPPL1	113	Independent	1-7,9	Supplier support for LYMSs in general is
CUST1	115	Independent	1-7,9	Customer behavior for LYMSs in general is
MIDDLE1	117	Independent	1-7,9	Middle-agent behavior for LYMSs in general is
ENVIOR1	119	Independent	1-7,9	Environmental-benevolence for LYMSs in general is
DESIGN2	50	Independent		Design of our LYMS is*
			1	Extremely poor
			2	Quite poor
			3	Slightly poor
			4	Neither poor nor good
			5	Slightly good
			6	Quite good

Table 9, continued

Label	#	Type	Value(s)	Definition
			7	Extremely good
			9	I don't know
QUALITY2	52	Independent	1-7,9	Quality of our LYMS is
DATA2	54	Independent	1-7,9	Data management for our LYMS is
MAINT2	56	Independent	1-7,9	Maintenance of our LYMS is
COMPCOM2	58	Independent	1-7,9	Computer to computer interface of our LYMS is
FUNCTIO2	60	Independent	1-7,9	Functions of our LYMS is
OBJECTI2	62	Independent	1-7,9	Objectives for our LYMS is
CONTROL2	64	Independent	1-7,9	Control for our LYMS is
INFOQUA2	66	Independent	1-7,9	Information quality of our LYMS is
USERCOM2	68	Independent	1-7,9	User-computer interface of our LYMS is
ATMOS2	70	Independent	1-7,9	Atmosphere for our LYMS is
TRAIN2	72	Independent	1-7,9	Training for our LYMS is
ATTITUD2	92	Independent	1-7,9	Attitude towards our LYMS is
COMMIT2	94	Independent	1-7,9	Commitment towards our LYMS is
UNDER2	96	Independent	1-7,9	Understanding about our LYMS is
COMPETN2	98	Independent	1-7,9	Competence for our LYMS is
DECISIO2	100	Independent	1-7,9	Decision-making latitude for our LYMS is
TOPMGT2	102	Independent	1-7,9	Top-management support for our LYMS is
MARKET2	104	Independent	1-7,9	Marketing support of our LYMS is
SALES2	106	Independent	1-7,9	Sales support of our LYMS is
OPER2	108	Independent	1-7,9	Operations support of our LYMS is
RESV2	110	Independent	1-7,9	Reservations support of our LYMS is
EXIST2	112	Independent	1-7,9	Existing systems for our LYMS is
SUPPL2	114	Independent	1-7,9	Supplier support of our LYMS is
CUST2	116	Independent	1-7,9	Customer behavior of our LYMS is
MIDDLE2	118	Independent	1-7,9	Middle-agent behavior of our LYMS
ENVIOR2	120	Independent	1-7,9	Environmental benevolence for our LYMS is
NINE	N/A	Control	0-120	Number of "Don't Know" responses
BLANK	N/A	Control	0-120	Number of missing responses
TOTAL	N/A	Control	0-120	NINE + BLANK

Table 9, continued

Label	#	Type	Value(s)	Definition
NONRESP	N/A	Control	1	Surveys received before follow-up post card
			2	Surveys received after follow-up post card
SUCCESS	N/A	Dependent	-5+5	Dependent factor score for selected system success constructs.

Note: For complete definitions of independent variables refer to Appendix K.
Refers to survey question number.

Mean Comparisons of Three Systems

One of the first requirements for the data analysis was to determine whether the three systems should be analyzed separately or together. To do this the descriptive statistics of the variables were first examined to decide what statistical test should be applied.

Test Selection and Model Assumptions

Although MANOVA and ANOVA models are robust against deviations from normality (Stevens, 1992, p. 247), platykurtosis has a strong deleterious effect on power. For this reason a non-parametric model had to be employed to determine whether the three systems should be evaluated separately or together.

The non-parametric test selected for this process was the Mann-Whitney U-test. This test was selected because it is appropriate for comparing two populations and the data met the model's assumptions.

Assumptions for the Mann-Whitney U-test are as follows (Ott, et. al., 1992, p. 310): 1) The variables under study are measured on ordinal, interval, or ratio scales. 2) A random sample is selected from each of the two populations. 3) Both sample sizes are greater than 10.

All of the data collected were either interval or ratio scales, so assumption one was met. The sample sizes were greater than 10, so assumption three was met. To test for the randomness of sample selection (assumption number two) the descriptive statistics were examined and the Kolmogorov-Smirnov goodness of fit test for uniform distribution of the survey returns was performed on the tracking numbers issued to the properties during the research design stage. Since the tracking numbers were issued for each property (for a given system), and not for each potential respondent, the test on uniformity had to be broken down by type of respondent (i.e. general manager, director of marketing, front office manager, and reservations manager), as well as by system. The results of these tests of uniformity of distribution across the tracking numbers are shown in Table 10.

In each case the test failed to reject the null hypothesis that the distribution was uniform at the .05% level of significance. Since returned surveys appeared to be uniformly distributed across their tracking numbers both visually and statistically, the data met the requirements of the second assumption of the Mann-Whitney test.

Test Applications and Results

The variables of the three systems were tested using the Kruskal-Wallis 1-way ANOVA test. Fifty eight out of 88 variables proved to be significantly different at the .05 level. Because of these results, post-hoc tests were performed using the Mann-Whitney test to identify which systems were different. The results are displayed in Table 11.

Table 10
Kolmogorov-Smirnov Goodness of Fit Test for
Uniform Distributions on TRACK Variable

System	Position	Track Range	Cases	K-S Z	Significance
1	1	2-222	46	.665	.769
1	2	2-204	88	.789	.561
1	3	18-206	24	1.286	.073
1	4	1-211	133	1.173	.127
2	1	404-416	2	.707	.699
2	2	401-429	8	.758	.614
2	3	404-429	11	.808	.531
2	4	401-432	11	.671	.759
3	1	301-391	13	.530	.941
3	2	334-395	9	.852	.462
3	3	305-395	10	1.300	.068
3	4	330-395	3	.577	.893

Table 11
Comparison of System Distributions Using Mann-Whitney Procedure

Variable	Type	Systems 1 & 2	Systems 1 & 3	Systems 2 & 3
POSITION	Control		*	*
INVOLVE	Control	*	*	
SKILL	Control			
COMPYR	Control			
PROPS	Control	*	*	*
PROPL	Control			
ROOMS	Control	*	*	
UNITS	Control	*	*	*
FTEW	Control	*	*	*
FTES	Control	*	*	
REV	Control	*	*	*
REVCHG	Dependent			
RELIABLE	Dependent	*		
COMPLETE	Dependent	*		
ACCURATE	Dependent	*		
RELEVANT	Dependent		*	*
TIMELY	Dependent			*
ADAPTABL	Dependent			
FRIENDLY	Dependent	*		*
USEFUL	Dependent		*	
FLEXIBLE	Dependent			
SECURE	Dependent			
ACCESS	Dependent	*		
INTEGRAT	Dependent	*		*
MANUALS	Dependent		*	
REPORTS	Dependent	*	*	
YIELDYR	Control	*		*
SYSYR	Control	*	*	
COMFORT	Control	*	*	
ESSEN	Control	*	*	
RESSALE	Dependent			
OPRMKTG	Dependent		*	
SALESDEC	Dependent		*	
MYLOAD	Dependent	*	*	
EMPLOAD	Dependent	*		*
GOAL	Dependent		*	

* Denotes Pairs of Groups Significantly Different at the .050 Level.

Table 11, continued

Variable	Type	Systems 1 & 2	Systems 1 & 3	Systems 2 & 3
IMAGE	Dependent	*		
COMMIT	Dependent	*	*	
BETTER	Dependent	*	*	
OVERALL	Dependent	*	*	
IMPACT	Dependent	*	*	
DF	Control		*	*
AMS	Control			
APMDC	Control	*		*
ARD	Control	*	*	
AOMNS	Control	*	*	
CRS	Control			
CRSM	Control		*	
OCRCR	Control	*	*	
CO	Control	*		*
OROG	Control		*	*
CWCO	Control			*
PDST	Control		*	
PEMAW	Control	*		
PWIA	Control		*	*
PCBAS	Control		*	*
ISMSS	Control		*	*
AEMI	Control		*	
PTAR	Control	*		*
TVBDI	Control			
USAGE	Control		*	*
DESIGN	Independent		*	
QUALITY	Independent		*	
DATA	Independent			
MAINT	Independent			
COMPCOM	Independent	*		*
FUNCTIO	Independent			
OBJECTI	Independent		*	*
CONTROL	Independent			
INFOQUAL	Independent			
USERCOM	Independent	*		*
ATMOS	Independent			
TRAIN	Independent			

* Denotes Pairs of Groups Significantly Different at the .050 Level.

Table 11, continued

Variable	Type	Systems 1 & 2	Systems 1 & 3	Systems 2 & 3
ATTITUD	Independent		*	
COMMIT	Independent		*	
UNDER	Independent	*		
COMPETN	Independent	*		
DECISO	Independent		*	*
TOPMGT	Independent			
MARKET	Independent	*		
SALES	Independent			
OPER	Independent	*	*	
RESV	Independent	*	*	
EXIST	Independent			
SUPPL	Independent			
CUST	Independent			
MIDDLE	Independent			
ENVIOR	Independent			
Control		18/35 (51%)	22/35 (63%)	16/35 (46%)
Dependent		14/26 (54%)	13/26 (50%)	05/26 (19%)
Independent		07/27 (26%)	08/27 (30%)	04/27 (15%)
Total		39/88 (44%)	43/88 (49%)	25/88 (28%)

* Denotes Pairs of Groups Significantly Different at the .050 Level.

When system one was tested against system two significant differences were found with 51% of the control variables, 54% of the dependent variables, 26% of the independent variables, and 44% of all variables, at the .05 level of probability. When system one was tested against system three significant differences were found with 63% of the control variables, 50% of the dependent variables, 30% of the independent variables, and 49% of all variables, at the .05 level of significance. When system two was tested against system three significant differences were found with 46% of the control variables, 19% of the dependent variables, 15% of the independent variables, and 28% of all variables, at the .05 level of significance.

Approximately 5% of the significant findings would be attributed to random error since the tests were performed at the .05 level of significance. Deducting 5% from each total still left a substantial number of significant differences between the three systems. The results of these tests provided evidence that the distributions of the three systems differed and they should be treated separately throughout the analysis.[1]

Comparison of Respondents to Non-Respondents

Respondents were compared to non-respondents using two methods. The first method compared geographic and biographic data between respondent and non-

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[1] Even though the data violated the assumptions of a MANOVA test, one was applied to test for the independence of the three systems. The MANOVA supported the results of the Mann-Whitney tests.

respondent samples. The second method treated late-respondents as a surrogate variable for non-respondents, and compared the distribution between respondent and late-respondent samples.

The non-respondents were identified by their missing tracking numbers (TRACK) and are listed in Table 12 by their respective system. The tracking numbers were numbers imbedded in each survey to allow the identification of non-responding properties. Appendix L lists all of the respondents by their tracking number.

Collection and Analysis of Biographic and Geographic Data

To compare geographic and biographic data, a sample of non-respondent properties was selected using a random number table (Cowden & Cowden, 1960). These properties were contacted by phone and biographic and geographic data were collected. These data are exhibited in Tables 13, 14, and 15.

The non-respondent samples for all three systems contained country and state distributions reflective of their respective respondent samples. They also contained representative varieties of property types reflective of their respective respondent sample populations as described by their service levels (PROPS) and physical locations (PROPL).

Table 12
Non-Respondents Identified by Tracking Numbers

System #1

26	35	88	94	113	120	130	140	167	183	199	207
29	36	89	106	116	121	134	157	169	184	201	209
33	50	91	107	119	127	138	165	173	195	205	

System #2

403	409	414	418	430
405	410	415	424	431
407	411	417	425	

System #3

302	313	322	331	345	354	361	369	378	385	394
303	314	325	335	346	355	362	370	380	386	
304	315	326	336	347	356	363	371	381	387	
307	316	327	337	350	358	365	374	382	388	
309	318	328	341	351	359	366	376	383	389	
312	319	329	342	352	360	368	377	384	390	

Table 13
Geographic and Biographic Data of Selected Non-Respondents for System One

System #1	Location	PROPT	PROPL	FTEW	Rooms
026	CA	Full	Suburb	320	373
029	CA	Full	Downtown	200	255
036	CO	Full	Suburb	150	310
050	FL	Lux	Resort	275	350
094	MD	Full	Suburb	270	407
106	MA	Full	Downtown	250	324
113	MI	Full	Airport	100	161
119	MO	Full	Resort	850	1000
127	NJ	Full	Suburb	200	289
130	NJ	Full	Suburb	320	400
157	OH	Full	Downtown	200	243
165	PA	Full	Suburb	350	465
167	RI	Full	Downtown	250	345
169	Sold				
183	Sold				
184	TX	Full	Suburb	290	386
205	WI	Full	Suburb	300	396
207	Sold				
Average		14Full 1Lux	8Suburb 4Downtown 2Resort 1Airport	288	380

Table 14
Geographic and Biographic Data of Selected Non-Respondents for System Two

System #2	Location	PROPT	PROPL	FTEW	Rooms
405	IL	Full	Resort	200	252
407	England	Lux	Resort	100	116
409	England	Full	Resort	150	128
411	England	Full	Suburb	75	115
414	England	Lux	Downtown	124	73
415	England	Full	Suburb	45	74
418	CA	Full	Resort	200	260
425	PA	Lux	Downtown	100	96
430	NY	Lux	Downtown	400	551
431	Switz	Lux	Suburb	150	345
Average		5Full 5Lux	4Resort 3Suburb 3Downtown	154	201

Table 15
Geographic and Biographic Data of Selected Non-Respondents for System Three

System #3	Location	PROPT	PROPL	FTEW	Rooms
303	AR	Econ	Airport	95	190
307	DE	Full	Hwy	75	132
319	MD	Full	Hwy	70	122
327	NV	Full	Suburb	40	150
331	NY	Full	Indus Pk	125	202
341	TN	Econ	Hwy	15	103
342	TX	Econ	Hwy	28	160
351	AZ	Full	Suburb	50	185
360	IL	Full	Suburb	45	118
366	ME	Full	Airport	65	209
374	NV	Econ	Resort	46	163
378	NY	Full	Suburb	200	309
384	PA	Full	Hwy	90	142
386	SC	Econ	Hwy	75	117
394	WV	Econ	Conven	75	200
Average		9Full 6Mid	6Hwy 4Suburb 2Airport 1Resort 1Conven 1Airport	73	166

The distributions of the respondent and non-respondent samples were statistically compared for the number of full-time equivalent workers (FTEW) and number of rooms (ROOMS). To do this, the respondent systems were coded as 1, 2, & 3 and the non-respondent systems were coded as 4, 5, & 6: where 4 was the non-respondent sample of system one, 5 was the non-respondent sample of system two, and 6 was the non-respondent sample of system three. A Mann-Whitney procedure was used to test the null hypotheses that the distributions of the respective respondent and non-respondent samples were from the same population. The test failed to reject the null hypothesis for each respondent / non-respondent set. In other words, no significant differences were found to exist between data sets: 1 & 4, 2 & 5, or 3 & 6 (respondent / non-respondent sets) for the variables FTEW and ROOMS. The results are shown in Table 16.

Comparison of Respondent to Late-Respondents (as Surrogate Non-Respondents)

To compare "non-respondents" to respondents using late-respondents as surrogate variables for non-respondents, the late-respondents had to first be defined and identified. A follow-up post card was mailed to all non-respondents. Questionnaires that began arriving four days after the follow-up notices were sent became the most logical candidates for late-respondents, since these respondents best matched the characteristics of non-respondents. Figure 9 shows the arrival times of the surveys in days from the mailing date.

Table 16
Comparison of Respondents to Non-Respondents
Using the Mann-Whitney Test

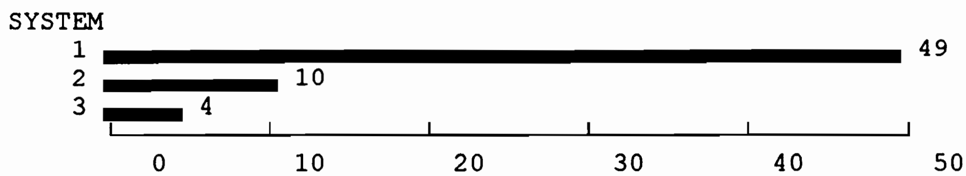
Variables	System	Z-value	Significance
Resp. Rooms vs. Non-Resp. Rooms	1	-1.049	.2940
Resp. Rooms vs. Non-Resp. Rooms	2	-1.419	.1559
Resp. Rooms vs. Non-Resp. Rooms	3	-1.345	.1787
Resp. FTEW vs. Non-Resp. FTEW	1	-0.498	.6186
Resp. FTEW vs. Non-Resp. FTEW	2	-1.403	.1606
Resp. FTEW vs. Non-Resp. FTEW	3	-1.813	.0699

Forty-nine usable surveys were received after the follow-up notice was mailed for system one. Ten were received for system two, and four were received for system three. This is depicted in Figure 11.

The distributions of the respondents and late-respondents were compared for the three systems. A series of Mann-Whitney U-test was used to compare the system's variables. The results are displayed in Table 17.

Less than ten percent of the variables proved to be significantly different at the .05 level of probability for the three systems. Because of the individual tests, one would expect that five percent of the variables would prove significant at the .05 level of significance from random error alone. Deducting five percent from the totals to compensate for the increase in alpha error, left less than five percent of the variables differing. No significant differences were found between the respondent and late-respondent samples for any of the three systems.

Even though the data violated assumptions of a MANOVA test, one was applied on each of the three systems to compare the respondent and late-respondent samples. The tests supported the results of the Mann-Whitney tests; i.e. No significant differences were found between the respondent and late-respondent samples. In conclusion, no significant differences were found between the respondent and non-respondent samples.



Valid cases 63 Missing cases 0

Figure 11
Number of Late-respondents (by System)

Table 17
Comparison of Variable Means Using the Mann-Whitney U-Test

Variable	Type	System 1	System 2	System 3
POSITION	Control		*	
INVOLVE	Control			
SKILL	Control			*
COMPYR	Control			
PROPS	Control			
PROPL	Control			
ROOMS	Control			
UNITS	Control		*	
FTEW	Control			
FTES	Control			
REV	Control		*	
REVCHG	Dependent			
RELIABLE	Dependent			
COMPLETE	Dependent			
ACCURATE	Dependent			
RELEVANT	Dependent			
TIMELY	Dependent			
ADAPTABL	Dependent			
FRIENDLY	Dependent			
USEFUL	Dependent			
FLEXIBLE	Dependent			
SECURE	Dependent			
ACCESS	Dependent			
INTEGRAT	Dependent			
MANUALS	Dependent	*		
REPORTS	Dependent			
YIELDYR	Control			
SYSYR	Control			
COMFORT	Control			
ESSEN	Control			*
RESSALE	Dependent			
OPRMKTG	Dependent			
SALESDEC	Dependent			
MYLOAD	Dependent			
EMPLOAD	Dependent			
GOAL	Dependent			

* Denotes Pairs of Groups Significantly Different at the .050 Level.

Table 17, continued

Variable	Type	System 1	System 2	System 3
IMAGE	Dependent			
COMMIT	Dependent			
BETTER	Dependent			
OVERALL	Dependent			
IMPACT	Dependent		*	
DF	Control			
AMS	Control			
APMDC	Control	*		
ARAD	Control		*	
AOMNS	Control			
CRS	Control			
CRSM	Control			
OCRCR	Control			
CO	Control			
OROG	Control			
CWCO	Control			
PDST	Control			
PEMAW	Control			
PWIA	Control			
PCBAS	Control			
ISMSS	Control	*		*
AEMI	Control			
PTAR	Control			
TVBDI	Control			
USAGE	Control			
DESIGN	Independent			
QUALITY	Independent			
DATA	Independent	*	*	
MAINT	Independent			
COMPCOM	Independent			
FUNCTIO	Independent			
OBJECTI	Independent	*		
CONTROL	Independent			
INFOQUAL	Independent			
USERCOM	Independent			
ATMOS	Independent			
TRAIN	Independent			

* Denotes Pairs of Groups Significantly Different at the .050 Level.

Table 17, continued

Variable	Type	System 1	System 2	System 3
ATTITUD	Independent			
COMMIT	Independent			
UNDER	Independent			
COMPETN	Independent			
DECISO	Independent			
TOPMGT	Independent			
MARKET	Independent			
SALES	Independent			
OPER	Independent			
RESV	Independent			
EXIST	Independent			
SUPPL	Independent		*	
CUST	Independent			
MIDDLE	Independent			
ENVIOR	Independent			*
Control		02/35 (06%)	03/35 (09%)	03/35 (09%)
Dependent		01/26 (04%)	02/26 (08%)	00/26 (00%)
Independent		02/27 (07%)	02/27 (07%)	01/27 (04%)
Total		05/88 (06%)	07/88 (08%)	04/88 (05%)

* Denotes Pairs of Groups Significantly Different at the .050 Level.

Development of the Dependent Variables

The survey contained 27 potential measures of system success (dependent variables). These were derived from a valid and reliable test (Appendix A), an extensive literature review, and discussions with users, vendors, and developers. To determine which variables were most useful and appropriate, correlation and factor analyses were first employed. The reliabilities of the variables were also examined.

To begin this process all the potential variables were examined to verify that they had a sufficient percentage of responses to be useful. The variables REVCHG (i.e. change in revenue) and PROCHG (i.e. change in profit) were eliminated because of low response rates. Approximately two-thirds of the respondents failed to provide an estimate for change in revenue and even fewer provided an estimate for change in profit.

Out of curiosity, and because the variable REVCHG was, in theory, highly relevant to LYMS success, the reliability of the variable was tested against the 25 other system success constructs. It was found to be very low: Cronbach's alpha was consistently below .20.

After PROCHG and REVCHG were dropped from the pool of potential dependent variables, the intercorrelations of remaining system success constructs were examined and the variables were factor analyzed. Tables 18, 19, and 20 list the Pearson correlation coefficients for the system success constructs for each system.

Table 18
Correlation Matrix for System One's System Success Constructs

Correlation	RELIABLE	COMPLETE	ACCURATE	RELEVANT	TIMELY
RELIABLE	1.0000	.5371**	.7382**	.6032**	.4924**
COMPLETE	.5371**	1.0000	.5940**	.4726**	.4978**
ACCURATE	.7382**	.5940**	1.0000	.5338**	.5114**
RELEVANT	.6032**	.4726**	.5338**	1.0000	.5485**
TIMELY	.4924**	.4978**	.5114**	.5485**	1.0000
ADAPTABL	.4412**	.4005**	.4440**	.4617**	.4170**
FRIENDLY	.1010	.1915*	.1284	.1288	.2579**
USEFUL	.5935**	.4602**	.4903**	.6364**	.4534**
FLEXIBLE	.3513**	.3605**	.4646**	.3581**	.4039**
SECURE	.1403	.2677**	.1922*	.1078	.2349**
ACCESS	-.0199	.1791*	.1004	-.0101	.1778*
INTEGRAT	.1851*	.3587**	.2696**	.2443**	.2795**
MANUALS	.1169	.1682*	.0810	.1172	.2803**
REPORTS	.2875**	.3544**	.2622**	.2318**	.4073**
RESSALE	.3343**	.3409**	.3329**	.3136**	.2512**
OPRMKTG	.2078**	.1450	.2566**	.1438	.1811*
SALESDEC	.3988**	.3212**	.3734**	.4558**	.3536**
MYLOAD	.1080	.1849*	.0685	.1573*	.2001**
EMPLOAD	.2023**	.1802*	.2499**	.1503	.1700*
GOAL	.3647**	.3431**	.3404**	.4150**	.3805**
IMAGE	.2185**	.2174**	.1866*	.2591**	.3373**
COMMIT	.4125**	.3053**	.3339**	.3557**	.2329**
BETTER	.5561**	.3931**	.4714**	.5428**	.4471**
OVERALL	.4898**	.4876**	.5633**	.4686**	.5253**
IMPACT	.4180**	.3395**	.3667**	.4468**	.4317**

2-tailed Signif: * - .01 ** - .001 " . " is printed if a coefficient cannot be computed

Table 18, continued

Correlation	ADAPTABL	FRIENDLY	USEFUL	FLEXIBLE	SECURE	ACCESS
RELIABLE	.4412**	.1010	.5935**	.3513**	.1403	-.0199
COMPLETE	.4005**	.1915*	.4602**	.3605**	.2677**	.1791*
ACCURATE	.4440**	.1284	.4903**	.4646**	.1922*	.1004
RELEVANT	.4617**	.1288	.6364**	.3581**	.1078	-.0101
TIMELY	.4170**	.2579**	.4534**	.4039**	.2349**	.1778*
ADAPTABL	1.0000	.3585**	.4000**	.5655**	.1819*	.2562**
FRIENDLY	.3585**	1.0000	.1933*	.3472**	.2757**	.4663**
USEFUL	.4000**	.1933*	1.0000	.3359**	.1661	-.0204
FLEXIBLE	.5655**	.3472**	.3359**	1.0000	.2520**	.2062**
SECURE	.1819*	.2757**	.1661	.2520**	1.0000	.1825*
ACCESS	.2562**	.4663**	-.0204	.2062**	.1825*	1.0000
INTEGRAT	.3813**	.2618**	.1939*	.3381**	.3577**	.4004**
MANUALS	.2706**	.3342**	.1577	.1394	.1734	.2775**
REPORTS	.3932**	.2077**	.4010**	.3340**	.2311**	.1902*
RESSALE	.2391**	.1085	.3530**	.2394**	.1860*	.0909
OPRMKTG	.2024**	.1162	.1507	.2736**	.1441	.1050
SALESDEC	.2690**	.2113**	.5812**	.3330**	.2255**	.0104
MYLOAD	.2163**	.3021**	.3265**	.1897*	.0667	.1381
EMPLOAD	.2164**	.1050	.2703**	.2310**	.0058	.0196
GOAL	.3080**	.2055**	.5530**	.3672**	.1219	.0602
IMAGE	.3362**	.2641**	.3256**	.2489**	.0437	.1054
COMMIT	.2583**	.1881*	.3867**	.2398**	.1434	.0693
BETTER	.3336**	.1860*	.6823**	.3662**	.1839*	.0151
OVERALL	.4287**	.2655**	.5416**	.4637**	.1362	.1794*
IMPACT	.3777**	.3030**	.6029**	.2936**	.1033	.1227

2-tailed Signif: * - .01 ** - .001 " . " is printed if a coefficient cannot be computed

Table 18, continued

Correlations	INTEGRAT	MANUALS	REPORTS	RESSALE	OPRMKTG	SALESDEC
RELIABLE	.1851*	.1169	.2875**	.3343**	.2078**	.3988**
COMPLETE	.3587**	.1682*	.3544**	.3409**	.1450	.3212**
ACCURATE	.2696**	.0810	.2622**	.3329**	.2566**	.3734**
RELEVANT	.2443**	.1172	.2318**	.3136**	.1438	.4558**
TIMELY	.2795**	.2803**	.4073**	.2512**	.1811*	.3536**
ADAPTABL	.3813**	.2706**	.3932**	.2391**	.2024**	.2690**
FRIENDLY	.2618**	.3342**	.2077**	.1085	.1162	.2113**
USEFUL	.1939*	.1577	.4010**	.3530**	.1507	.5812**
FLEXIBLE	.3381**	.1394	.3340**	.2394**	.2736**	.3330**
SECURE	.3577**	.1734	.2311**	.1860*	.1441	.2255**
ACCESS	.4004**	.2775**	.1902*	.0909	.1050	.0104
INTEGRAT	1.0000	.2563**	.3088**	.2150**	.1505	.1881*
MANUALS	.2563**	1.0000	.5027**	.1030	.2138**	.2103*
REPORTS	.3088**	.5027**	1.0000	.2461**	.1947*	.2960**
RESSALE	.2150**	.1030	.2461**	1.0000	.5489**	.5305**
OPRMKTG	.1505	.2138**	.1947*	.5489**	1.0000	.2946**
SALESDEC	.1881*	.2103*	.2960**	.5305**	.2946**	1.0000
MYLOAD	.1139	.2594**	.2600**	.1812*	.0928	.2914**
EMPLOAD	.1279	.1552	.1437	.2632**	.2645**	.2944**
GOAL	.1240	.1962*	.2866**	.4896**	.2650**	.6482**
IMAGE	.1325	.2884**	.3294**	.2304**	.2313**	.2840**
COMMIT	.2052**	.2263**	.2669**	.3993**	.2898**	.4015**
BETTER	.1466	.1996*	.4059**	.4302**	.1710*	.6362**
OVERALL	.2679**	.2738**	.4276**	.3770**	.2253**	.4985**
IMPACT	.1495	.3178**	.3963**	.3232**	.1275	.5265**

2-tailed Signif: * - .01 ** - .001 " . " is printed if a coefficient cannot be computed

Table 18, continued

Correlations	MYLOAD	EMPLOAD	GOAL	IMAGE	COMMIT	BETTER
RELIABLE	.1080	.2023**	.3647**	.2185**	.4125**	.5561**
COMPLETE	.1849*	.1802*	.3431**	.2174**	.3053**	.3931**
ACCURATE	.0685	.2499**	.3404**	.1866*	.3339**	.4714**
RELEVANT	.1573*	.1503	.4150**	.2591**	.3557**	.5428**
TIMELY	.2001**	.1700*	.3805**	.3373**	.2329**	.4471**
ADAPTABL	.2163**	.2164**	.3080**	.3362**	.2583**	.3336**
FRIENDLY	.3021**	.1050	.2055**	.2641**	.1881*	.1860*
USEFUL	.3265**	.2703**	.5530**	.3256**	.3867**	.6823**
FLEXIBLE	.1897*	.2310**	.3672**	.2489**	.2398**	.3662**
SECURE	.0667	.0058	.1219	.0437	.1434	.1839*
ACCESS	.1381	.0196	.0602	.1054	.0693	.0151
INTEGRAT	.1139	.1279	.1240	.1325	.2052**	.1466
MANUALS	.2594**	.1552	.1962*	.2884**	.2263**	.1996*
REPORTS	.2600**	.1437	.2866**	.3294**	.2669**	.4059**
RESSALE	.1812*	.2632**	.4896**	.2304**	.3993**	.4302**
OPRMKTG	.0928	.2645**	.2650**	.2313**	.2898**	.1710*
SALESDEC	.2914**	.2944**	.6482**	.2840**	.4015**	.6362**
MYLOAD	1.0000	.3662**	.3764**	.2805**	.2772**	.3540**
EMPLOAD	.3662**	1.0000	.4015**	.2039**	.3195**	.2670**
GOAL	.3764**	.4015**	1.0000	.4785**	.4389**	.6620**
IMAGE	.2805**	.2039**	.4785**	1.0000	.3728**	.4103**
COMMIT	.2772**	.3195**	.4389**	.3728**	1.0000	.5711**
BETTER	.3540**	.2670**	.6620**	.4103**	.5711**	1.0000
OVERALL	.3655**	.3290**	.5309**	.4203**	.4889**	.6669**
IMPACT	.4969**	.2569**	.6007**	.4434**	.4320**	.7238**

2-tailed Signif: * - .01 ** - .001 " . " is printed if a coefficient cannot be computed

Table 18, continued

Correlations	OVERALL	IMPACT
RELIABLE	.4898**	.4180**
COMPLETE	.4876**	.3395**
ACCURATE	.5633**	.3667**
RELEVANT	.4686**	.4468**
TIMELY	.5253**	.4317**
ADAPTABL	.4287**	.3777**
FRIENDLY	.2655**	.3030**
USEFUL	.5416**	.6029**
FLEXIBLE	.4637**	.2936**
SECURE	.1362	.1033
ACCESS	.1794*	.1227
INTEGRAT	.2679**	.1495
MANUALS	.2738**	.3178**
REPORTS	.4276**	.3963**
RESSALE	.3770**	.3232**
OPRMKTG	.2253**	.1275
SALESDEC	.4985**	.5265**
MYLOAD	.3655**	.4969**
EMPLOAD	.3290**	.2569**
GOAL	.5309**	.6007**
IMAGE	.4203**	.4434**
COMMIT	.4889**	.4320**
BETTER	.6669**	.7238**
OVERALL	1.0000	.6533**
IMPACT	.6533**	1.0000

2-tailed Signif: * - .01 ** - .001 " . " is printed if a coefficient cannot be computed

Table 19
Correlation Matrix for System Two's System Success Constructs

Correlations	RELIABLE	COMPLETE	ACCURATE	RELEVANT	TIMELY
RELIABLE	1.0000	.1645	.5056**	.5101**	.5324**
COMPLETE	.1645	1.0000	.4693*	.2809	.1003
ACCURATE	.5056**	.4693*	1.0000	.8105**	.2582
RELEVANT	.5101**	.2809	.8105**	1.0000	.5459**
TIMELY	.5324**	.1003	.2582	.5459**	1.0000
ADAPTABL	.4987**	.5059**	.5595**	.4244	.1729
FRIENDLY	.2613	.3088	.4899**	.3834*	.0081
USEFUL	.3370	.4093*	.7440**	.7041**	.1600
FLEXIBLE	.5193**	.5231**	.3353	.2116	.1200
SECURE	.3734	.3186	.4034	.3655	.3145
ACCESS	.2137	.2148	.2228	.1111	-.0832
INTEGRAT	-.0470	.5245**	.2735	.1321	.0114
MANUALS	.4830*	.3549	.3995*	.3453	.2512
REPORTS	.5006**	.1324	.1451	.0237	-.0217
RESSALE	-.0157	.0924	.2772	.2087	.0734
OPRMKTG	.2744	.1675	.3107	.2091	.4139*
SALESDEC	.1264	.0947	.2552	.1555	.2444
MYLOAD	.1671	.1800	.4122*	.4309*	.0096
EMPLOAD	.1429	.2751	.3924*	.4031*	.0242
GOAL	.2863	.1577	.2144	.1578	.0924
IMAGE	.3715*	.3700*	.3389	.2526	.2066
COMMIT	.2696	.2635	.2137	.1919	.3892
BETTER	.2916	.4732*	.4771**	.4117*	.3392
OVERALL	.4827**	.3743*	.7567**	.6657**	.3883*
IMPACT	.3571*	.3319	.6421**	.6447**	.5539**

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 19, continued

Correlations	ADAPTABL	FRIENDLY	USEFUL	FLEXIBLE	SECURE	ACCESS
REVCHG	.5774	.5774	1.0000**	.5774	.0000	-.7746
RELIABLE	.4987**	.2613	.3370	.5193**	.3734	.2137
COMPLETE	.5059**	.3088	.4093	.5231**	.3186	.2148
ACCURATE	.5595**	.4899**	.7440**	.3353	.4034	.2228
RELEVANT	.4244*	.3834	.7041**	.2116	.3655	.1111
TIMELY	.1729	.0081	.1600	.1200	.3145	-.0832
ADAPTABL	1.0000	.7617**	.4265	.6815**	.5935**	.1527
FRIENDLY	.7617**	1.0000	.4281	.6977**	.3576	.2169
USEFUL	.4265	.4281	1.0000	.3049	.4359	.1842
FLEXIBLE	.6815**	.6977**	.3049	1.0000	.3215	.5591**
SECURE	.5935**	.3576	.4359	.3215	1.0000	.1065
ACCESS	.1527	.2169	.1842	.5591**	.1065	1.0000
INTEGRAT	.3479	.3000	.2046	.3831	.2540	.2008
MANUALS	.6548**	.3540	.0294	.5192**	.3730	.5130**
REPORTS	.4349*	.4033	.0904	.5342**	.3751	.5847**
RESSALE	.2166	.0939	.2798	-.0491	.2807	-.3087
OPRMKTG	.3080	-.0310	.2296	.1033	.3397	-.1859
SALESDEC	.1750	.0294	.1196	-.0355	-.0985	-.2222
MYLOAD	.2633	.4370	.3983	.2013	.1175	.0562
EMPLOAD	.2616	.4202	.3522	.2400	.0575	.0869
GOAL	.3405	.2585	.2739	.2152	.0042	-.1534
IMAGE	.4045*	.1666	.4000	.1532	.3009	-.0197
COMMIT	.2497	.0441	.3437	.2302	.3172	-.0970
BETTER	.2061	-.0256	.4373	.0797	.0947	.0730
OVERALL	.4546*	.3956	.6235**	.3150	.2048	.1286
IMPACT	.4616**	.3224	.5258**	.2117	.3942	-.0373

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 19, continued

Correlations	INTEGRAT	MANUALS	REPORTS	RESSALE	OPRMKTG	SALESDEC
REVCHG	-.1741	-.8660	-.6623	-.9272	-.3333	.
RELIABLE	-.0470	.4830*	.5006**	-.0157	.2744	.1264
COMPLETE	.5245**	.3549	.1324	.0924	.1675	.0947
ACCURATE	.2735	.3995*	.1451	.2772	.3107	.2552
RELEVANT	.1321	.3453	.0237	.2087	.2091	.1555
TIMELY	.0114	.2512	-.0217	.0734	.4139*	.2444
ADAPTABL	.3479	.6548**	.4349*	.2166	.3080	.1750
FRIENDLY	.3000	.3540	.4033	.0939	-.0310	.0294
USEFUL	.2046	.0294	.0904	.2798	.2296	.1196
FLEXIBLE	.3831*	.5192**	.5342**	-.0491	.1033	-.0355
SECURE	.2540	.3730	.3751	.2807	.3397	-.0985
ACCESS	.2008	.5130**	.5847**	-.3087	-.1859	-.2222
INTEGRAT	1.0000	.2335	-.0049	.2325	.2210	.0530
MANUALS	.2335	1.0000	.4146*	-.3862	-.0343	-.0323
REPORTS	-.0049	.4146*	1.0000	-.2021	-.1054	-.0385
RESSALE	.2325	-.3862	-.2021	1.0000	.7403**	.3081
OPRMKTG	.2210	-.0343	-.1054	.7403**	1.0000	.3494
SALESDEC	.0530	-.0323	-.0385	.3081	.3494	1.0000
MYLOAD	.3482	.1885	.2350	.2795	.0514	.1816
EMPLOAD	.5598**	.2057	.1103	.3359	.1046	.1783
GOAL	.0393	.0062	.2090	.2728	.1252	.7606**
IMAGE	.1194	.2504	.3662	.1959	.3534	.5086**
COMMIT	.4201*	.0610	-.0703	.4310*	.4628*	.4927**
BETTER	.2266	.1787	-.0284	.3316	.2545	.6066**
OVERALL	.3108	.3780	.0105	.2605	.2999	.2694
IMPACT	.3919*	.3087	.0879	.5051**	.5526**	.3745

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 19, continued

Correlations	MYLOAD	EMPLOAD	GOAL	IMAGE	COMMIT	BETTER
RELIABLE	.1671	.1429	.2863	.3715*	.2696	.2916
COMPLETE	.1800	.2751	.1577	.3700*	.2635	.4732*
ACCURATE	.4122*	.3924*	.2144	.3389	.2137	.4771**
RELEVANT	.4309*	.4031*	.1578	.2526	.1919	.4117*
TIMELY	.0096	.0242	.0924	.2066	.3892	.3392
ADAPTABL	.2633	.2616	.3405	.4045*	.2497	.2061
FRIENDLY	.4370*	.4202*	.2585	.1666	.0441	-.0256
USEFUL	.3983*	.3522*	.2739	.4000*	.3437	.4373*
FLEXIBLE	.2013	.2400	.2152	.1532	.2302	.0797
SECURE	.1175	.0575	.0042	.3009	.3172	.0947
ACCESS	.0562	.0869	-.1534	-.0197	-.0970	.0730
INTEGRAT	.3482	.5598**	.0393	.1194	.4201*	.2266
MANUALS	.1885	.2057	.0062	.2504	.0610	.1787
REPORTS	.2350	.1103	.2090	.3662	-.0703	-.0284
RESSALE	.2795	.3359	.2728	.1959	.4310*	.3316
OPRMKTG	.0514	.1046	.1252	.3534*	.4628*	.2545
SALESDEC	.1816	.1783	.7606**	.5086**	.4927**	.6066**
MYLOAD	1.0000	.9212**	.3206	.4296*	.4126*	.5006**
EMPLOAD	.9212**	1.0000	.3075	.3638*	.4706**	.5238**
GOAL	.3206	.3075	1.0000	.5093**	.5549**	.5838**
IMAGE	.4296	.3638	.5093**	1.0000	.4882**	.5476**
COMMIT	.4126*	.4706**	.5549**	.4882**	1.0000	.6880**
BETTER	.5006**	.5238**	.5838**	.5476**	.6880**	1.0000
OVERALL	.5507**	.5853**	.2770	.4994**	.3683*	.6448**
IMPACT	.5485**	.5555**	.3264	.5509**	.4842**	.5550**

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 19, continued

Correlations	OVERALL	IMPACT
REVCHG	-.3333	-.8704
RELIABLE	.4827**	.3571*
COMPLETE	.3743*	.3319
ACCURATE	.7567**	.6421**
RELEVANT	.6657**	.6447**
TIMELY	.3883*	.5539**
ADAPTABL	.4546*	.4616**
FRIENDLY	.3956*	.3224
USEFUL	.6235**	.5258**
FLEXIBLE	.3150	.2117
SECURE	.2048	.3942*
ACCESS	.1286	-.0373
INTEGRAT	.3108	.3919*
MANUALS	.3780	.3087
REPORTS	.0105	.0879
RESSALE	.2605	.5051**
OPRMKTG	.2999	.5526**
SALESDEC	.2694	.3745*
MYLOAD	.5507**	.5485**
EMPLOAD	.5853**	.5555**
GOAL	.2770	.3264
IMAGE	.4994**	.5509**
COMMIT	.3683*	.4842**
BETTER	.6448**	.5550**
OVERALL	1.0000	.7606**
IMPACT	.7606**	1.0000

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 20
Correlation Matrix for System Three's System Success Constructs

Correlations	RELIABLE	COMPLETE	ACCURATE	RELEVANT	TIMELY
RELIABLE	1.0000	.4730**	.3619	.4889**	.4026*
COMPLETE	.4730**	1.0000	.6308**	.6698**	.4441*
ACCURATE	.3619*	.6308**	1.0000	.7403**	.3150
RELEVANT	.4889**	.6698**	.7403**	1.0000	.4667**
TIMELY	.4026*	.4441*	.3150	.4667**	1.0000
ADAPTABL	.0691	.2934	.3277	.3045	.2437
FRIENDLY	.1898	.3972*	.3022	.5032**	.6618**
USEFUL	.2455	.3475	.5695**	.6463**	.6668**
FLEXIBLE	.2594	.2787	.3912*	.3937*	.3529*
SECURE	.0645	.2747	.2096	.0697	.2709
ACCESS	.1246	.3671*	.3413	.3166	.4350*
INTEGRAT	.5685**	.4820**	.2276	.0400	.2543
MANUALS	.3872*	.3907*	.3232	.1412	.4936**
REPORTS	.4099*	.3892*	.5494**	.3653*	.5358**
RESSALE	.1438	.5380**	.5099**	.5452**	.2769
OPRMKTG	.1346	.4865**	.5608**	.5288**	.2972
SALESDEC	.3361	.5683**	.5856**	.5140**	.2147
MYLOAD	.2813	.4695**	.4687**	.5186**	.3671*
EMPLOAD	.0774	.3844	.4886**	.3310	.1756*
GOAL	.3959*	.3996*	.4112*	.2627	.2358
IMAGE	.3538*	.1314	.1873	.2328	.4193*
COMMIT	.1329	.1877	.3417	.3220	.3028
BETTER	.1534	.1133	.5247**	.4256*	.2272
OVERALL	.3218	.4144*	.4768**	.5373**	.3441*
IMPACT	.4123*	.2141	.4743**	.4577**	.2456

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 20, continued

Correlations	ADAPTABL	FRIENDLY	USEFUL	FLEXIBLE	SECURE	ACCESS
RELIABLE	.0691	.1898	.2455	.2594	.0645	.1246
COMPLETE	.2934	.3972*	.3475	.2787	.2747	.3671*
ACCURATE	.3277	.3022	.5695**	.3912*	.2096	.3413
RELEVANT	.3045	.5032**	.6463**	.3937*	.0697	.3166
TIMELY	.2437	.6618**	.6668**	.3529*	.2709	.4350*
ADAPTABL	1.0000	.3602*	.4535**	.6405**	.1432	-.0011
FRIENDLY	.3602*	1.0000	.6929**	.2077	.0467	.5381**
USEFUL	.4535**	.6929**	1.0000	.3873*	.1533	.3153
FLEXIBLE	.6405**	.2077	.3873	1.0000	.1664	-.0844
SECURE	.1432	.0467	.1533	.1664	1.0000	.0361
ACCESS	-.0011	.5381**	.3153	-.0844	.0361	1.0000
INTEGRAT	.2780	.1304	.1377	.2420	.3612*	.1397
MANUALS	.2270	.4124*	.3070	.2607	.2712	.3215
REPORTS	.4387*	.6039**	.6941**	.2661	-.0177	.4925**
RESSALE	.2803	.3683*	.3635*	.4468	.2389	.0219
OPRMKTG	.3102	.4019*	.3958*	.5205**	.2637	.1156
SALESDEC	.3920*	.2830	.3682*	.5877**	.3147	.0049
MYLOAD	.3688*	.4166*	.4213*	.5553**	.1530	.2156
EMPLOAD	.4619**	.3555*	.3029	.4563**	.2678	.1232
GOAL	.5361**	.1793	.2833	.5540**	.1057	-.0445
IMAGE	.3102	.1907	.3307	.4362	.1151	.0928
COMMIT	.5068**	.2774	.4692**	.5640**	.2002	.0465
BETTER	.2289	.3331	.4916**	.4174*	-.0277	.1436
OVERALL	.3429	.4374**	.4761**	.5713**	.2034	.1191
IMPACT	.4233*	.2939	.4274*	.6090**	.1284	.0884

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 20, continued

Correlations	INTEGRAT	MANUALS	REPORTS	RESSALE	OPRMKTG	SALESDEC
RELIABLE	.5685**	.3872*	.4099*	.1438	.1346	.3361
COMPLETE	.4820**	.3907*	.3892*	.5380**	.4865**	.5683**
ACCURATE	.2276	.3232	.5494**	.5099**	.5608**	.5856**
RELEVANT	.0400	.1412	.3653*	.5452**	.5288**	.5140**
TIMELY	.2543	.4936**	.5358**	.2769	.2972	.2147
ADAPTABL	.2780	.2270	.4387	.2803	.3102	.3920*
FRIENDLY	.1304	.4124*	.6039**	.3683*	.4019*	.2830
USEFUL	.1377	.3070	.6941**	.3635*	.3958*	.3682*
FLEXIBLE	.2420	.2607	.2661	.4468*	.5205**	.5877**
SECURE	.3612*	.2712	-.0177	.2389	.2637	.3147
ACCESS	.1397	.3215	.4925**	.0219	.1156	.0049
INTEGRAT	1.0000	.4350*	.4515**	.1789	.2135	.3310
MANUALS	.4350*	1.0000	.5876**	.3226	.3032	.2461
REPORTS	.4515**	.5876**	1.0000	.3173	.3820*	.3200
RESSALE	.1789	.3226	.3173	1.0000	.9462**	.8379**
OPRMKTG	.2135	.3032	.3820*	.9462**	1.0000	.8401**
SALESDEC	.3310	.2461	.3200	.8379**	.8401**	1.0000
MYLOAD	.3561*	.4484**	.5015**	.7950**	.7554**	.5763**
EMPLOAD	.1635	.4187*	.4650**	.7121**	.7555**	.6821**
GOAL	.4959**	.4245*	.4480**	.6581**	.6006**	.6908**
IMAGE	.1658	.6215**	.3801*	.2853	.2044	.2129
COMMIT	.1002	.0867	.3195	.4817**	.5512**	.5761**
BETTER	-.1059	.2208	.2877	.4706**	.5369**	.4011*
OVERALL	.3095	.3108	.4103*	.8009**	.8252**	.6971**
IMPACT	.1213	.3629*	.4230*	.4444**	.5010**	.5584**

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 20, continued

Correlations	MYLOAD	EMPLOAD	GOAL	IMAGE	COMMIT	BETTER
RELIABLE	.2813	.0774	.3959*	.3538*	.1329	.1534
COMPLETE	.4695**	.3844*	.3996*	.1314	.1877	.1133
ACCURATE	.4687**	.4886**	.4112*	.1873	.3417	.5247**
RELEVANT	.5186**	.3310	.2627	.2328	.3220	.4256*
TIMELY	.3671*	.1756	.2358	.4193*	.3028	.2272
ADAPTABL	.3688*	.4619**	.5361**	.3102	.5068**	.2289
FRIENDLY	.4166*	.3555*	.1793	.1907	.2774	.3331
USEFUL	.4213*	.3029	.2833	.3307	.4692**	.4916**
FLEXIBLE	.5553**	.4563**	.5540**	.4362	.5640**	.4174
SECURE	.1530	.2678	.1057	.1151	.2002	-.0277
ACCESS	.2156	.1232	-.0445	.0928	.0465	.1436
INTEGRAT	.3561*	.1635	.4959**	.1658	.1002	-.1059
MANUALS	.4484**	.4187*	.4245*	.6215**	.0867	.2208
REPORTS	.5015**	.4650**	.4480**	.3801*	.3195	.2877
RESSALE	.7950**	.7121**	.6581**	.2853	.4817**	.4706**
OPRMKTG	.7554**	.7555**	.6006**	.2044	.5512**	.5369**
SALESDEC	.5763**	.6821**	.6908**	.2129	.5761**	.4011*
MYLOAD	1.0000	.7062**	.5814**	.4386**	.4315**	.4311**
EMPLOAD	.7062**	1.0000	.4835**	.2687	.5314**	.2707
GOAL	.5814**	.4835**	1.0000	.4578**	.4988**	.3096
IMAGE	.4386**	.2687	.4578**	1.0000	.2735	.3973*
COMMIT	.4315**	.5314**	.4988**	.2735	1.0000	.3654*
BETTER	.4311**	.2707	.3096	.3973	.3654	1.0000
OVERALL	.7439**	.4906**	.6455**	.4087*	.5741**	.6789**
IMPACT	.4083*	.5252**	.4249	.6520**	.6116**	.5724**

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

Table 20, continued

Correlations	OVERALL	IMPACT
RELIABLE	.3218*	.4123*
COMPLETE	.4144*	.2141
ACCURATE	.4768**	.4743**
RELEVANT	.5373**	.4577**
TIMELY	.3441*	.2456
ADAPTABL	.3429	.4233*
FRIENDLY	.4374**	.2939
USEFUL	.4761**	.4274*
FLEXIBLE	.5713**	.6090**
SECURE	.2034	.1284
ACCESS	.1191	.0884
INTEGRAT	.3095	.1213
MANUALS	.3108	.3629*
REPORTS	.4103*	.4230*
RESSALE	.8009**	.4444**
OPRMKTG	.8252**	.5010**
SALESDEC	.6971**	.5584**
MYLOAD	.7439**	.4083*
EMPLOAD	.4906**	.5252**
GOAL	.6455**	.4249*
IMAGE	.4087*	.6520**
COMMIT	.5741**	.6116**
BETTER	.6789**	.5724**
OVERALL	1.0000	.5585**
IMPACT	.5585**	1.0000

2-tailed Signif: * - .05 ** - .01 " . " is printed if a coefficient cannot be computed

These procedures were done to reduce the number of dependent variables and summarize their information. Stevens (1992, p. 227) suggested that 1) if a large number of dependent variables are included without any strong rationale that small differences on each variable can add up to obscure the real differences, 2) the power of multivariate tests generally decline as the number of dependent variables increase, 3) the reliabilities of the variables can be a problem, 4) a small number of dependent variables facilitate interpretation, and 5) with a large number of variables, there are a much smaller number that will account for most of the variance. It is also important to recognize that all of the dependent variables in this study were selected to measure only one phenomenon: that of system success.

Since it was the design of this study to measure only one phenomenon on the dependent side, it was logical to identify the variables that were most highly correlated to all of the other variables. Correlation analysis was used to do this.

On a technical level, correlation analysis can be used with any data and there are no underlying assumptions regarding its use (Ott, et. al., 1992, p. 489). The only specific requirement of the Pearson product-moment correlation model is that the data are measured on an interval or ratio scale. On a practical level, since the Pearson model only measures linear relationships, it will not register significance for non-linear relationships. On a theoretical level, when the intent is to make inferences of the population from which the data has been drawn it is important that 1) the scatter plots of Y values for corresponding X values are uniform across values of X (homoscedastic), 2) that the samples of X and Y values are randomly selected from the population of interest, and 3) that the theoretical relationships between the X and Y variables are valid (Ott, et. al., 1992, pp. 489-494).

The only assumptions that had to be met to use the Pearson model for the purpose of reducing the number of dependent variables were that 1) the data were measured interval or ratio scales and 2) the relationship between the X and Y variables were not non-linear. The data met these assumptions because they were measured on interval scales and an examination of the variable's scatter plots revealed no non-linear relationships.

Variables that were significant and that had the highest sums of correlations to the other dependent variables were identified. To do this the values of all the significant correlations were summed for each variable. Variables with the largest sums were identified for each system and the average correlation for each of these variables was computed. Correlated variables were considered significant for system one at the .01 level and at the .05 level for systems two and three. This was done because the large number of cases for system one (291) resulted in more significant relationships. System two and system three had fewer cases and were less likely to have highly significant relationships. Using different levels of significance acted as an adjustment for the different sample sizes. Again, since the intent of this procedure was to reduce the number of dependent variables, the top twelve were selected because this represented approximately half of the available system success constructs.

Even though the dependent variables were selected to measure the single phenomenon of system success, it was possible that this phenomenon could actually be composed of various factors. While correlation analysis was used to identify the sets of most congruent variables, factor analysis was the appropriate model to identify those variables that explain the greatest amount of uncorrelated variance. Thus, both correlation and factor analysis were originally employed to reduce the number of dependent variables.

Identifying the variables with the highest factor loadings was a straight forward process. A principal components factor analysis using a varimax rotation was performed for each system and the variables with loadings of .70 or above were selected from the rotated factor matrixes. Even though a larger number of cases tends to increase the significance of the loadings (Hair, et.al., 1987, p. 250) the value of .70 was uniformly selected because it provided a cut-off point that identified approximately one half of the variables for each of the three systems.

A principal component method was used with a varimax (orthogonal) rotation because the interest was in summarizing data, rather than identifying underlying theoretical constructs (Hair, 1987, pp. 241-246; Stevens, 1992, pp. 374-382). The assumptions for using the principal components factor analysis model are the same as those for correlation analysis because factor analysis is an extension of correlation analysis (Stevens, 1992, pp. 375-377). Since it had already been established that the data under analysis met those assumptions for the purpose of data reduction, no further examination of the data was required.

Correlation and principal components procedures were run for each system and the results were combined since the researcher was attempting to identify measures of system success that were stable across the three systems. The dependent variables, their average correlations and factor loadings are listed in Table 21 .

Every variable, with the exception of INTEGRAT (i.e. how well the LYMS was integrated with the PMS and reservation systems) had a loading of .70 or greater, or an average correlation in the top twelve for at least one of systems. Twenty three of the 25 variables were listed in at least two of the categories. Again, because the purpose was to reduce the number of dependent variables, only the variables that were listed in more than two categories were selected as the dependent variables used to measure system success. They are identified with asterisks on the Table 21. Thus, 15 of the 27 original dependent variables were originally selected to measure system success.

Post-Hoc Tests to Confirm Selection Method for Dependent Variables

After the independent variables were developed several additional tests were performed to test the validity of the method used to develop the dependent variables. These tests included the following: 1) Fifteen dependent variables were selected at random

Table 21
Identification of Variables with High Factor Loadings and High Intercorrelations

Variable	System #1 Avg. Load	System #1 Avg. Corr	System #2 Avg. Load	System #2 Avg. Corr	System #3 Avg. Load	System #3 Avg. Corr
RELIABLE*	.79	.35		.45	.88	
COMPLETE		.28	.81			
ACCURATE*	.84	.34		.47		.47
RELEVANT*	.76	.37		.52		.47
TIMELY		.29	.91			
ADAPTABLE*		.29	.89	.49		
FRIENDLY*	.72		.78		.81	
USEFUL*		.38		.46	.73	.44
FLEXIBLE			.73	.50		
SECURE	.71	.83				
ACCESS		.73				.75
INTEGRAT						
MANUALS	.79					.80
REPORTS	.72				.42	
RESSALE*	.72		.72		.91	.55
OPRMKTG*	.80		.71		.92	.56
SALESDEC*		.31	.84		.80	.53
MYLOAD*			.95	.48	.73	.47
EMPLOAD*			.96	.46	.74	.48
GOAL*		.37	.90			.45
IMAGE	.74			.38	.73	
COMMIT				.45		
BETTER*	.71	.36	.79	.45	.75	
OVERALL*		.37		.44	.73	.50
IMPACT*	.77	.39		.52	.74	.46

1) Values for all variables with factor loadings over .70.
2) Values for all variables with highest average for significant correlations.
3) * = Variables with more than two listings on table.

and their correlations with the independent variables were compared to the correlations computed with the method described in the previous section. 2) The same procedure was performed using the only the variables with the highest loadings. 3) The same procedure was performed using only the variables with the highest correlations. 4) The same procedure was performed using all of the dependent variables (with the exception of REVCHG and PROCHG). 5) And, the same procedure was performed using the variables that produced the highest reliability scores.

The following fifteen dependent variables were randomly selected.

RELIABLE
COMPLETE
ACCURATE
TIMELY
SECURE
ACCESS
INTEGRAT
MANUALS
RESSALE
OPRMKTG
SALESDEC
MYLOAD
GOAL
COMMIT
BETTER

The variables with the highest loadings were selected to perform the second test. The selection criteria was a loading of .80 or higher on any of the three systems. This value was selected to provide approximately the same number of variables that were selected using the method described in the previous section. The following variables were identified.

RELIABLE
COMPLETE
ACCURATE
TIMELY
ADAPTABLE
FRIENDLY
RESSALE
OPRMKTG
SALEDEC
MYLOAD
EMPLOAD
GOAL

The variables with the highest correlations were selected to perform the third test. The selection criteria was an average correlation of .47 or higher for any of the three systems. This value was also selected to provide approximately the same number of variables that were selected using the method described in the previous section. The following variables were identified.

ACCURATE
RELEVANT
ADAPTABLE
FLEXIBLE
SECURE
ACCESS
MANUALS
RESSALE
OPRMKTG
SALESDEC
MYLOAD
EMPLOAD
BETTER
OVERALL
IMPACT

The fourth test used all of the variables except for the two that were eliminated because of low response rates (i.e. PROCHG and REVCHG). And, the fifth test used the variables that produced the highest reliability scores. The selection criteria was to obtain the highest possible Cronbach alpha's for two out of three systems. The result was to include all of the dependent variables except for the variables ACCESS and INTEGRAT and the two that were eliminated because of low response rates. They included:

RELIABLE
COMPLETE
ACCURATE
RELEVANT
TIMELY
ADAPTABLE
FRIENDLY
USEFUL
FLEXIBLE
SECURE
MANUALS
REPORTS
RESSALE
OPRMKTG
SALESDEC
MYLOAD
EMPLOAD
GOAL
IMAGE
COMMIT
BETTER
OVERALL
IMPACT

After the appropriate variables were selected, a weighted factor score was developed for each set by applying a principal components model and setting the number of factors extracted to one. For more information on how this was done see the next section in this chapter. The correlations between the weighted dependent variable and the independent variables were computed and compared to the original method. The Pearson correlations coefficients developed using the original method described in the previous section are shown in Appendix M. The results of each alternative method as compared to the original method is shown in Table 22.

The number of higher correlations were compared to the number of lower correlations for every significant variable. Using the random approach provided six higher correlations across the systems between the dependent and independent variables when compared to the original selection method. The approach of selecting only the variables with the highest loadings was worse than the original method. With this approach 20 correlations were lower across the three systems. The method of selecting only the variables with the highest correlations provided results that were about the same as by selecting the dependent variables randomly. The method that used all 25 dependent variables produced 20 higher correlations across the three systems. The best method was the one that used the variables that produced the highest reliability scores across the systems. It produced 24 higher correlations and had the additional benefit of having the highest reliability scores. For this reason, the original method proposed to reduce the number of dependent variables was scrapped and the 23 variables that produced the highest reliability scores were used to develop a weighted factor score to serve as the dependent variable.

Table 22
Summary Comparison of Alternative Methods to Original Approach Develop the Dependent Variables

Method System	# of Higher Correlations	# of Lower Correlations	Difference
Random			
System #1	25	04	
System #2	06	07	
System #3	05	19	
Total	36	30	+6
Highest Loadings			
System #1	12	14	
System #2	05	08	
System #3	06	21	
Total	23	43	-20
Highest Correlations			
System #1	24	03	
System #2	05	07	
System #3	06	21	
Total	35	31	+4
All Variables			
System #1	25	02	
System #2	05	08	
System #3	13	13	
Total	43	23	+20
Highest Reliabilities			
System #1	27	00	
System #2	05	07	
System #3	13	14	
Total	45	21	+24

Reliability and Validity Assessments of the Dependent Variables

Based on the preceding analysis, the 23 dependent variables that produced the highest reliability scores across the systems were used to measure system success. These included:

RELIABLE
COMPLETE
ACCURATE
RELEVANT
TIMELY
ADAPTABLE
FRIENDLY
USEFUL
FLEXIBLE
SECURE
MANUALS
REPORTS
RESSALE
OPRMKTG
SALESDEC
MYLOAD
EMPLOAD
GOAL
IMAGE
COMMIT
BETTER
OVERALL
IMPACT

Cronbach's alpha and factor analysis were used to evaluate the reliability and construct validity of the dependent variables selected to serve as measures for system success. According to Carmines and Zeller (1988, pp. 37-49), Cronbach's alpha is superior to the test-retest, alternative form, and split-halves methods of reliability evaluation. As a general rule, Carmines and Zeller (1988, p. 51) suggested that Cronbach's alpha's should not be below .80 for widely used scales. Tests of internal reliability using Cronbach's alpha for the three systems produced an alpha value of .9211 for system one, .9139 for system two and, .9458 for system three. Thus, the selected system success construct measures had high reliabilities across all of the systems.

Factor analysis was used to assess the construct validity of the selected dependent variables by evaluating whether the system success constructs actually measured a single phenomenon as they were supposed to do. Carmines and Zeller (1988, pp. 60-62) suggested that factor analysis using the principal components model can test the hypothesis that variables are measuring a single phenomenon and thus support the construct validity of the instrument. They stated that the unrotated factor matrix supported this hypothesis if 1) the first extracted component explains a large proportion of the variance (> .40), 2) subsequent components explain fairly equal proportions of the remaining variance except for a gradual decrease and, 3) all or most of the items have substantial loading on the first component (> .30).

Another test recommended by Carmines and Zeller (1988, pp. 59-69) to test construct validity was to factor analyze a second time using only the variables with the highest loading on each factor extracted during the first factor analysis. If the factors remained intact there would be evidence that one or more phenomenon were being measured. If the factors collapsed into one or two factors there would be evidence that the measures were parallel and had construct validity.

A third test is the Scree test. This test is commonly used by analysts to help determine the appropriate number of factors to extract. The recommendation is to retain all components in the sharp decent before the first one on the line where they start to level off (Stevens, 1992, p. 378).

The first test supported the hypothesis that for each system the dependent variables were measuring one phenomenon. Appendix N shows that: 1) The first unrotated factor matrix, on average, explained more than 40% of the variance for the three systems. The first factor for system one explained 40.3% of the variance. The first factor for system two explained 39.4% of the variance. And, the first factor for system three explained 46.8% of the variance. 2) Subsequent components explained approximately equal proportions of the remaining variance except for a gradual decrease in all the systems. 3) And, all but one of the items in the three systems had loadings on the first component greater than .30.

The second test proposed by Carmines and Zeller (1988) also supported the construct validity of the survey instrument. Appendix N shows that when the variables with highest loadings from the first factor analysis were factor analyzed by themselves system one collapsed from five factors to one, system two from seven factors to two, and system three collapsed from six factors to two. Thus, the second test also supported the construct validity of the survey instrument.

The third test, known as the Scree test, supported the construct validity of the dependent variables, as well. As shown in Appendix N, all of the Scree plots had sharp drops on the first factor. The Eigen values for system one dropped from 9.26 to 1.52. System two dropped from 9.07 to 3.11. System three dropped from 10.77 to 1.71.

Since the survey was not designed to be used as a predictive instrument there was no reason to test for criterion validity. It was, although, important to establish content validity. As suggested by Carmines and Zeller (1988, pp. 20-21), there was prima facie evidence of the instrument's content validity because 1) the dependent variables were conceived from an extensive literature review and interview process where the full domain of the content relevant to system success was specified and 2) a survey was designed that adequately reflected the domain of the content that was to be measured. In addition, the variables selected had been tested by other researchers there was strong support for the conclusion that the variables possessed high content validity by those researchers as well (see Measurement of LYMS Success, chapter two).

These combined analyses supported the hypotheses that the variables selected to measure system success were reliable and valid. These conclusions had even more merit since they were supported by all three systems.

Conversion of Multiple Dependent Variables Into Single Dependent Variable

The 23 dependent variables selected as valid and reliable measures of system success were converted into one dependent variable by developing a weighted factor score using factor analysis. This was an appropriate approach since the intent was to summarize parallel system success constructs into one measure: a measure of system success. Factor scores have the advantage of representing a composite of all variables (Hair, Anderson, & Tatham, 1987, p. 260). The decision rule, as suggested by Hair, Anderson, and Tatham, (1987, p. 260), is that if the scale is well-constructed, valid, and reliable, factor scores are a better alternative than surrogate variables.

This reduction was performed by entering the 23 variables into a factor model and specifying one factor to be extracted using a principal components model with a varimax rotation. Again, this combination was chosen because it is most appropriate when the intent is to summarize data (Hair, Anderson, & Tatham, p. 260).

The weighted factor scores explained 40.3% of the variance for system one, 39.4% for system two, and 46.8% for system three. This was sufficient since it was previously established that the variables were measuring a single phenomenon: system success. The weighted regression factor score was labeled SUCCESS.

Evaluation of Confounding Variables

A set of variables were identified during the review of literature as variables that could confound the results. Those variables included:

POSITION	- employment position of the respondent,
INVOLVE	- respondent's level of involvement in the LYMS design,
SKILL	- respondent's level of computer skills,
COMPYR	- number of years the respondent has worked with computers,
PROPS	- property's service level,
PROPL	- property location and type,
ROOMS	- number of rooms,

UNITS	- number of units (hotel properties) in chain,
FTEW	- number of full-time equivalent workers,
FTES	- number of full-time equivalent computer support staff,
REV	- average annual property revenue over last three years,
YIELDYR	- number of years on-line with all LYMSs,
SYSYR	- the number of years the current LYMS has been on-line,
COMFORT	- if had LYMS long enough to be comfortable with it,
ESSEN	- if feel like LYMS is essential to property,
USAGE	- number of LYMS functions used.

The variables INVOLVE, UNITS, and FTES were eliminated because of little or no variation. Most respondents had no involvement in the design of the systems. Since two systems were developed by chains, there was little variation in the number of units. And, the number of full-time support personnel for computer systems was either zero, constant, or answered incorrectly because some respondents answered in terms of their chain and others in terms of their property.

The variables ESSEN and USAGE were also eliminated as useful confounding variables. ESSEN was found to be too similar to questions posed as system success constructs to act as a variable to delimit one of the life-cycle stages as it was intended. It was also discovered that, because of the nature of LYMSs, they are often considered essential to the property without having passed into the mature period of their life-cycles (or they pass into their mature stage very rapidly). USAGE was also found to be too highly related to system success to be considered a confounding variable, since their was no way to tell with this survey whether using more features of LYMSs made it more successful, or whether users tended to use more features of successful LYMSs.

The correlations between the remaining control variables that were measured on an interval scale and system success (SUCCESS) were examined using Pearson correlation coefficients. These variables included SKILL, COMPYR, ROOMS, FTEW, REV, YEILDYR, SYSYR, and COMFORT. This procedure was performed for each system.

The data met the underlying assumptions of the Pearson model (Ott, et.al., 1992, pp. 489-494). 1) The data were measured on an interval scale. 2) Scatter plots of Y values for corresponding X values were fairly uniform across values of X. 3) The samples of X and Y values were randomly selected from the population of interest. 4) And, the theoretical relationships between the X and Y variables were valid.

Table 23 shows the significance levels for the variables that were tested. For system one, the correlations between SUCCESS and the variables ROOMS, FTEW, and REV were found to be significant at the .05 level. All of these variables were related to the size of the property. No significant correlations were found for systems two or three at the .05 level.

The ordinal variables included POSITION, PROPS, and PROPL. Since the Spearman rank-order correlation coefficient model was not available, a Kruskal-Wallis 1-way ANOVA model was used to determine if there were any differences between the distributions of SUCCESS by the groups formed from each ordinal variable.

The only assumption required of the Kruskal-Wallis model is that the data are obtained from a population with a continuous frequency distribution (Ott, et. al., 1992, p. 558).

Table 23
Correlations Between Potential Confounding Variables and SUCCESS

	System One SUCCESS	System Two SUCCESS	System Three SUCCESS
SKILL	.0719	-.0443	-.1524
	(194) P=.319	(15) P=.875	(30) P=.422
COMPYR	-.1144	.0177	.0799
	(179) P=.061	(15) P=.950	(29) P=.680
ROOMS	-.2310	-.1426	-.1788
	(196) P=.001	(15) P=.293	(30) P=.344
FTEW	-.2478	-.1563	-.2427
	(195) P=.000	(14) P=.268	(30) P=.196
REV	-.1645	.5191	.0723
	(178) P=.028	(06) P=.291	(17) P=.783
YIELDYR	.0333	.0405	-.0604
	(195) P=.644	(15) P=.886	(30) P=.751
SYSYR	-.0147	-.3632	.1344
	(194) P=.839	(15) P=.183	(30) P=.479
COMFORT	-.1046	-.0974	.0481
	(186) P=.067	(15) P=.730	(30) P=.801

An examination of the sample frequency distributions indicated that this assumption was met since there were no breaks in the sample data.

The results of the Kruskal-Wallis tests are shown in Table 24 and they indicate that significant differences existed between the SUCCESS distributions for system one's POSITION groups and system three's PROPL groups at the .05 level. Overall, significant differences were found for the property size and position of the respondent for system one and for the property location for system three.

The ROOMS (number of rooms), FTEW (number of full-time equivalent workers), and REV (average annual revenue over the last three years) variables all related to the property's size. Since only one was needed to analyze the data, a factor analysis was performed and FTEW was identified as the best variable to represent property size because it consistently loaded the highest.

Logically, FTEW was a good choice because it could account for differences in number of rooms as well as average annual revenue. For example, a pair of two-hundred room properties could have substantially different average annual incomes because of differences in room rates and amenity offerings. These differences are accounted for by the number of full-time equivalent workers since more luxurious properties would tend to operate with more employees, and vice versa.

An analysis was required to determine what sized properties were different. To determine this, FTEW was recoded into increments of 50 because it provided enough groups to pinpoint differences but not so many groups that an excessive amount of

Table 24
Distribution Comparison of Ordinal Control Variables
Using Kruskal-Wallis 1-way ANOVA

Variables	System One	System Two	System Three
SUCCESS By POSITION	CS=13.39 P=.0039	CS=03.52 P=.1717	CS=0042 P=.9366
SUCCESS By PROPS	CS=02.68 P=.2621	CS=04.50 P=.1054	CS=01.84 P=.3991
SUCCESS By PROPL	CS=07.47 P=.2795	CS=04.69 P=.1962	CS=13.47 P=.0193

analysis would be required. In addition, when the differences were found, the groups could be examined more carefully to locate their natural breaks.

FTEW was recoded as 0 through 50 = 1, 51 through 100 = 2, 101 through 150 = 3, 151 through 200 = 4, 201 through 250 = 5, 251 through 300 = 6, 301 through 350 = 7, 351 through 400 = 8, 401 through 450 = 9, 451 through 500 = 10, and 501 through 2000 = 11.

Mann-Whitney tests were performed on each combination of groups with respect to system success (SUCCESS). The results of tests on system one indicated that system success differed between those properties with more than 500 full-time equivalent workers and those with less than 501 full-time equivalent workers. Additional Mann-Whitney tests revealed that any deviations from 500 FTEWs as the dividing mark reduced significance. When the dividing point was set at properties greater than 500 FTEWs, the significance was .0036. When the dividing point was set at properties greater than 499 FTEWs, the significance value increased to .0157.

An examination of the descriptive statistics revealed that properties with more than 500 FTEWs were either convention or resort properties (with the exception of one large airport property). When the dividing point was set at 499 FTEWs more airport and suburban properties were added to the sample of convention and resort properties and the significance value increased. The question arose as to whether SUCCESS was actually differing by property type (PROPL) instead of property size (FTEW). Descriptive statistics for property types based on size were generated and are shown in Appendix O.

A test was designed to determine whether size or type was the distinguishing characteristic. Convention and resort properties were compared in two ways using Mann-Whitney tests. First they were compared across their size dimension: convention properties <= 500 FTEW vs. convention properties > 500 FTEW and resort properties <= 500 FTEW vs. resort properties > 500 FTEW. Then they were compared within their size dimension: convention properties <= 500 FTEW vs. resort properties <= 500 FTEW and resort properties > 500 FTEW vs. convention properties > 500. In addition, a Kruskal-Wallis 1-way ANOVA test was used to compare all of the properties that were <= 500 FTEW and all of the properties that were > 500 FTEW. The results of the Mann-Whitney tests are shown in Tables 25 and 26. The Mann-Whitney and Kruskal-Wallis tests indicated that only large resorts differed from small resorts at the .05 level of significance. Systems two and three did not have any installations with properties larger than 500 FTEWs.

The dependent variable for system one also varied on the basis of the respondent's position. Using a series of Mann-Whitney tests it was determined (at the .05 level of significance) that general managers differed from marketing directors and reservation managers. And, that marketing directors differed from front desk managers.

The dependent variable for system three varied on the basis of the property's location. Again, using a series of Mann-Whitney tests it was determined, at the .05 level of significance, that resort properties differed from highway properties, airport properties, and downtown properties. Highway properties differed from resort properties and suburban properties. And, downtown properties differed from suburban properties and resort properties.

In conclusion, the dependent variable SUCCESS for system one differed by the respondent's position (POSITION) and by large and small resort properties (resorts <= 500 FTEW vs. resorts > 500 FTEW). And, the dependent variable SUCCESS for system three differed on the basis of property type (PROPL). It should be noted that, except for system one's POSITION variable, the groupings of the other variables were represented by small sample sizes, ranging from 3 to 11 cases each.

Table 25
Comparison of Properties <= 500 FTEW and > 500 FTEW for System One
Using Mann-Whitney Tests

Property Type	Z	P
Convention	-0.9101	.3829
Resort	-3.3641	.0008
Others (None over 500 FTEW)		

Table 26
Comparison of Convention and Resort Properties for System One
Using Mann-Whitney Tests

Size	Z	P
<= 500 FTEW	-0.5223	.6015
> 500 FTEW	-1.5897	.1119

Development of Independent Variables

The independent variables were derived from potential CSFs that had been identified and categorized through the literature review and through consultation with academics, vendors, developers, and users. These variables were operationalized by designing a set of questions for each potential CSF.

One question (the importance question) asked the respondent how important he or she felt the variable was with respect to LYMSs in general. The second question (the quality question) asked the respondent how good the variable was with respect to the system under investigation. A definition for each set of variables accompanied the importance and quality questions to help the respondent understand exactly what was being asked. An example of the way the questions and respective definitions were arranged is shown below.

Questions About System Factors

Design refers to the general sophistication, integration, flexibility, adaptability, and efficiency of the revenue management system's hardware and software.

I believe the design of hardware and software for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important

The design of hardware and software of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good

The initial logic for including the importance variable was to adjust for factors that may be more or less important. This would help determine how the quality of a particular factor rated in terms of the user's expectations and provide a base-line for inter-case comparisons. For example, if the respondent scored the importance of ATMOSPHERE as only slightly important and the quality of ATMOSPHERE as extremely good, it would indicate that the working conditions and surroundings for the employees while they operated the revenue management system exceeded the respondent's expectations. If both importance and quality were used to develop the independent variables, a relatively unimportant factor rated high in quality and a relatively important factor rated low in quality could have the same scores.

After some additional thought it became clear that the respondent's expectations were relatively inconsequential to the identification of critical success factors. Sumichrast (1994) suggested that allowing the respondents to rate the importance of the factor would be, in some sense, letting them select the "critical success factors" with no empirical evaluation of the system's success constructs.

To shed additional light on the subject, the average correlations between alternative methods and the system success variable (SUCCESS) were compared. The working assumption was that the approach that provided the best information would provide the highest correlations.

Tables 27, 28, and 29 show the correlations between the independent and dependent variables for the quality question alone, quality times importance, quality plus importance, the difference between quality and importance (a gap analysis approach), and quality raised by the

Table 27
System One - Correlations to SUCCESS for Alternative Methods
of Developing Independent Variables

Variable	Quality	Impt*Qual	Impt+Qual	Impt-Qual	Qual**Impt
DESIGN	.5963**	.6018**	.5876**	-.4487**	.3975**
QUALITY	.6583**	.6095**	.5727**	-.4478**	.4065**
DATA	.5197**	.5379**	.5190**	-.2971**	.4122**
MAINT	.5231**	.5172**	.4919**	-.3976**	.3741**
COMPCOM	.4075**	.4018**	.3913**	-.2993**	.2700**
FUNCTIO	.6844**	.7015**	.6929**	-.5322**	.4568**
OBJECTI	.5721**	.5439**	.5206**	-.4800**	.3714**
CONTROL	.5141**	.5235**	.5094**	-.3659**	.3495**
INFOQUA	.6504**	.6525**	.6382**	-.5069**	.3643**
USERCOM	.4224**	.4091**	.3862**	-.3441**	.3001**
ATMOS	.3354**	.3481**	.3395**	-.1953*	.3108**
TRAIN	.2657**	.2824**	.2460**	-.2174*	.3317**
ATTITUD	.6162**	.6179**	.6088**	-.3880**	.4253**
COMMIT	.5952**	.5656**	.5439**	-.4763**	.4195**
UNDER	.2444**	.2426**	.2312**	-.1772*	.2045*
COMPETN	.2458**	.2399**	.2344**	-.1858*	.1720*
DECISIO	.3841**	.3646**	.3617**	-.3512**	.2119*
TOPMGT	.3157**	.3246**	.3226**	-.2125*	.3068**
MARKET	.4870**	.4390**	.4001**	-.4618**	.4044**
SALES	.4257**	.4420**	.4208**	-.2679**	.3249**
OPER	.2900**	.2849**	.2626**	-.1734*	.2379**
RESV	.3456**	.3515**	.3348**	-.2560**	.3367**
EXIST	.3953**	.4257**	.4194**	-.2448**	.3107**
SUPPL	.4806**	.4872**	.4692**	-.3151**	.4087**
CUST	.3880**	.3885**	.3561**	-.2555**	.2665**
MIDDLE	.3445**	.3328**	.3166**	-.1739*	.1905*
ENVIOR	.3353**	.3347**	.3245**	-.1182	.2344*
Average Absolute Values	.4460	.4433	.4260	.3096	.3259

Minimum pairwise N of cases: 149
1-tailed Signif: * - .01 ** - .001

Table 28
System Two - Correlations to SUCCESS for Alternative Methods of Developing Independent Variables

Variable	Quality	Impt*Qual	Impt+Qual	Impt-Qual	Qual**Impt
DESIGN	.1426	-.0080	.0178	-.1629	-.0950
QUALITY	.4699	.3205	.2724	-.2730	.4776
DATA	.1027	-.0183	-.0573	-.1990	.0468
MAINT	.1819	.2592	.2630	-.0081	.3156
COMPCOM	.3668	.3480	.2201	-.3791	.5523
FUNCTIO	.3157	.3595	.3823	-.0577	.1450
OBJECTI	.4127	.5142	.5192	-.2452	.4644
CONTROL	.0419	-.0206	-.0475	-.0090	-.0525
INFOQUA	.3430	.2033	.1102	-.3982	.5282
USERCOM	.6754*	.4249	.3813	-.5139*	.4736
ATMOS	.4356	.3477	.3334	-.3441	-.2930
TRAIN	.3281	.3442	.3459	-.2991	.1929
ATTITUD	.7957**	.7971**	.7944**	-.7641**	.3726
COMMIT	.8082**	.7943**	.7827**	-.8005**	.5826
UNDER	.6817*	.6464*	.6102*	-.6881*	.4513
COMPETN	.5448	.5129	.4731	-.4905	.3544
DECISIO	.4616	.3562	.3697	-.3741	.1255
TOPMGT	.2769	.2838	.3086	-.2129	-.1117
MARKET	.3104	.2677	.2815	-.2376	.0418
SALES	.5550	.5494	.5470	-.5447	.3609
OPER	.2942	.3344	.3561	-.1974	.0070
RESV	.3179	.3351	.3543	-.2579	.2889
EXIST	.3620	.2422	.2186	-.2389	.0676
SUPPL	.4152	.1978	.1549	-.2123	.3170
CUST	.1449	.0486	.0029	-.1639	-.0985
MIDDLE	.1370	-.0083	-.0435	-.0953	-.1555
ENVIOR	.0831	-.0283	-.0481	-.0225	-.0997
Average of Absolute Values	.3706	.3174	.3072	.3033	.2619

Minimum pairwise N of cases: 10
1-tailed Signif: * - .01 ** - .001

Table 29
System Three - Correlations to SUCCESS for Alternative Methods of Developing Independent Variables

Variable	Quality	Impt*Qual	Impt+Qual	Impt-Qual	Qual**Impt
DESIGN	.7812**	.7248**	.6895**	-.7169**	.5295*
QUALITY	.6769**	.6565**	.6547**	-.4979*	.4257
DATA	.6630**	.6596**	.6380**	-.2760	.5250*
MAINT	.4237	.4187	.4184	-.3184	.2577
COMPCOM	.3356	.3879	.3863	-.2319	.5195*
FUNCTIO	.7295**	.6963**	.6805**	-.6233**	.5414*
OBJECTI	.4204	.4158	.4139	-.3560	.3386
CONTROL	.5451*	.5200*	.4915*	-.4931*	.3679
INFOQUA	.5770**	.6250**	.6181**	-.4346	.5129*
USERCOM	.5494*	.5582*	.5264*	-.4062	.4461
ATMOS	.1902	.2299	.2500	-.0453	.0439
TRAIN	.3336	.3411	.3552	-.2659	.3527
ATTITUD	.4972*	.6414**	.6468**	-.1358	.4273
COMMIT	.4855*	.5314*	.5371*	-.3195	.3946
UNDER	.3861	.4954*	.4920*	-.2000	.5027*
COMPETN	.4053	.4917*	.4927*	-.2245	.4366*
DECISIO	.5180*	.5894**	.5867**	-.3233	.5209*
TOPMGT	.2838	.3172	.3151	-.2138	.2857
MARKET	.4102	.4565*	.4449*	-.1523	.3964
SALES	.5349*	.5366*	.4991*	-.3565	.5093*
OPER	.4211	.4356	.4232	-.2218	.3902
RESV	.3177	.3890	.3977	-.1282	.2415
EXIST	.4861*	.5042*	.5086*	-.2690	.4757*
SUPPL	.3236	.3627	.4037	-.0472	.0586
CUST	.2347	.2998	.2950	-.0375	.2832
MIDDLE	.0300	.1003	.1307	.1666	-.1297
ENVIOR	.1746	.2439	.2469	.0131	.2757
Average of Absolute Values	.4346	.4677	.4654	.2768	.3773

Minimum pairwise N of cases: 26
1-tailed Signif: * - .01 ** - .001

power of importance. All of these approaches produced significant results, but the highest correlations were produced by using the quality variable alone for two out of the three systems.

The differences were rather small between quality alone and the product of importance and quality. As a practical point, it would probably not matter which of the two approaches were used, but logic and the evidence provided by comparing the average correlations dictated that the quality variable be used alone to form the independent variables. This approach provided a simpler model with the highest correlations to SUCCESS and removed any undesirable interactions between quality and importance.

Tests of Hypothesis

The study's research hypothesis was: What relationships exist between variables identified as potential CSFs and LYMS success? The null hypothesis was: No relationships exist between variables identified as potential CSFs and LYMS success. To test the null hypothesis the Pearson product-moment correlation coefficient model was used. The null hypothesis of this model is that there is no linear correlation between X and Y.

Potential CSFs were identified during the literature review and initial research portions of this study. The dependent and independent variables were developed during the data analysis portion of this study. The different types of respondents were not weighted because there was a tendency for the respondents to self-select according to their comfort level with, and knowledge about, the system. Thus, their was a natural weighting between the respondent types for each system that the researcher felt he could not improve upon. The next step was to evaluate the data against the assumptions of the Pearson correlation model and then to apply the model.

Assumptions of Pearson Correlation Coefficient Model

As previously mentioned, correlation analysis can be used with any data and there are no particular underlying assumptions regarding the use of the Pearson product-moment correlation model except that data are measured on an interval or ratio scale (Ott, et. al., 1992, p. 489).

Since the Pearson model only measures linear relationships, it was important to establish that no non-linear relationships existed between the variables. Each independent variable was plotted against the dependent variable for each system and examined. None of the plots had non-linear relationships and therefore were candidates for measuring associations using Pearson correlation coefficients.

Ott et. al. (1992, pp. 489-494) suggested that on a theoretical level, when the intent is to make inferences of the population from which the data has been drawn, it is important that 1) the scatter plots of Y values for corresponding X values are uniform across values of X (homoscedastic), 2) that the samples of X and Y values are randomly selected from the population of interest, and 3) that the theoretical relationships between the X and Y variables are valid.

Examination of the scatter plots showed the data to be relatively homoscedastic. It was previously established that the data were randomly selected from their respective populations. And, the theoretical relationships between the X and Y variables were valid.

As an additional test, the products of the dependent and independent variables were tested for normality using the Kolmogorov-Smirnov goodness of fit test for the normal distribution. All variable combinations failed to reject the null hypothesis that they were normally distributed data.

Correlation Coefficients Between Independent and Dependent Variables

The final analysis was the computation of the Pearson correlation coefficients. This was performed to identify the critical success factors. The standard used to identify the CSFs was a level of significance of less than .05 and correlations higher than .30.

The .05 level of significance has been used through-out this research effort because it is generally accepted by researchers in the social sciences as a reasonable level to set the alpha error. The .30 level of correlation was used because, as described in chapter three, it would be better to err in favor of identifying a non-CSF than to err by rejecting a valid CSF. It was also important to consider that many variables could be involved in system success and it might not take much correlation to identify a factor critical to the success of the system.

Table 30 shows the Pearson correlation coefficients of all cases for the three systems. Table 31 shows the correlations of all cases of system one and for its POSITION variable by groups. Table 32 shows the correlations of all cases of system one and for its FTEW variable for resorts over and under 500 FTEWs, and for all property types over and under 500 FTEWs. Table 33 shows the correlations of all cases of system three and for its PROPL variable by groups. Some of system three's PROPL groups are not exhibited because there were too few cases. The sub-groups formed between system one's POSITION and FTEW variables were not correlated to SUCCESS because too few cases existed to perform a valid analysis.

Table 30
Pearson Correlation Coefficients for Three Systems

Variables	System One	System Two	System Three
DESIGN2	.5963*	.1426	.7812*
	(183) P=.000	(14) P=.313	(27) P=.000
QUALITY2	.6583*	.4699*	.6769*
	(195) P=.000	(15) P=.039	(27) P=.000
DATA2	.5197*	.1027	.6630*
	(192) P=.000	(14) P=.363	(28) P=.000
MAINT2	.5231*	.1819	.4237*
	(184) P=.000	(15) P=.258	(28) P=.012
COMPCOM2	.4075*	.3668	.3356*
	(184) P=.000	(13) P=.109	(28) P=.040
FUNCTIO2	.6844*	.3157	.7295*
	(195) P=.000	(15) P=.126	(27) P=.000
OBJECTI2	.5721*	.4127	.4204*
	(192) P=.000	(15) P=.063	(26) P=.016
CONTROL2	.5141*	.0419	.5451*
	(188) P=.000	(14) P=.443	(27) P=.002
INFOQUA2	.6504*	.3430	.5770*
	(195) P=.000	(14) P=.115	(27) P=.001
USERCOM2	.4224*	.6754*	.5494*
	(192) P=.000	(14) P=.004	(26) P=.002
ATMOS2	.3354*	.4356*	.1902
	(189) P=.000	(15) P=.052	(26) P=.176
TRAIN2	.2657	.3281	.3336*
	(194) P=.000	(15) P=.116	(27) P=.045
ATTITUD2	.6162*	.7957*	.4972*
	(195) P=.000	(15) P=.000	(29) P=.003
COMMIT2	.5952*	.8082*	.4855*
	(196) P=.000	(15) P=.000	(28) P=.004
UNDER2	.2444	.6817*	.3861*
	(196) P=.000	(15) P=.003	(28) P=.021
COMPETN2	.2458	.5448*	.4053*
	(196) P=.000	(15) P=.018	(29) P=.015
DECISIO2	.3841*	.4616*	.5180*
	(196) P=.000	(15) P=.042	(28) P=.002
TOPMGT2	.3157*	.2769	.2838
	(194) P=.000	(15) P=.159	(29) P=.068
MARKET2	.4870*	.3104	.4102*
	(190) P=.000	(14) P=.140	(29) P=.014
SALES2	.4257*	.5550*	.5349*
	(189) P=.000	(14) P=.020	(28) P=.002
OPER2	.2900	.2942	.4211*
	(194) P=.000	(14) P=.154	(28) P=.013
RESV2	.3456*	.3179	.3177*
	(195) P=.000	(13) P=.145	(28) P=.050
EXIST2	.3953*	.3620	.4861*
	(183) P=.000	(13) P=.112	(29) P=.004
SUPPL2	.4806*	.4152	.3236*
	(175) P=.000	(14) P=.070	(26) P=.053
CUST2	.3880*	.1449	.2347
	(178) P=.000	(14) P=.311	(27) P=.119
MIDDLE2	.3445*	.1370	.0300
	(184) P=.000	(13) P=.328	(27) P=.441
ENVIOR2	.3353*	.0831	.1746
	(149) P=.000	(10) P=.410	(26) P=.197

(Coefficient / (Cases) / 1-tailed Significance)
" . " is printed if a coefficient cannot be computed
* identifies values with significance < .05 and correlations > .30 (rounded)

Table 31
Pearson Correlation Coefficients for System One's POSITION Variable

Variables	All Cases	Position #1	Position #2	Position #3	Position #4
DESIGN2	.5963* (183) P=.000	.8448* (21) P=.000	.5990* (53) P=.000	.5162* (12) P=.043	.4677* (97) P=.000
QUALITY2	.6583* (195) P=.000	.8702* (21) P=.000	.5295* (59) P=.000	.4985* (12) P=.050	.6173* (103) P=.000
DATA2	.5197* (192) P=.000	.7372* (21) P=.000	.4297* (57) P=.000	.7073* (12) P=.005	.4093* (102) P=.000
MAINT2	.5231* (184) P=.000	.6219* (21) P=.001	.4386* (56) P=.000	.7966* (11) P=.002	.4957* (96) P=.000
COMPCOM2	.4075* (184) P=.000	.3238 (21) P=.076	.2888 (53) P=.018	.7170* (9) P=.015	.4586* (101) P=.000
FUNCTIO2	.6844* (195) P=.000	.7738* (21) P=.000	.5993* (59) P=.000	.5886* (12) P=.022	.6696* (103) P=.000
OBJECTI2	.5721* (192) P=.000	.6457* (22) P=.001	.4231* (57) P=.001	.1678 (12) P=.301	.6160* (101) P=.000
CONTROL2	.5141* (188) P=.000	.6017* (20) P=.003	.3416* (56) P=.005	.0176 (12) P=.478	.5577* (100) P=.000
INFOQUA2	.6504* (195) P=.000	.8658* (22) P=.000	.5586* (58) P=.000	.5530* (12) P=.031	.6057* (103) P=.000
USERCOM2	.4224* (192) P=.000	.4101* (21) P=.032	.4049* (57) P=.001	.5145* (12) P=.043	.4047* (102) P=.000
ATMOS2	.3354* (189) P=.000	.3996* (21) P=.036	.3882* (57) P=.001	.4453 (12) P=.073	.2660 (99) P=.004
TRAIN2	.2657 (194) P=.000	-.0526 (22) P=.408	.3812* (58) P=.002	.3734 (12) P=.116	.2734 (102) P=.003
ATTITUD2	.6162* (195) P=.000	.5832* (22) P=.002	.7658* (59) P=.000	.6806* (12) P=.007	.5238* (102) P=.000
COMMIT2	.5952* (196) P=.000	.7453* (22) P=.000	.6932* (59) P=.000	.5360* (12) P=.036	.4927* (103) P=.000
UNDER2	.2444 (196) P=.000	-.0086 (22) P=.485	.3752* (59) P=.002	.5060* (12) P=.047	.2590 (103) P=.004
COMPETN2	.2458 (196) P=.000	-.1139 (22) P=.307	.3480* (59) P=.003	.2676 (12) P=.200	.2942 (103) P=.001
DECISIO2	.3841* (196) P=.000	.3401 (22) P=.061	.4879* (59) P=.000	.3839 (12) P=.109	.3604* (103) P=.000
TOPMGT2	.3157* (194) P=.000	.1920 (22) P=.196	.4577* (58) P=.000	.2579 (12) P=.209	.2925 (102) P=.001
MARKET2	.4870* (190) P=.000	.6909* (22) P=.000	.5723* (58) P=.000	.4305 (12) P=.081	.3296* (98) P=.000
SALES2	.4257* (189) P=.000	.6545* (22) P=.000	.4323* (59) P=.000	.3492 (12) P=.133	.3088* (96) P=.001
OPER2	.2900 (194) P=.000	.6571* (22) P=.000	.1996 (59) P=.065	-.1228 (12) P=.352	.2989 (101) P=.001
RESV2	.3456* (195) P=.000	.6034* (22) P=.001	.4904* (59) P=.000	.4227 (12) P=.086	.1508 (102) P=.065
EXIST2	.3953* (183) P=.000	.5962* (22) P=.002	.3365* (55) P=.006	.2235 (11) P=.254	.3946* (95) P=.000
SUPPL2	.4806* (175) P=.000	.5867* (19) P=.004	.4638* (49) P=.000	.5776* (11) P=.031	.4422* (96) P=.000
CUST2	.3880* (178) P=.000	.8143* (19) P=.000	.2402 (54) P=.040	.6852* (11) P=.010	.1981 (94) P=.028
MIDDLE2	.3445* (184) P=.000	.1950 (21) P=.198	.3987* (57) P=.001	.7447* (11) P=.004	.3090* (95) P=.001
ENVIOR2	.3353* (149) P=.000	.7318* (17) P=.000	.2872 (41) P=.034	.4018 (10) P=.125	.2328 (81) P=.018

(Coefficient / (Cases) / 1-tailed Significance)

" . " is printed if a coefficient cannot be computed

* identifies values with significance < .05 and correlations > .30 (rounded)

Table 32
Pearson Correlation Coefficients for System One's FTEW Variable

Variables	All Cases	Resorts < 501 FTEW	Resorts > 500 FTEW	All < 501 FTEW	All > 500 FTEW
DESIGN2	.5963*	.4641*	.2104	.6549*	.3191
	(183) P=.000	(14) P=.047	(4) P=.395	(162) P=.000	(20) P=.085
QUALITY2	.6583*	.3156	.5698	.6651*	.5979*
	(195) P=.000	(16) P=.117	(4) P=.215	(173) P=.000	(21) P=.002
DATA2	.5197*	.3999	.8216	.5556*	.3139
	(192) P=.000	(15) P=.070	(4) P=.089	(170) P=.000	(21) P=.083
MAINT2	.5231*	.4140	.9646*	.5335*	.6101*
	(184) P=.000	(16) P=.055	(4) P=.018	(163) P=.000	(20) P=.002
COMPCOM2	.4075*	.1567	.0603	.3462*	.4981*
	(184) P=.000	(16) P=.281	(3) P=.481	(165) P=.000	(18) P=.018
FUNCTIO2	.6844*	.4286*	.5505	.6439*	.7606*
	(195) P=.000	(16) P=.049	(4) P=.225	(174) P=.000	(20) P=.000
OBJECTI2	.5721*	.5284*	-.8333	.4947*	.6773*
	(192) P=.000	(16) P=.018	(4) P=.083	(170) P=.000	(21) P=.000
CONTROL2	.5141*	.4452*	-.0733	.5165*	.4303*
	(188) P=.000	(16) P=.042	(4) P=.463	(167) P=.000	(21) P=.026
INFOQUA2	.6504*	.5617*	.8548	.6787*	.4483*
	(195) P=.000	(16) P=.012	(4) P=.073	(173) P=.000	(21) P=.021
USERCOM2	.4224*	.3898	.3728	.4808*	.3517
	(192) P=.000	(16) P=.068	(4) P=.314	(171) P=.000	(20) P=.064
ATMOS2	.3354*	.4438*	.8502	.3399*	.2572
	(189) P=.000	(15) P=.049	(4) P=.075	(168) P=.000	(20) P=.137
TRAIN2	.2657	.1758	-.8502	.2894	.3476
	(194) P=.000	(16) P=.257	(4) P=.075	(172) P=.000	(21) P=.061
ATTITUD2	.6162*	.6420*	.4606	.6146*	.5520*
	(195) P=.000	(16) P=.004	(4) P=.270	(173) P=.000	(21) P=.005
COMMIT2	.5952*	.6924*	.	.5679*	.7020*
	(196) P=.000	(16) P=.001	(4) P=.	(174) P=.000	(21) P=.000
UNDER2	.2444	.3424	.2104	.2011	.5460*
	(196) P=.000	(16) P=.097	(4) P=.395	(174) P=.004	(21) P=.005
COMPETN2	.2458	.1882	-.1844	.1711	.6312*
	(196) P=.000	(16) P=.243	(4) P=.408	(174) P=.012	(21) P=.001
DECISIO2	.3841*	.5908*	-.8016	.3067*	.5126*
	(196) P=.000	(16) P=.008	(4) P=.099	(174) P=.000	(21) P=.009
TOPMGT2	.3157*	.5299*	.2104	.3024*	.5644*
	(194) P=.000	(16) P=.017	(4) P=.395	(174) P=.000	(19) P=.006
MARKET2	.4870*	.6397*	.2104	.4931	.4805*
	(190) P=.000	(16) P=.004	(4) P=.395	(169) P=.000	(20) P=.016
SALES2	.4257*	.5935*	.2104	.4711	.2050
	(189) P=.000	(16) P=.008	(4) P=.395	(168) P=.000	(20) P=.193
OPER2	.2900	.2163	-.5847	.3176*	.1340
	(194) P=.000	(16) P=.210	(4) P=.208	(173) P=.000	(20) P=.287
RESV2	.3456*	.3504	.9646*	.3625*	.2569
	(195) P=.000	(16) P=.092	(4) P=.018	(174) P=.000	(20) P=.137
EXIST2	.3953*	.1458	.	.4292*	.0758
	(183) P=.000	(15) P=.302	(3) P=.	(164) P=.000	(18) P=.382
SUPPL2	.4806*	.2486	.	.5006*	.5152*
	(175) P=.000	(16) P=.177	(4) P=.	(156) P=.000	(18) P=.014
CUST2	.3880*	.2499	.2104	.4499*	-.1641
	(178) P=.000	(15) P=.185	(4) P=.395	(159) P=.000	(19) P=.251
MIDDLE2	.3445*	.5621*	.0159	.3350*	.3010
	(184) P=.000	(15) P=.015	(4) P=.492	(164) P=.000	(19) P=.105
ENVIOR2	.3353*	-.1104	-.2762	.3506*	.1057
	(149) P=.000	(14) P=.354	(3) P=.411	(133) P=.000	(15) P=.354

(Coefficient / (Cases) / 1-tailed Significance)
" . " is printed if a coefficient cannot be computed
* identifies values with significance < .05 and correlations > .30 (rounded)

Table 33
Pearson Correlation Coefficients for System Three PROPL Variable

Variables	All Cases	Highway	Suburban	Convention	Resort
DESIGN2	.7812* (27) P=.000	.8343 (4) P=.083	.5934 (7) P=.080	.8463* (7) P=.008	.8503 (4) P=.176
QUALITY2	.6769* (27) P=.000	.6719 (4) P=.164	.6315 (7) P=.064	.0057 (7) P=.495	.8503 (4) P=.176
DATA2	.6630* (28) P=.000	.6110 (4) P=.195	.7242* (8) P=.021	.3962 (7) P=.189	.9995* (3) P=.010
MAINT2	.4237* (28) P=.012	.1501 (4) P=.425	.7106* (8) P=.024	-.3323 (7) P=.233	.8503 (4) P=.176
COMPCOM2	.3356* (28) P=.040	.2415 (4) P=.379	.4103 (8) P=.156	-.6530 (7) P=.056	.8809 (4) P=.157
FUNCTIO2	.7295* (27) P=.000	.8343 (4) P=.083	.5934 (7) P=.080	.7863* (7) P=.018	.9995* (4) P=.010
OBJECTI2	.4204* (26) P=.016	. (4) P=.	.5030 (7) P=.125	.0073 (6) P=.495	.8809 (4) P=.157
CONTROL2	.5451* (27) P=.002	. (4) P=.	.3499 (7) P=.221	.5310 (7) P=.110	.9995* (4) P=.010
INFOQUA2	.5770* (27) P=.001	.3715 (4) P=.314	.6210 (7) P=.068	.7102* (7) P=.037	.8503 (4) P=.176
USERCOM2	.5494* (26) P=.002	.0420 (4) P=.479	.4304 (6) P=.197	.8023* (7) P=.015	.8809 (4) P=.157
ATMOS2	.1902 (26) P=.176	-.6523 (4) P=.174	-.1508 (7) P=.373	-.0073 (6) P=.495	.8809 (4) P=.157
TRAIN2	.3336* (27) P=.045	.7969 (4) P=.102	.4126 (7) P=.179	-.5846 (7) P=.084	. (3) P=.
ATTITUD2	.4972* (29) P=.003	-.0420 (4) P=.479	-.1450 (8) P=.366	.1976 (7) P=.336	.8446 (4) P=.078
COMMIT2	.4855* (28) P=.004	-.1501 (4) P=.425	.4740 (8) P=.118	.4072 (6) P=.211	.9990* (4) P=.000
UNDER2	.3861* (28) P=.021	-.8327 (4) P=.084	.5719 (8) P=.069	.2211 (6) P=.337	.8446 (4) P=.078
COMPETN2	.4053* (29) P=.015	-.9195 (4) P=.040	.5402 (8) P=.083	.4846 (7) P=.135	.8446 (4) P=.078
DECISIO2	.5180* (28) P=.002	-.9823 (4) P=.009	.5334 (7) P=.109	.5094 (7) P=.121	.9990* (4) P=.000
TOPMGT2	.2838 (29) P=.068	-.2853 (4) P=.357	.7319* (8) P=.019	-.2583 (7) P=.288	.8885 (4) P=.056
MARKET2	.4102* (29) P=.014	.1641 (4) P=.418	.6801* (9) P=.022	-.0362 (6) P=.473	.4921 (4) P=.254
SALES2	.5349* (28) P=.002	.2643 (4) P=.368	.6948* (8) P=.028	-.1295 (6) P=.403	.4921 (4) P=.254
OPER2	.4211* (28) P=.013	.3870 (4) P=.306	.3587 (9) P=.172	-.0046 (5) P=.497	.8446 (4) P=.078
RESV2	.3177* (28) P=.050	.0420 (4) P=.479	.5909* (9) P=.047	-.2276 (5) P=.356	.8446 (4) P=.078
EXIST2	.4861* (29) P=.004	.3213 (4) P=.339	.4100 (9) P=.137	-.3150 (6) P=.272	.4921 (4) P=.254
SUPPL2	.3236* (26) P=.053	.5900 (4) P=.205	.8319* (8) P=.005	-.7675 (6) P=.037	. (3) P=.
CUST2	.2347 (27) P=.119	-.6523 (4) P=.174	.0993 (9) P=.400	-.0898 (5) P=.443	.8446 (4) P=.078
MIDDLE2	.0300 (27) P=.441	-.3715 (4) P=.314	-.1893 (9) P=.313	-.4206 (6) P=.203	. (3) P=.
ENVIOR2	.1746 (26) P=.197	-.3715 (4) P=.314	-.0477 (9) P=.452	-.4853 (5) P=.204	.8809 (3) P=.157

(Coefficient / (Cases) / 1-tailed Significance)
" . " is printed if a coefficient cannot be computed
* identifies values with significance < .05 and positive correlations > .30 (rounded)
Note: Some property groups have been omitted because of too few cases.

Summary

This chapter has shown how the data was analyzed. The data was first purified and then analyzed to determine whether the three systems should be treated as one system or individually. Non-parametric statistical tests were used because the data did not follow normal distributions. Results of these tests indicated that the systems should be analyzed independently.

The non-respondent samples were then compared to the respondent samples and their distributions were found to be from the same population. The dependent variables were developed and tested for reliability and validity. Twenty-three of the 27 original dependent variables were kept and reliability values were high for all three systems.

After the dependent variables were developed and tested, they were converted into a single weighted factor score. The confounding variables were analyzed and it was determined that the respondent's position and the size of resort properties for system one and the property type for system three were related to SUCCESS.

After the confounding variables were analyzed, the independent variables were developed and it was determined to use the quality dimension. Finally, the dependent and independent variables were grouped based on the confounding variables and correlated to test the research hypothesis.

The results of the analyses performed in this chapter are presented in the next chapter. Implications to researchers and practitioners are discussed and future extensions of the research are proposed.

CHAPTER FIVE
DISCUSSION, CONCLUSIONS, AND SUMMARY

This chapter discusses the findings, presents conclusions, and summarizes the results. The findings are discussed in two stages. The primary findings are those findings that are directly related to the testing of the study's research hypothesis. The secondary findings are those findings that are not directly relate to the study's research hypothesis. The conclusions are then presented in terms of how they can benefit practitioners and researchers. Limitations of the study are discusses and suggestions for future research are presented in the form of research questions.

Discussion of Primary Findings

Primary findings relate to the testing of the study's research hypothesis. The study's research hypothesis was: What relationships exist between variables identified as potential CSFs and LYMS success? The study's null hypothesis was: No relationships exist between variables identified as potential CSFs and LYMS success.

The most significant primary finding was that every independent variable was identified as a CSF for at least one of the three systems. These factors were identified as CSFs because they had correlations of .30 or higher, significance levels <= .05, and standard deviations > 7 (i.e. none of the lower correlations occured due to a lack of variation). They are listed on Table 34 with short definitions and in the order of their

Table 34
Average Correlations of Significant Factors for Three Systems

Variable	Avg. r	Avg. r Square	Type	Short Definition
FUNCTIO2	.7070	.4999	Task	Functions of the LYMS
DESIGN2	.6888	.4744	System	Design of the LYMS
ATTITUD2	.6364	.4050	User	Attitude towards the LYMS
COMMIT2	.6296	.3960	User	Commitment towards the LYMS
INFOQUA2	.6137	.3766	Task	Information quality of the LYMS
QUALITY2	.6017	.3620	System	Quality of the LYMS
DATA2	.5914	.3498	System	Data management for the LYMS
USERCOM2	.5491	.3015	Task	User/computer interface
UNDER2	.5339	.2850	User	Understanding about the LYMS
CONTROL2	.5296	.2805	Task	Control for the LYMS
SALES2	.5052	.2552	Organization	Sales support of the LYMS
OBJECTI2	.4963	.2463	Task	Objectives for the LYMS
COMPETN2	.4751	.2257	User	Competence with the LYMS
MAINT2	.4734	.2241	System	Maintenance of the LYMS
DECISIO2	.4546	.2066	User	Decision-making latitude
MARKET2	.4486	.2012	Organization	Marketing support of the LYMS
EXIST2	.4407	.1942	Organization	Existing systems for the LYMS
OPER2	.4211	.1773	Organization	Operations support of the LYMS
SUPPL2	.4021	.1617	Environment	Supplier support of the LYMS
ATMOS2	.3885	.1509	Task	Atmosphere for the LYMS
CUST2	.3880	.1505	Environment	Customer behavior
COMPCOM2	.3716	.1380	System	Computer to computer interface
MIDDLE2	.3445	.1187	Environment	Middle-agent behavior
TRAIN2	.3336	.1113	Task	Training for the LYMS
ENVIOR2	.3353	.1124	Environment	Environmental benevolence
RESV2	.3317	.1051	Organization	Reservations support for the LYMS
TOPMGT2	.3157	.0997	Organization	Top-management support for LYMS

relative correlations to system success. For more complete definitions see the survey instrument in Appendix K.

All variables were significant for system one and only TRAIN2, UNDER2, COMPETN2, and OPER2 had correlations lower than .30. System two only had 15 cases were the dependent variable could be computed and therefore had many less significant variables. System three had 28 cases and only ATMOS2, TOPMGT2, CUST2, MIDDLE2, and ENVIRO2 were found to be insignificant at the .05 level.

When the correlations of the significant variables for the three systems were averaged and arranged in the order of their average correlations (see Table 34), the most important variables were FUNCTIO2, DESIGN2, ATTITUD2, COMMIT2, INFOQUA2, QUALITY2, DATA2, USERCOM2, UNDER2, CONTROL2, SALES2, and OBJECTI2 accounting for 50% to 25% of the variance of system success, in order of their relative strengths. The second group of variables accounted for 24% to 15% of the variance of system success and included COMPETN2, MAINT2, DECISIO2, MARKET2, EXIST2, OPER2, SUPPL2, ATMOS2, CUST2 in order of their relative strengths. The least correlated variables included COMPCOM2, MIDDLE2, TRAIN2, ENVIOR2, RESV2, TOPMGT2 and only accounted for 14% to 10% of the variance. Overall, the most highly correlated types of factors were user, system, and task factors.

When the three systems were compared to identify their differences, it was found that the respondents of system one considered the customer's and middle agent's behavior and their tolerance to differential pricing (CUST2 & MIDDLE2), and the general positive economic, political, legislative, and sociocultural conditions of the external environment (ENVIRO2) to be more important than did the respondents of the other two systems. System one's respondents considered the user's technical knowledge and comfort level with the system (COMPEN2) to be less important than did the respondents of the other two systems.

Respondents of system two felt that the user's conceptual knowledge of the processes that drive the revenue management system (UNDER2) were more important than did respondents of the other two systems. Respondents of system two considered the general level of system sophistication, integration, flexibility, adaptability, and efficiency (DESIGN2), the organization, storage, and retrieval of data and information relating to and supporting the system (DATA2), the continuous and consistent care and repair of the system (MAINT2), the information accountability, information security, and quality and quantity of feedback (CONTROL2), the customer's behavior and tolerance to differential pricing (CUST2), and the general positive economic, political, legislative, and sociocultural conditions of the external environment (ENVIRO2) to be less important than did the respondents of the other two systems.

The developer responsible for system two took a different approach designing his system than did the developers of the other two systems. System two was very open-ended and required a high level of continuous interaction and involvement from the department heads. Many of the systems surveyed were not interfaced with the property's PMS. These structural differences could explain the differences in identification of CSFs.

Respondents of system three considered the interest, commitment, investment of resources, and championing by operations personnel (OPER2), the quality of the existing property management system, reservation system, and other systems that might interface with the LYMS (EXIST2), and the general level of sophistication, integration, flexibility, adaptability, and efficiency of the system (DESIGN2) to be more important than did the respondents of the other two systems. They considered the positive acceptance and beliefs users hold towards the system (ATTITUD2), the working conditions and surroundings for employees while they operate the system (ATMOS2), and the middle agent's behavior and tolerance to differential pricing (MIDDLE2) to be less important than did the respondents of the other two systems.

System three catered to properties smaller than those of systems one and two. Managers of properties using system three often assumed the roles of department heads as well as that of general manager. This might explain why the working conditions were not considered as important to system success as it was with the other systems. It might also explain why the quality of existing systems that might interface with the LYMS was considered more important to system success.

When the system one was analyzed, controlling for the POSITION variable, it became clear that the general managers were responsible for identifying the highest sets of correlations (see Tables 35, 36, 37, & 38). This group of respondents identified QUALITY2, INFOQUA2, DESIGN2, CUST2, FUNCTIO2, COMMIT2,

Table 35
Significant CSFs For General Managers of System One

Variable	r	r square
QUALITY2	.8702	.7573
INFOQUA2	.8658	.7496
DESIGN2	.8448	.7137
CUST2	.8143	.6631
FUNCTIO2	.7738	.5988
COMMIT2	.7453	.5547
DATA2	.7372	.5435
ENVIOR2	.7318	.5355
MARKET2	.6909	.4773
OPER2	.6571	.4318
SALES2	.6545	.4284
OBJECTI2	.6457	.4169
MAINT2	.6219	.3868
RESV2	.6034	.3641
CONTROL2	.6017	.3620
EXIST2	.5962	.3555
SUPPL2	.5867	.3442
ATTITUD2	.5832	.3401
USERCOM2	.4101	.1682
ATMOS2	.3996	.1597

Table 36
Significant CSFs For Marketing Directors of System One

Variable	r	r square
ATTITUD2	.7658	.5864
COMMIT2	.6932	.4805
FUNCTIO2	.5993	.3592
DESIGN2	.5990	.3588
MARKET2	.5723	.3275
INFOQUA2	.5586	.3120
QUALITY2	.5295	.2804
RESV2	.4904	.2405
DECISIO2	.4879	.2380
SUPPL2	.4638	.2151
TOPMGT2	.4577	.2095
MAINT2	.4386	.1924
SALES2	.4323	.1924
DATA2	.4297	.1846
OBJECTI2	.4231	.1790
USERCOM2	.4049	.1639
MIDDLE2	.3987	.1590
ATMOS2	.3882	.1507
TRAIN2	.3812	.1453
UNDER2	.3752	.1408
COMPETN2	.3480	.1211
CONTROL2	.3416	.1167
EXIST2	.3365	.1132
COMPCOM2	.2888	.0834
ENVIOR2	.2872	.0825
CUST2	.2402	.0576

Table 37
Significant CSFs For Front Office Managers of System One

Variable	r	r square
MAINT2	.7966	.6346
MIDDLE2	.7447	.5546
COMPCOM2	.7170	.5141
DATA2	.7073	.5003
CUST2	.6852	.4695
ATTITUD2	.6806	.4632
FUNCTIO2	.5886	.3465
SUPPL2	.5776	.3336
INFOQUA2	.5530	.3058
COMMIT2	.5360	.2873
DESIGN2	.5162	.2665
USERCOM2	.5145	.2647
UNDER2	.5060	.2560
QUALITY2	.4985	.2485

Table 38
Significant CSFs For Reservation Managers of System One

Variable	r	r square
FUNCTIO2	.6696	.4484
QUALITY2	.6173	.3811
OBJECTI2	.6160	.3795
INFOQUA2	.6057	.3669
CONTROL2	.5577	.3110
ATTITUD2	.5238	.2744
MAINT2	.4957	.2457
COMMIT2	.4927	.2428
DESIGN2	.4677	.2187
COMPCOM2	.4586	.2103
SUPPL2	.4422	.1955
DATA2	.4093	.1675
USERCOM2	.4047	.1638
EXIST2	.3946	.1557
DECISIO2	.3604	.1299
MARKET2	.3296	.1086
MIDDLE2	.3090	.0955
SALES2	.3088	.0954
OPER2	.2989	.0893
COMPETN2	.2942	.0866
TOPMGT2	.2925	.0856
TRAIN2	.2734	.0747
ATMOS2	.2660	.0708
UNDER2	.2590	.0671
ENVIOR2	.2328	.0542
CUST2	.1981	.0392

DATA2, ENVIOR2, MARKET2, OPER2, SALES2, OBJECTI2, MAINT2, RESV2, CONTROL2, EXIST2, SUPPL2, ATTITUD2 as important CSFs accounting for 76% to 34% of the variance of system success in order of their relative strengths. USERCOM2 and ATMOS2 were identified by the general managers as explaining approximately 15% of the variance.

The marketing directors of system one indicated that ATTITUD2, COMMIT2, FUNCTIO2, DESIGN2, MARKET2, INFOQUA2, and QUALITY2 accounted for 58% to 28% of the variance. RESV2, DECISIO2, SUPPL2, TOPMGT2, MAINT2, SALES2, DATA2, OBJECTI2, USERCOM2, MIDDLE2, and ATMOS2 accounted for 24% to 15% of the variance of system success. The marketing directors felt that TRAIN2, UNDER2, COMPETN2, CONTROL2, EXIST2, COMPCOM2, ENVIOR2, CUST2 accounted for less than 15% of the variance.

Front office managers identified MAINT2, MIDDLE2, COMPCOM2, DATA2, CUST2, ATTITUD2, FUNCTIO2, SUPPL2, INFOQUA2, COMMIT2, DESIGN2, USERCOM2, UNDER2, and QUALITY2 as accounting for 63% to 25% of the variance of system success. Since the number of front office managers who responded was relatively low, no other variables were found to be significant.

Reservation managers of system one identified FUNCTIO2, QUALITY2, OBJECTI2, INFOQUA2, CONTROL2, and ATTITUD2 as accounting for 45% to 27% of the variance of system success, in order of their relative strengths. They felt that MAINT2, COMMIT2, DESIGN2, COMPCOM2, SUPPL2, DATA2, USERCOM2, and

EXIST2 accounted for 24% to 15% of the variance. And, they indicated the rest of the variables accounted for less than 15% of the variance of system success.

All four types of respondents identified the positive acceptance and beliefs that users hold towards the system (ATTITUD2), the use of forecasting, pricing, demand, overbooking, inventory, segmentation, rate, and other decision support models (FUNCTIO2), the quality of the reported and/or real-time information produced by the system (INFOQUAL2), and the reliability, effectiveness, performance, response time, and durability of the system (QUALITY2) as being among the most important CSFs. All four types of respondents identified the user's technical knowledge and their comfort level with the system (COMPETN2), and the quality and quantity of system-related instruction given to employees who work with the system (TRAIN2) as the least important CSFs. Three out of the four types of respondents identified DECISO2, OPRE2, TOPMGT2, UNDER2, and ENVIOR2 as being among the least important CSFs in addition to COMPETN2 and TRAIN2.

The biggest differences were that only front office managers felt that COMPCOM2, UNDER2, and MIDDLE2 were among the most important CSFs and only general managers felt that SALES2, OPER2, RESV2, EXIST2, and ENVIOR2 were among the most important CSFs. Reservation managers and marketing directors felt that CUST2 was a low priority CSF, where front office and general managers felt it was a high priority CSF. Marketing directors and front office managers felt that CONTROL2 was a low priority CSF, where general and reservations managers felt it was a high priority CSF.

Interestingly, except for the directors of marketing, each type of respondent tended to rate variables that involved themselves as relatively unrelated to system success when compared to the other respondents.

System one was also analyzed on the basis of property size. It was determined that mainly large resort properties had different distributions with respect to system success, but there were too few cases to properly analyze their correlations against system success. Table 32 shows there was only one significant variable for large resort properties because of the limited number of cases. For this reason, and because the Mann-Whitney test failed to reject the hypothesis that resorts and convention properties had the same SUCCESS distributions, they were combined to analyze the differences between properties with more than 500 FTEWs and less than 501 FTEWs. Tables 39 and 40 show the CSFs of these two groups and their respective r squares.

Properties with more than 500 FTEWs identified FUNCTIO2, COMMIT2, OBJECTI2, COMPETN2, MAINT2, QUALITY2, TOPMGT2, ATTITUD2, UNDER2, SUPPL2, and DECISIO2 as variables that accounted for 58% to 26% of the variance of system success, in their order of their relative strengths. Those respondents felt that MARKET2, INFOQUA2, and CONTROL2 accounted for 23% to 18% of the variance of system success.

Properties with less than 501 FTEWs identified INFOQUA2, QUALITY2, DESIGN2, FUNCTIO2, ATTITUD2, COMMIT2, DATA2, MAINT2, CONTROL2, and

Table 39
Significant CSFs for System One Properties With > 500 FTEWs

Variable	r	r square
FUNCTIO2	.7606	.5785
COMMIT2	.7020	.4928
OBJECTI2	.6773	.4583
COMPETN2	.6312	.3984
MAINT2	.6101	.3722
QUALITY2	.5979	.3575
TOPMGT2	.5644	.3185
ATTITUD2	.5520	.3047
UNDER2	.5460	.2981
SUPPL2	.5152	.2654
DECISIO2	.5126	.2628
COMPCOM2	.4981	.2481
MARKET2	.4805	.2309
INFOQUA2	.4483	.2009
CONTROL2	.4303	.1851

Table 40
Significant CSFs for System One Properties With < 501 FTEWs

Variable	r	r square
INFOQUA2	.6787	.4606
QUALITY2	.6651	.4424
DESIGN2	.6549	.4289
FUNCTIO2	.6439	.4146
ATTITUD2	.6146	.3777
COMMIT2	.5679	.3225
DATA2	.5556	.3087
MAINT2	.5335	.2846
CONTROL2	.5165	.2668
SUPPL2	.5006	.2506
OBJECTI2	.4947	.2447
MARKET2	.4931	.2431
USERCOM2	.4808	.2312
SALES2	.4711	.2219
CUST2	.4499	.2024
EXIST2	.4292	.1842
RESV2	.3625	.1314
ENVIOR2	.3506	.1229
COMPCOM2	.3462	.1199
ATMOS2	.3399	.1155
MIDDLE2	.3350	.1122
OPER2	.3176	.1009
DECISIO2	.3067	.0941
TOPMGT2	.3024	.0914
TRAIN2	.2894	.0838
UNDER2	.2011	.0404
COMPETN2	.1711	.0292

SUPPL2 as variables that accounted for 46% to 25% of the variance. And, they identified OBJECTI2, MARKET2, USERCOM2, SALES2, CUST2, and EXIST2 as accounting for 24% to 18% of the variance of system success. The rest of the CSFs accounted for less than 15% of the variance of system success.

Both groups identified FUNCTIO2, COMMIT2, MAINT2, QUALITY2, and ATTITUD2 as among the most important variables. And, they both identified RESV2, ENVIOR2, ATMOS2, MIDDLE2, OPER2, and TRAIN2 as among the least important variables. The biggest differences were that properties with > 500 FTEW placed more importance on the variables UNDER2, and COMPETN2 than did properties with < 501 FTEWs, and properties with < 501 FTEW placed more emphasis on DESIGN2, EXIST2, CUST2, and ENVIRO2.

It was not practical to correlate respondent types by properties > 500 FTEWs and properties with < 501 FTEWs to system success because of the limited number of cases in the > 500 FTEWs category. No confounding variables were identified for system two and only property type was identified as a confounding variable for system three.

Relatively few cases existed for system three's property type categories (see Table 33). The only significant, positively correlated variables were DATA2, MAINT2, MARKET2, SALES2, RESV2, SUPPL2, and TOPMGT for suburban properties, USERCOM2, INFOQUAL2, FUNCTIO2, and DESIGN2 for convention properties, and DATA2, FUNCTIO2, CONTROL2, COMMIT2, and DECISO2 for resort properties.

Because of the limited number of cases, the similarities and differences could not be interpreted with any confidence.

Discussion of Secondary Findings

Secondary findings are those findings that are not directly related to the testing of the study's hypothesis. Some of the secondary findings occurred as a result of the primary findings and some occurred as a result of testing the control variables against system success.

Secondary findings that occurred as a result of testing the control variables included the following:

Organizational size was determined to be best measured on the basis of full-time equivalent workers (FTEWs) rather than on the basis of average annual revenue over the past three years, or by the number of rooms. Many of the respondents did not provide information on the average annual revenue over the last three years; Some had only been with the property for a short time, some did not have access to the information, and some felt it was proprietary. The number of rooms was not as valued a measure as FTEWs because it was unidimensional. FTEWs tended to incorporate attributes of the physical size of the property, its service level, and its revenue.

Organizational size was found to be related to system success, but not too strongly, since it was only found to be true in one system and only for a particular type of property. It is possible that this finding could have been the result of random error.

Property type was found to be related to system success, but, like organizational size, it was also only found to be related in one system. Unfortunately, not enough cases were available in system three to identify the differences between the property types.

The type of respondent was also found to be related to system success. The breakdown of CSFs by respondent types was presented in the section entitled "Primary Findings." It is not totally clear whether the respondents differed in their responses because of their employment roles, or because of their relationship to the LYMS, or both. Further research is required to answer this question.

It was clear that the knowledge that some general managers have about LYMSs should not be underestimated. This group recorded the highest correlations between the dependent and independent variables. This would indicate that they tended to identify stronger relationships between the factors and system success, possibly because of their greater knowledge, or because of their more generalized perspectives. The researcher heard many comments about how the general managers would not be able to answer too many questions about the LYMS because they were not as involved with the system as the other respondents. Of the four respondent types, the front office managers tended to have the most difficult time responding to the survey and might be the least reliable of the four respondent groups.

The respondent's computer skill level and number of years having worked with computer systems were not related to system success. Nor was the property's service level found to be a confounding factor in any of the three systems.

Several of the variables included in the survey were not analyzable. This occurred because there was little or no variation between cases or because they did not apply well to LYMSs. More specifically, INVOLVE, UNITS, and FTES were dropped because of too little variation. Most respondent were not involved with the system's design and since two of the systems were chains, there were no variations in number of lodging units.

It was not possible to assess the LYMS's life stage because the question that was suppose to distinguish between the stages of integration and internalization could not be applied. It is possible that the system is considered integral to the organization shortly after it is placed in service and the integration stage is skipped. It is also possible that the measures used to distinguish between the life-cycle stages were inappropriate for LYMSs. Additional research is required to understand this better.

Even though some of the dependent variables proved to be unreliable (i.e. REVCHG & PROCHG), the strong results of this research effort, represented by the high correlations between the dependent and independent variables, are evidence that the variables were well selected. The combination of a thorough literature review with field inquiries that included discussions and interviews academics, developers, vendors, and users proved to be a productive and appropriate approach for identifying system success measures, as well as for identifying potential critical success factors.

When LYMS CSFs were compared to those identified in the literature review of general ISs, they tended to support each other with only a few exceptions. By comparing Table 3 to Table 34, all of the most highly correlated CSFs for LYMSs were reported as important CSFs for IS in general, with the exception of sales support (i.e. SALE2), a variable unique to LYMSs. The biggest surprises were that while top management support and training were considered highly important to the success of ISs in general, they were rated near the bottom of the list for LYMSs. The reason this occurred is not clear. It is important to remember that while top management support and training are not considered too important to the success of LYMSs, they were still identified as valid CSFs and should be treated as such.

Eble (1991) reported finding the development of a "yield management culture" to be an important part of LYMS success. The independent variables relating to the user that would be representative of a yield management culture (i.e. ATTITUD2, COMMIT2, UNDER2, and COMPETN2) strongly supported his statement. The independent variables relating to the organization that would be representative of a yield management culture (i.e. TOPMGT2, MARKET2, SALES2, OPERATIONS, RESV2) did not strongly support his statement. While it is difficult to interpret these seemingly contradictory results, they probably indicate that the only ones who really need to be part of the yield management culture are the system's users.

Conclusions and Implications for Practitioners

The primary findings indicate that all of the factors represented by the independent variables need to be taken into account when designing, implementing, and operating a LYMS. Nevertheless, differences between the relative strengths of the variable's correlations would indicate that, in general, some CSFs are more important than others. Results from correlation analysis of the three systems indicate that the most important CSFs have to do with the system, its users, and its tasks.

At the top of the list are system design (DESIGN2) and system functions (FUNCTIO2). System design included the general level of sophistication, integration, flexibility, adaptability, and efficiency. System functions included forecasting, pricing, demand, overbooking, inventory, segmentation, rate and other decision support models. Each of those variables accounted for almost 50% of the variation of system success.

Other important variables relating to system success are the overall quality of the system (QUALITY) and data management (DATA2). System quality included characteristics such as reliability, effectiveness, performance, response time, and durability. Data management referred to the organization, storage, and retrieval of data and information that support the system. Each of these variables accounted for approximately 35% of the variance of system success. The second mentioned system variable would indicate that a good pre-existing information system might be important to LYMS success, even though the variable accounting for this factor (EXIST2) was only correlated as moderately important (accounting for 19% of the variance of system success).

The next set of important variables have to do with the users and included user attitude (ATTITUD2) and user commitment (COMMIT2). User attitude is the positive acceptance and beliefs that users hold toward the system. User commitment is the level of involvement and willingness of the users to work towards the success of the LYMS. These variables accounted for approximately 40% of the variance of system success and are likely to be highly representative of what Eble (1991) referred to as the "yield management culture." An understanding (UNDER2) of the processes that drive the LYMS was also found to be important, accounting for 28% of the variance of system success.

The third set of important factors related to tasks and included information quality (INFOQUA2), user/computer interface (USERCOM2), system control (CONTROL2), and the property's objectives (OBJECT2). Information quality referred to the quality of reported and/or real-time information produced by the LYMS. The user/computer interface referred to the ease of information access, quality of screens and graphics, and general level of "friendliness." System control referred to the information accountability, security, and quality and quantity of feedback for evaluating the system. Alignment of the system to the property's objectives included the incorporation of pricing strategies, short-term, and long-term business objectives. These variables accounted for an average of 30% of the variance of system success, ranging from 37% to 24% respectively.

Contrary to articles that suggested differently, support for the system among the various department was only considered to be moderately to weakly important as CSFs. Sales support (SALES2), marketing support (MARKET2), operations support (OPER2), and supplier support (SUPPL2) were rated as more important than reservations support (RESV2) and top management support (TOPMGT2). The first four variables accounted for an average of 20% of the variance of system success and last two variables received the lowest correlations of all variables, each accounting for only 10% of the variance of system success.

Other moderately important factors included the user's technical knowledge and comfort level with the system (COMPETN2), the maintenance of the system (MAINT2), the freedom that users have in selecting from options provided by the LYMS (DECISO2), the working conditions and surroundings for system's users (ATMOS2), customer behavior (CUST2), which refers to the booking patterns, purchasing patterns, and tolerance to differential pricing, and the computer-to-computer interface between the LYMS and other information systems (COMCOM2). These variables each accounted for an average of 18% of the variance of system success.

Besides reservations (RESV2) and top-management (TOPMGT2) support for the system, the other least correlated factors included training (TRAIN2), or the quality and quantity of system-related instruction given to the employees, middle agent behavior (MIDDLE2), which refers to the attitudes, beliefs, actions, and tolerance to differential pricing exhibited by travel agents and other middle agents who booked on behalf of guests, and environmental-benevolence (ENVIRO2), which refers to the general positive economic, political, legislative, and sociocultural conditions of the external environment. These factors each accounted for approximately 11% of the variance of system success.

From the preceding descriptions, it would appear that the vendors/developers of the more typical LYMSs (systems that do not require a very high level of continuous involvement from department heads) should spend a majority of their resources designing a high quality, highly functional, well-organized, user-friendly system, with good reports and controls. The vendors/developers and managers of these systems should be very liberal in developing a "yield management culture" among the primary users of the system.

This is not to suggest that the other variables need not be considered, or that all LYMSs are the same; but concern about training, customer behavior, middle agent behavior, working conditions, system maintenance, and concern for developing support among the various departments is not as critical as concern for the system, its users, and task factors.

The purpose of identifying CSFs is to focus management's planning and activity efforts, and to monitor performance. As a rough guide, vendors/developers of LYMSs might begin by aligning their efforts and resources to be more in proportion to the percentage of variance that each CSF accounted for with respect to system success. And, system managers at the property level should monitor the status of each CSF he or she has domain over, and do so on a continual basis.

Conclusions and Implications for Researchers

The use of statistical measures to identify CSFs appears to be both a valid and practical methodology. The high correlations between the dependent and independent variables supports the idea that relationships exist between system success and CSFs.

Developing the best possible measures of system success was critical to the identification of CSFs. The researcher found that a more reliable and more valid set of dependent variables was identified by removing the undesirable variables rather than by identifying the desirable ones. In other words, a reduction approach was found to be superior to a building approach. As other researcher have experienced, subjective measures were found to be superior to objective measures for ISs where usage is not voluntary.

Development of the independent variables required a thorough review of the literature as well as discussions and interviews with vendors, developers, and system users. The quality dimension of the system factors was found to be a sufficient measure to serve as the independent variables. The addition of the importance dimension did not contribute to the quality of the independent variable, and could possibly degrade the measure because it tends to allow respondents to identify the CSFs without the benefit of an empirical evaluation of system success constructs.

At one point the researcher felt that the external environment might be more important to the success of LYMSs than it is for ISs in general. By comparing Table 3 with Table 34 there was no evidence that this was true. The external environment appears to be of relatively low importance to both LYMSs and ISs in general.

As previously mentioned, LYMSs may not follow the same life-cycle stages as do most ISs. Either the typical measures used to identify the separate stages are not appropriate, or the LYMS skips from the implementation stage directly into the internalization stage, bypassing integration. The latter option is not unrealistic because the nature of a LYMS would tend to make it relatively indispensable once it is working. In either case, additional research is required.

The results of this research supported CSFs identified for other ISs. As more studies are produced, it is possible that a core set of CSFs will be identified for ISs in general. More studies are needed and longitudinal studies would help determine how stable these factors are as systems mature.

Limitations of the Study

In addition to the limitations and delimitations described in chapter one, the relatively small number of cases associated with system two made it difficult to interpret the results of those correlations with much confidence. Therefore, the conclusions of this study are primarily applicable to LYMSs that do not require a very high level of involvement from management, as does system two.

The potential effects of certain confounding variables could not be established because of the lack of industry cooperation. In particular, effects of the number of computer support personnel and number of lodging units in the chain could not be established because of the limited number of systems surveyed.

Future Extensions of the Research

The purpose of this research effort was to identified CSFs for LYMSs. Although this objective was accomplished, many other research questions remain unanswered. In addition to the questions listed earlier in this chapter, 20 more are proposed. These questions are related to either testing existing theory, building new theory, or IS applications, and have been classified that way.

Theory-Testing Research Questions

The two primary theory-based models related to the identification of CSFs that were uncovered in the literature review are stage-theory (based on life-cycle theory) and innovation-theory (based on decision and control theories). Two research questions that might result from testing these theories are:

R1: Do CSFs for LYMSs vary in relation to the system's developmental stages?

R2: Does LYMS success vary in relation to the level of organizational innovation?

Theory-Building Research Questions

Many research question can be proposed that relate to developing new IS theory. In particular, the categorization schemes and conceptual models that have been developed to help control for exogenous and confounding variables could be tested and used to build new theory in conjunction with other research. One such model that was developed to help categorize the variables used in this study is presented in Figure 12. There are also many questions that can be proposed relating to user-satisfaction. Some of research questions that might result are:

R3: Are the categories of the various CSF classification schemes related to those identified through statistical analysis?

R4: Does the user's evaluation of the system vary according to the relationship he or she has with the system? (Based on the end-user classification model.)

R5: Is the level of vendor support associated with the level of user-satisfaction?

R6: Is the number of MIS staff associated with the level of user-satisfaction?

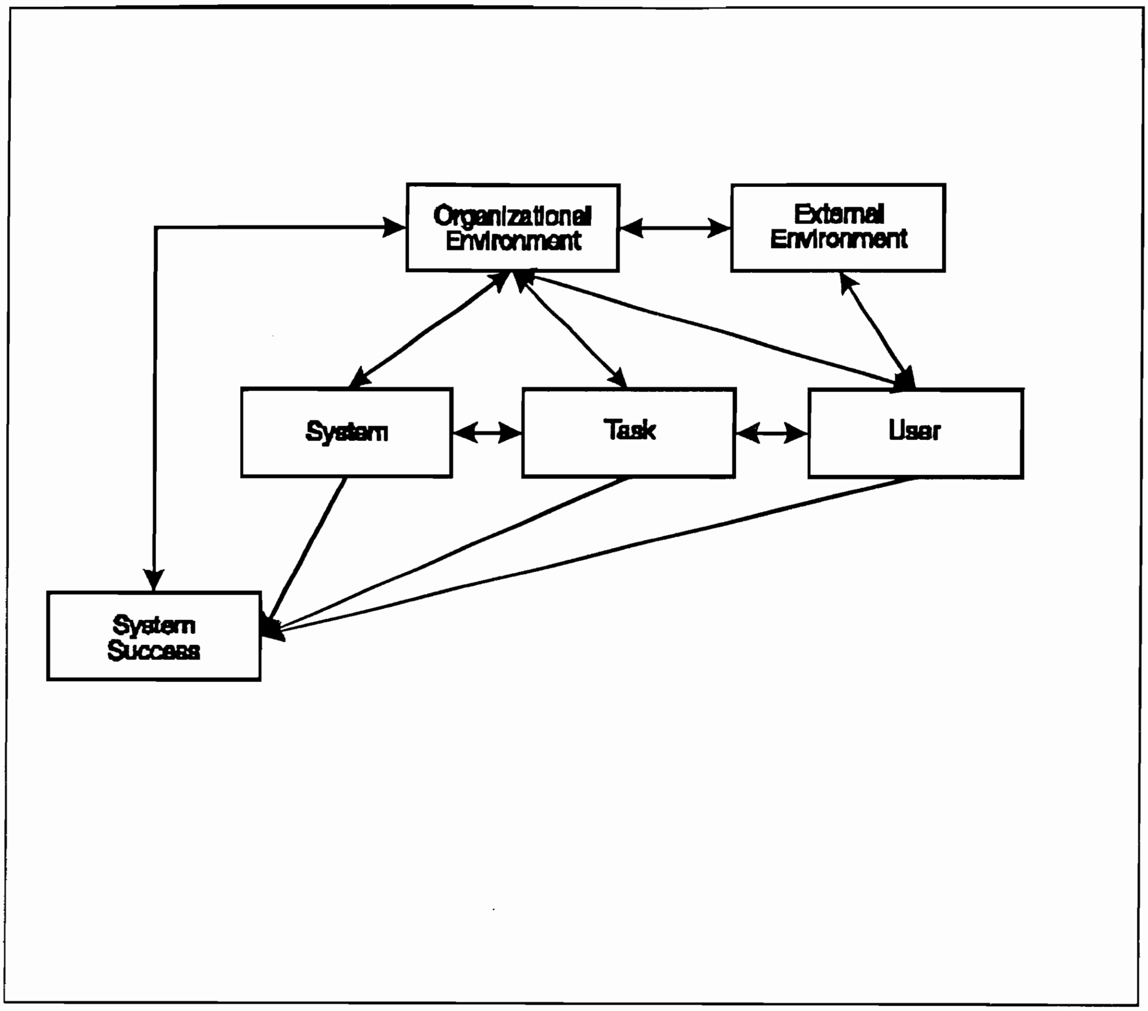


Figure 12
Hypothesized CSF Relationships for LYMS

R7: Is the amount of top management support associated with the level of user-satisfaction?

R8: Is the amount of top management expertise associated with the level of user-satisfaction?

R9: Is the degree of user involvement associated with the level of user-satisfaction?

R10: Is the amount of training (quantity/quality) offered by an organization associated with the level of user-satisfaction?

Applied Research Questions

Some research questions might be proposed simply because they have practical benefits. Examples of these include the following questions.

R10: Do lodging guests distinguish between properties with LYMSs and those without LYMSs?

R11: Does the success of the LYMS vary in relation to the level of communication between the marketing and operations departments?

R12: Is the number of LYMSs elements employed related to the success of the system?

R13: Do managers consider LYMS as strategically important to the business?

R14: What are the problems associated with implementing yield management incentive systems?

R15: What problems travel managers have with the systems?

R16: Do travel managers try to undermine the systems?

R17: How important is data organization to the success of the system?

R18: How important is forecasting to the success of the system?

R19: How important is general automation to the success of the system?

R20: How important is historical data to the success of the system?

Summary

Every independent variable was identified as a CSF for at least one of the three systems. The high correlations between the dependent and independent variables supported the current thinking that the CSF approach is a valid methodology, providing both theoretical and practical benefits.

System, user, and task factors were found to be the most highly correlated CSFs. Support for the system by the various departments and environmental conditions were found to be only moderately to weakly important as CSFs.

Vendors/developers and managers of LYMSs that are not strongly open systems (requiring a high level of continuous involvement from all of the department heads) should concentrate on designing a high quality, highly functional, well-organized, user-friendly system, with good reports and controls. They should also concentrate on developing positive acceptance and positive beliefs toward the system by its primary users. Developing a strong "yield management culture" among the primary users of the system that results in a high level of involvement and a willingness of the users to work towards the success of the LYMS was rated as a very important CSF. To insure LYMS success, all the CSFs identified in the study should be monitored, measured, and evaluated on a continuous basis.

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APPENDICES

Appendix A

Bailey and Pearson's IS User-Satisfaction Instrument

Scaling

Seven point interval scale: Extremely Satisfied, Quite Satisfied, Slightly Satisfied, Neither Satisfied or Dissatisfied (Equally Satisfied and Dissatisfied), Slightly Dissatisfied, Quite Dissatisfied, Extremely Satisfied.

Factors, Their Definitions and Adjective Pairs

Note: Each factor includes an adjective pair to evaluate the importance of the factor to the evaluator (i.e. To me, this factor is: important - unimportant)

1) Top management involvement: The positive or negative degree of interest, enthusiasm, support, or participation of any management level above the user's own level towards computer-based information systems or services or towards the computer staff which supports them.

strong vs. weak
consistent vs. inconsistent
good vs. bad
significant vs. insignificant

2) Organizational competition with the EDP unit: The contention between the respondent's organizational unit and the EDP unit when vying for organizational resources or for responsibility for success or failure of the computer-based information systems or services of interest to both parties.

productive vs. destructive
rational vs. emotional
low vs. high
harmonious vs. dissonant

3) Priorities determination: Policies and procedures which establish precedence for the allocation of EDP resources and services between different organizational units and their requests.

fair vs. unfair
consistent vs. inconsistent
just vs. unjust
precise vs. vague

4) Charge-back method of payment for services: The schedule of charges and the procedures for assessing users on a pro-rata basis for the EDP resources and services that they utilize.

just vs. unjust
reasonable vs. unreasonable
consistent vs. inconsistent
known vs. unknown

5) Relationship with the EDP staff: The manner and methods of interaction, conduct, and association between the user and the EDP staff.

harmonious vs. dissonant
good vs. bad
cooperative vs. uncooperative
candid vs. deceitful

6) Communication with the EDP staff: The manner and methods of information exchange between the user and the EDP staff.

harmonious vs. dissonant
productive vs. destructive
precise vs. vague
meaningful vs. meaningless

7) Technical competence of the EDP staff: The computer technology skills and expertise exhibited by the EDP staff.

current vs. obsolete
sufficient vs. insufficient
superior vs. inferior
high vs. low

8) Attitude of the EDP staff: The willingness and commitment of the EDP staff to subjugate external, professional goals in favor of organizationally directed goals and tasks.

user-oriented vs. self-centered
cooperative vs. belligerent
courteous vs. discourteous
positive vs. negative

9) Schedule of products and services: The EDP center timetable for production of information system outputs and for provision of computer-based services.

good vs. bad
regular vs. irregular
reasonable vs. unreasonable
acceptable vs unacceptable

10) Time required for new development: The elapsed time between the user's request for new applications and the design, development, and/or implementation of the application systems by the EDP staff.

short vs long
dependable vs undependable
reasonable vs. unreasonable
acceptable vs. unacceptable

11) Processing of change requests: The manner, method, and required time with which the EDP staff responds to user requests for changes in existing computer-based information systems or services.

fast vs. slow
timely vs untimely
simple vs complex
flexible vs. rigid

12) Vendor support: The type and quality of the service rendered by a vendor, either directly or indirectly, to the user to maintain the hardware or software required by that organizational status.

skilled vs. bungling
sufficient vs. insufficient
eager vs. indifferent
consistent vs inconsistent

13) Response / turnaround time: The elapsed time between a user-initiated request for service or action and a reply to that request. Response time generally refers to elapsed time for terminal type request or entry. Turnaround time generally refers to the elapsed time for execution of a program submitted or requested by a user and the return of the output to that user.

fast vs. slow
good vs. bad
consistent vs. inconsistent
reasonable vs. unreasonable

14) Means of input / output with the EDP center: The method and medium by which a user inputs data to and receives output from the EDP center.

convenient vs. inconvenient
clear vs. hazy
efficient vs. inefficient
organized vs disorganized

15) Convenience of access: The ease or difficulty with which the user may act to utilize the capability of the computer system.

convenient vs. inconvenient
good vs. bad
easy vs. difficult
efficient vs. inefficient

16) Accuracy: The correctness of the output information.

accurate vs. inaccurate
high vs. low
consistent vs. inconsistent
sufficient vs. insufficient

17) Timeliness: The availability of the output information at a time suitable for its use.

timely vs. untimely
reasonable vs. unreasonable
consistent vs. inconsistent
punctual vs. tardy

18) Precision: The variability of the output information from that which it purports to measure.

sufficient vs. insufficient
consistent vs. inconsistent
high vs. low
definite vs. uncertain

19) Reliability: The consistency and dependability of the output information.

consistent vs. inconsistent
high vs. low
superior vs. inferior
sufficient vs. insufficient

20) Currency: The age of the output information.

good vs. bad
timely vs. untimely
adequate vs. inadequate
reasonable vs. unreasonable

21) Completeness: The comprehensiveness of the information content.

complete vs. incomplete
consistent vs. inconsistent
sufficient vs. insufficient
adequate vs. inadequate

22) Format of output: The material design of the layout and display of the output contents.

good vs. bad
simple vs. complex
readable vs. unreadable
useful vs. useless

23) Language: The set of vocabulary, syntax, and grammatical rules used to interact with the computer systems.

simple vs. complex
powerful vs. weak
easy vs. difficult
easy-to-use vs. hard-to-use

24) Volume of output: The amount of information conveyed to a user from computer-based systems. This is expressed not only by the report or outputs but also by the voluminousness of the output contents.

concise vs. redundant
sufficient vs. insufficient
necessary vs. unnecessary
reasonable vs. unreasonable

25) Relevancy: The degree of congruence between what the user wants or requires and what is provided by the information products and services.

useful vs. useless
relevant vs. irrelevant
clear vs. hazy
good vs. bad

26) Error recovery: The methods and policies governing correction and rerun of system outputs that are incorrect.

fast vs. slow
superior vs. inferior
complete vs. incomplete
simple vs. complex

27) Security of data: The safeguarding of data from misappropriation or unauthorized alteration or loss.

secure vs. insecure
good vs. bad
definite vs. uncertain
complete vs. incomplete

28) Documentation: The recorded description of an information system. This includes formal instructions for the utilization of the system.

clear vs. hazy
available vs. unavailable
complete vs. incomplete
current vs. obsolete

29) Expectations: The set of attributes or features of the computer-based information products or services that a user considers reasonable and due from the computer-based information support rendered within his organization.

pleased vs. displeased
high vs. low
definite vs. uncertain
optimistic vs. pessimistic

30) Understanding of systems: The degree of comprehension that a user possesses about the computer-based information system or services that are provided.

high vs. low
sufficient vs. insufficient
complete vs. incomplete
easy vs. hard

31) Perceived utility: The user's judgement about the relative balance between the cost and the considered usefulness of the computer-based information products or services that are provided. The costs include any costs related to providing the resource, including money, time, manpower, and opportunity. The usefulness includes any benefits that the user believes to be derived from the support.

high vs. low
positive vs. negative
sufficient vs. insufficient
useful vs. useless

32) Confidence in the system: The user's feelings of assurance or certainty about the systems provided.

high vs. low
strong vs. weak
definite vs. uncertain
good vs. bad

33) Feeling of participation: The degree of involvement and commitment which the user shares with the EDP staff and others toward the functioning of the computer-based information system and services.

positive vs. negative
encouraged vs. repelled
sufficient vs. insufficient
involved vs. uninvolved

34) Feeling of control: The user's awareness of the personal power of lack of power to regulate, direct or dominate the development, alteration, and/or execution of the computer-based information systems or services which serve the user's perceived function.

high vs. low
sufficient vs. insufficient
precise vs. vague
strong vs. weak

35) Degree of training: The amount of specialized instruction and practice that is afforded to the user to increase the user's proficiency in utilizing the computer capability that is available.

complete vs. incomplete
sufficient vs. insufficient
high vs. low
superior vs. inferior

36) Job effects: The changes in job freedom and job performance that are ascertained by the user as resulting from the modifications induced by the computer-based information systems and services.

liberating vs. inhibiting
significant vs. insignificant
good vs. bad
valuable vs. worthless

37) Organizational position of the EDP function: The hierarchical relationship of the EDP function to the overall organizational structure.

appropriate vs. inappropriate
strong vs. weak
clear vs. hazy
progressive vs. regressive

38) Flexibility of systems: The capacity of the information system to change or to adjust in response to new conditions, demands, or circumstances.

flexible vs. rigid
versatile vs. limited
sufficient vs. insufficient
high vs. low

39) Integration of systems: The ability of systems to communicate/transmit data between systems servicing different functional areas.

complete vs. incomplete
sufficient vs. insufficient
successful vs. unsuccessful
good vs. bad

Appendix B

Initial Letters to Used to Secure Developer Cooperation

June 16th, 1993

Dear XXX,

Thank you for your interest in the lodging yield management system (LYMS) research project. This investigation has been funded by the College of Human Sciences at Texas Tech University and will answer important questions about these systems. It will be especially beneficial to LYMS developers and marketers, like yourselves.

This investigation is an empirical study of LYMS critical success factors and is designed to identify a limited number of areas that insure the successful performance of the yield management systems designed by your company, and other developers.

By participating, I will provide you with a report on what factors your users believe are necessary to insure system success. In addition, I will supply a report on what factors users of other systems believe are required to insure success. This way you'll be able to identify critical success factors for your LYMS, critical success factors for other LYMSs, and compare your system against other systems.

The investigation will proceed as follows: A pool of potential critical success factors will be established from literature research, interviews with developers, and actual users. A questionnaire will be developed from this information and mailed to a representative sample of lodging properties. All responses will be anonymous and treated confidentially. The data will be collected and analyzed, and the resulting reports will be prepared and mailed to you. With your cooperation, the process will take about three months to complete.

Since this is a funded project, there is no cost to participate. To include your company, I need to conduct a short interview (25 minutes or less) with a person familiar with your system and the problems users might encounter. I also need a list of properties you have worked with.

It would be beneficial if you could provide property contacts and a general letter of introduction, to help insure the questionnaires will be filled-out and returned, although it's not required to participate.

This is an exciting project that should shed light on how you can improve your system to insure and increase its commercial success. You'll also have an opportunity to compare your system to all other systems. The critical success factors identified for your particular system will, of course, remain completely confidential.

I am looking forward to your participation and the production of an interesting and informative report.

Sincerely Yours,

Robert K. Griffin
Assistant Professor,
Texas Tech University

June 17th, 1993

Dear XXX,

I contacted you about a year and a half ago regarding a research project designed to provide lodging yield management system (LYMS) developers, like yourself, with information on what your users feel are the critical success factors for your systems.

I apologize that I have not been able to get back to you any sooner, but things tend to move very slow in the academic world. After more than a year, I just received funding for the project in January and have been conducting an extensive literature review on the subject for the last five months. I am now ready to conduct the actual research and want to update you on the work.

This investigation has been funded by the College of Human Sciences at Texas Tech University and will answer important questions about these systems. It is an empirical study of LYMS critical success factors and is designed to identify a limited number of areas that insure the successful performance of the yield management systems designed by your company, and other developers.

By participating, I will provide you with a report on what factors your users believe are necessary to insure system success. In addition, I will supply a report on what factors users of other systems believe are required to insure success. This way you'll be able to identify critical success factors for your LYMS, critical success factors for other LYMSs, and compare your system against other systems.

The investigation will proceed as follows: A pool of potential critical success factors will be established from literature research, interviews with developers, and actual users. A questionnaire will be developed from this information and mailed to a representative sample of lodging properties. All responses will be anonymous and treated confidentially. The data will be collected and analyzed, and the resulting reports will be prepared and mailed to you. With your cooperation, the process will take about three months to complete.

Since this is a funded project, there is no cost to participate. To include your company, I need to conduct a short interview (25 minutes or less) with a person familiar with your system and the problems users might encounter. I also need a list of the properties you are working with.

It would be beneficial if you could provide property contacts and a general letter of introduction, to help insure the questionnaires will be filled-out and returned, although it's not required to participate.

This is an exciting project that should shed light on how you can improve your system to insure and increase its commercial success. You'll also have an opportunity to compare your system to all other systems. The critical success factors identified for your particular system will, of course, remain completely confidential.

I will contact you by phone to discuss any questions you might have. I am looking forward to your participation and the production of an interesting and informative report.

Sincerely Yours,

Robert K. Griffin
Assistant Professor,
Texas Tech University

Appendix C

Follow-up Letters to Used to Secure Developer Cooperation

July 1st, 1993

Dear XXX,

I hope you have had time to look over the letter I sent explaining the lodging yield management system (LYMS) research project. The reports I will send should provide you with valuable and important information about your system and its users.

One developer expressed concern over providing a list of clients, so I have come up with an alternative. If you like, I can send the questionnaires to your secretary and instruct him or her on which properties to mail to. Or, I can do everything from my office. Just let me know your preference.

The only other requirement is a list of what you and your experts feel are "critical success factors." I can do this by phone or mail. If you prefer mail, list the factors into groups relating to the system itself, the tasks that users perform, the users, the organization, and the external environment. I have enclosed samples and a blank form. Just try and add to the list. Otherwise, I can do this by phone in about 20 minutes.

I am looking forward to your participation and the opportunity to provide you with the results of this survey. All work will be done in the highest standards. The report for your company will remain confidential and the units that respond will remain anonymous.

Feel free to contact me if you have any concerns or questions. Thank you for the opportunity to serve.

Sincerely Yours,

Robert K. Griffin
Assistant Professor
Texas Tech University

Appendix D

Form Sent to Secure Additional CSFs

Please list as many potential "Success Factors" as you can think of for each area.
You may use Table Four as a guide. Try add factors that are not already listed on Table Four. If you don't understand what to do, I can explain by phone. Thanks for your help with this project. Professor Robert K. Griffin, (806-795-4150).

Success Factors that Relate to the LYMS Itself

Success Factors that Relate to Tasks Performed by the Users

Success Factors that Relate to the LYMS Users themselves

Success Factors that Relate to the Organization where the LYMS is used

Success Factors that Relate to the External Environment (i.e. Hotel Customers, Government, Competition, etc.)

Appendix E

Cover Letter That Accompanied CSF Form

Dear XXX,

I am conducting research to help improve your lodging yield management system (LYMS). I need help to identify as many potential "critical success factors" for your yield management system as possible. Your operation has been especially selected for this phase of the research and whatever contribution you can make will be greatly appreciated. The results will be used to help improve your system.

Please list whatever factors you can think of that might be important to the success of the LYMS you are using. I have enclosed a table to help give you ideas of what I am looking for. Try add factors that are not already listed. I have also enclosed a stamped envelope for your convenience.

It is important that we get your perspective as well as your marketing and operations managers. I have enclosed similar forms and envelopes for them to fill out. Anything you can do to encourage them to complete and return them would be appreciated. Your responses, and those of your department heads, will remain completely confidential and anonymous.

Thanks for your assistance.

Sincerely Yours,

Robert K. Griffin
Assistant Professor
Texas Tech University

Appendix F
Database Classification Scheme for the Hospitality Industry

Macro Environment

Sociocultural
Education
Social
Psychographic
Demographic
Cultural Diversity

Political
Law
Lobbying
Judicial
Legislative
Administrative

Economic
GNP
Fiscal
Monetary
Labor
Trade
Capital Markets
Economic Impact
Taxation

Technology
Mechanical Equipment
Electronic Equipment
Energy
Layout & Design
Maintenance
Safety
Communication
Food Engineering
Security
Nutrition
Robotics
Software

Ecological
Recycling
Conservation
Solid Waste
Source Reduction
Air Quality
Water Quality
Packaging

Industries
Transportation
Tourism
Foodservice
Institutions
Lodging
Attractions
Other

Infrastructure
Airport
Public Utilities
Distributors
Fuel
Highway/Roadway
Railway

Competitive & Firm

Finance
Asset Management
Capital Budgeting
Financing
Planning
Dividends
Forecasting
Investments
Merger/Acquisition
Capital Structure
Bankruptcy
Franchising

Marketing
Product
Price
Place
Promotion
Value
Target Markets
Research
Segmentation
Organizational Markets
Distribution
Research

Research & Development
Product
Industry
Methodology
Process
Customer
Service

Administration
MIS
Risk Management
Accounting
Strategy
Organizational Structure
Service Delivery
Yield Management
Property Security
Legal
Policies

Operations
Sanitation
Materials Management
Food Handling
Quality Standards
Menu Engineering
Production
Efficiency
Systems

Human Resources
Unions
Reporting
Development
Compensation
Performance Appraisal
Selection
Recruitment
Culture
Job Design
Training
Labor Force
Staffing
Benefits
Retention

Suppliers

Suppliers
Products
Distribution
Prices
Service
Support
Value

Customers

Customers
Geographics
Demographics
Psychographics
Needs
Benefits
Purchasing
Turnover
Abilities
Utilities
Risks
Primary Demand
Secondary Demand
Target Markets

Labor Markets

Labor Markets
Supply
Demand
Work Qualifications
Legal Requirements

(Adapted from the Virginia Polytechnic Institute Center for Hospitality Research Trends Database Classification Scheme, 1992)

Appendix G

Letter Requesting Assistance From Developers With Survey Pre-Testing

December 30th, 1993

Dear XXX,

Enclosed please find the latest revision of the "Revenue Management System Questionnaire." It is the product of considerable research over the last eighteen months involving literature reviews, and input from many developers and users.

I am currently on the last revision and need your thoughts and criticisms as soon as possible. I want to take this opportunity to describe how the instrument is intended to be used, what it can do for your company, and to solicit your feedback.

The first thing you may notice is that it is relatively lengthy. This is necessary because it must include all areas that may be critical to system success. It has been carefully organized to make it easy to fill-out. Most users are able to complete the survey in less than fourteen minutes. Users have also noted that interruptions have not hindered their ability to continue the questionnaire's completion. You might want to confirm or disconfirm this.

This questionnaire is designed to evaluate both current and future revenue management systems. Its primary purpose is to identify factors that are critical to your system's success. The instrument incorporates a gap-analysis technique so that once you have evaluated your current system it can be re-used to determine how well you have met any re-design goals with new versions.

More specifically, the questionnaire is designed to: 1) measure system success from several perspectives, 2) identify what system factors are related to system success and which are not, 3) determine if innovation level is related to system success, 4) ascertain if certain user characteristics are related to how the user perceives the system and to its success, 5) evaluate the relative importance of training and support, 6) determine how the system affects interdepartmental communication and cooperation, 7) analyze the impact of competition, guests, and travel agents on the system, 8) appraise how much time users need to become comfortable, and 9) determine the relationship between system success and the various system functions that properties choose to employ.

Please review this questionnaire and advise how I can improve it. It would be most beneficial if you could provide a property where I could do an actual pre-test. Also, if there are any functions listed under the section "Questions About System Functions" that your system does not provide, they can be removed.

I hope you find the intent of this work to be helpful. It has been designed to benefit both developers and users of revenue management systems. I will get back to you for your comments next week.

Sincerely Yours,

Robert K. Griffin

Appendix H

Letter Requesting Assistance From Users With Survey Pre-Testing

January 22nd, 1994

Dear XXX,

Mr. XXX and Ms. XXX have referred me to you (out of several hundred persons) to evaluate the enclosed questionnaire instrument. This questionnaire is the product of considerable research and testing. It will be used to help evaluate and improve your demand forecasting system and needs one final test. I respectfully request your assistance with this effort.

Please fill out the questionnaire and note any problems that you encounter or suspect. In particular, are all of the questions clear? Do you think when the questionnaire is sent to GMs, directors of reservations, directors of marketing, and directors of operations, they will have a consistent understanding of the meaning of each question? Is anything missing? And, how can I improve the questionnaire?

Just note your comments directly onto the questionnaire and send it back by January 30th. A self-addressed envelope has been provided for your convenience.

Your input is highly valued and will help me design the best instrument for XXX. Thank you for your assistance and the opportunity to serve your company.

Sincerely Yours,

Robert K. Griffin

Appendix I

Cover Letters for Survey

March 1st, 1994

Dear XXX,

Please help improve your Revenue (Yield) Management System by completing the enclosed questionnaire. We are depending upon your information to properly evaluate the system.

This questionnaire is the result of months of research and has been tested and approved by XXX Corporation. It is designed to provide your company with comprehensive data about your revenue management system Although the questionnaire is a bit lengthy (necessary to fully evaluate your system), it usually takes less than 15 minutes to fill-out.

A confidential report will be sent to XXX and XXX as soon as all of the questionnaires have been returned. A souvenir pencil has been enclosed in appreciation of your assistance.

Sincerely Yours,

Robert K. Griffin

cc XXX, Director of Revenue Management Systems, XXX Corporation.
XXX, Director of Reservations Operations & Systems Development,
XXX Corporation.

Appendix J

Follow-up Post Card for Surveys

Just A Reminder

If you haven't already filled out your Revenue (Yield) Management Questionnaire would you please take a little time to do so? Your opinions are very important and will help guide us in improving the system. Please try to send it in so we can wrap this project up by the end of the month. Thank You!!

Sincerely,

P.S. If you need another copy leave a message at 413-545-4076.

Appendix K

Revenue (Yield) Management System Questionnaire

This comprehensive questionnaire has been specially designed to help make improvements to your revenue (yield) management system. Your input is very important to help designers develop new and better systems. Although this survey may look long, it normally only takes about 15 minutes to complete.

Your answers will help XXX design systems that can make you and your property more successful. To allow you the freedom to answer honestly, a third party has been contracted to design, distribute, collect, and analyze this survey.

Please mail the completed questionnaire to Robert K. Griffin, xxx Flint Laboratory, Box 32710, University of Massachusetts, Amherst, MA 01003-2710. A return envelope has been provided for your convenience. Your response is respectfully requested by the 15th of March, but the sooner, the better. Thank you for answering this important questionnaire.

Questions About You

I work as the (please check the box that most accurately describes your position)

General or Assistant Manager	Director or Manager of Sales or Marketing	Director or Manager of Operations or Rooms or Front Office	Director or Manager of Reservations

I was involved in the design of our revenue management system

I was not involved	to a slight degree	to a moderate degree	to a high degree

Compared to a beginner, my skills with computers and/or computerized information systems are

less than a beginner	equivalently (slightly) skilled	moderately skilled	highly skilled

I have been working with computers and/or computerized information systems for ________ years.

Questions About Your Property

I would classify this property as

Limited Service	Mid-Priced	Full-Service	Luxury

I would classify this property as

Highway	Airport	Downtown	Industrial Park	Suburban	Convention	Resort

There are approximately ________ rooms on this property.

There are approximately ________ hotel properties (units) in the company.

This property employs approximately ________ full-time equivalent workers.
(Note: Full-time means 40hrs/week. Please combine full-time and part-time workers in your estimate.)
(e.g. Four part-time employees, each working 10hrs/week, are equivalent to one full-time equivalent worker.)

This property employs approximately _________ full-time equivalent workers to support our computer systems, including its hardware, software, and users. (Please calculate as described in the previous question.)

The average annual gross revenue (rooms plus all other sales) for this property over the last three years is approximately $_______________ per [I have no idea.] year.

I would estimate that, as a result of using the current revenue management system, property revenue has increased (circle +) or decreased (circle -) by + / -_________% and property profit has increased (circle +) or decreased (circle -) by + / - [I have no idea.] _________%.

In the following section, please indicate your general agreement or disagreement to each statement by checking the box that most accurately represents your feelings.

In general, employees get excited when a new version of a product or system is about to be released (whether computerized or non-computerized).

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

In general, employees are interested and supportive of innovative ideas and products (including computerized and non-computerized ideas and products).

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

In general, employees find new technology and products easy to understand and work with (including computerized or non-computerized products and technology).

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

In general, employees would be willing to test an experimental product or system (including computerized and non-computerized products and systems).

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

In general, employees would be interested enough to try and find out about a product or system being tested (whether computerized or non-computerized).

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

In general, employees were involved in the development of our revenue management system.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

Note: After you have completed this questionnaire, please make any additional comments here.

Questions About the Revenue Management System Itself

On the table below, please indicate the degree to which your current revenue management system can be characterized by each variable by checking the appropriate box on each row. For example, the first row reads "Extremely Unreliable," on the far left, and "Extremely Reliable," on the far right.

In my best estimation, I would say that our current revenue management system is/has:
(check one box per row)

Extremely	Quite	Slightly	Neither	Slightly	Quite	Extremely	
Unreliable	Unreliable	Unreliable	Unreliable nor Reliable	Reliable	Reliable	Reliable	Can't Say
Incomplete	Incomplete	Incomplete	Incomplete nor Complete	Complete	Complete	Complete	Can't Say
Inaccurate	Inaccurate	Inaccurate	Inaccurate nor Accurate	Accurate	Accurate	Accurate	Can't Say
Irrelevant	Irrelevant	Irrelevant	Irrelevant nor Relevant	Relevant	Relevant	Relevant	Can't Say
Untimely	Untimely	Untimely	Untimely nor Timely	Timely	Timely	Timely	Can't Say
Unadaptable	Unadaptable	Unadaptable	Unadaptable nor Adaptable	Adaptable	Adaptable	Adaptable	Can't Say
Unfriendly	Unfriendly	Unfriendly	Unfriendly nor Friendly	Friendly	Friendly	Friendly	Can't Say
Unuseful	Unuseful	Unuseful	Unuseful nor Useful	Useful	Useful	Useful	Can't Say
Inflexible	Inflexible	Inflexible	Inflexible nor Flexible	Flexible	Flexible	Flexible	Can't Say
Vulnerable to Unauthorized Access	Vulnerable to Unauthorized Access	Vulnerable to Unauthorized Access	Vulnerable to nor Secure From Unauthorized Access	Secure From Unauthorized Access	Secure From Unauthorized Access	Secure From Unauthorized Access	Can't Say
Hard for Users to Access	Hard for Users to Access	Hard for Users to Access	Hard nor Easy for Users to Access	Easy for Users to Access	Easy for Users to Access	Easy for Users to Access	Can't Say
Poorly Integrated with PMS / Reservations	Poorly Integrated with PMS / Reservations	Poorly Integrated with PMS / Reservations	Poorly Integrated nor Well Integrated with PMS / Reservations	Well Integrated with PMS / Reservations	Well Integrated with PMS / Reservations	Well Integrated with PMS / Reservations	Can't Say
Poorly Designed Manuals	Poorly Designed Manuals	Poorly Designed Manuals	Poorly nor Well Designed Manuals	Well Designed Manuals	Well Designed Manuals	Well Designed Manuals	Can't Say
Poor Reports and Other Output	Poor Reports and Other Output	Poor Reports and Other Output	Poor nor Good Reports and Other Output	Good Reports and Other Output	Good Reports and Other Output	Good Reports and Other Output	Can't Say

This property has been using revenue (yield) management systems for _________ years. [I don't know.]

This property has been using the current revenue management system for _________ years. [I don't know.]

We haven't had the revenue management system long enough to feel comfortable with it.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

Most employees who work with the revenue management system feel like it's an essential part of the property.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

Questions About How the Revenue Management System Affects You and Your Property

In the following section, please indicate your general agreement or disagreement to each statement by checking the box that most accurately represents your feelings.

The revenue management system improves communications between reservations and sales.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system improves communications between operations (rooms & front office) and marketing.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system improves my property's sales related decision-making.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system reduces my workload.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management reduces my employees' workload.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system helps my property focus on its goals and strategies.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system has improved my image of computer technology.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

Employees who work with the revenue management system are usually committed to it.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

My property is better off by using the revenue management system.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system has met my overall expectations.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

The revenue management system has positively impacted my job.

Highly Disagree	Moderately Disagree	Slightly Disagree	Neither Disagree nor Agree	Slightly Agree	Moderately Agree	Highly Agree

Questions About System Factors

Design refers to the general sophistication, integration, flexibility, adaptability, and efficiency of the revenue management system's hardware and software.

I believe the design of hardware and software for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The design of hardware and software of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Quality refers to the reliability, effectiveness, performance, response time, and durability of the revenue management system.

I believe that quality for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The quality of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Data management refers to the organization, storage, and retrieval of data and information relating to and supporting the revenue management system.

I believe that data management for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The data management of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Steady maintenance refers to the continuous and consistent care and repair of the revenue management system, by either property or corporate employees, or through service contracts.

I believe that steady maintenance for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The steady maintenance of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Computer-to-computer interfaces refers to the ability to communicate, and the quality of those communications, between the revenue management system and other information systems.

I believe that computer-to-computer interfaces for revenue (yield) management systems are, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The computer-to-computer interfaces of our revenue management system are

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Questions About Task Factors

Functions refers to the use of forecasting, pricing, demand, overbooking, inventory, segmentation, rate, and other decision support models by the revenue management system.

I believe that functions for revenue (yield) management systems are, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The functions of our revenue management system are

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Objectives refers to the property's business objectives, pricing strategies, and long-term & short-term focuses incorporated by the revenue management system.

I believe that objectives for revenue (yield) management systems are, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The objectives of our revenue management system are

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Control refers to the information accountability, information security, and quantity and quality of feedback for evaluating the revenue management system.

I believe that control for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The control of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Information quality refers to the quality of reported and/or real-time information produced by the revenue management system.

I believe that information quality for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The information quality of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

User/computer interface refers to the ease of information access, quality of screens and graphics, and general level of "friendliness" of the revenue management system.

I believe that user/computer interface for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The user/computer interface of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Atmosphere refers to the working conditions and surroundings for employees while they operate the revenue management system.

I believe that atmosphere for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The atmosphere of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Training refers to the quality and quantity of system-related instruction given to employees who work with the revenue management system.

I believe that training for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The training for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Questions About System Functions

Please check all of the functions you believe are used by your property with your current system.

Revenue Management System Functions	Do Use	Don't Use		Don't Know
Demand Forecasting				
Automated Market Segmentation				
Adjusts Prices as Market Demands Change				
Accounts for Revenue from All Departments				
Accounts for and Optimizes Multiple Night Stays				
Controls the Rate Structure				
Controls the Rate Structure Mix				
Opens and Closes Rates to Control Room Inventory				
Controls Overbookings				
Optimizes Rates Offered to Groups				
Considers What the Competition is Offering				
Provides Decision Support Tools				
Provides Early Market Activity Warnings				
Provides What-If (Simulation) Analysis				
Provides Cost/Benefit Analysis of Sales				
Incorporates Specific Marketing & Sales Strategies				
Allows for Employee and Management Input				
Provides Trends Analysis Report				
Treats Volume Buyers Differently than Individuals				

Questions About User Factors

Attitude refers to the positive acceptance and beliefs users hold towards the revenue management system.

I believe that the attitude of users towards revenue management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The attitude of users towards our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Commitment refers to the level of involvement and willingness of users to work towards the success of the revenue management system.

I believe that commitment of users towards revenue management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The commitment of users towards our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Understanding refers to the user's conceptual knowledge of the processes that drive the revenue management system.

I believe that understanding by users for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The understanding by users of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Competence refers to the user's technical knowledge of, and their comfort level with, the revenue management system.

I believe that competence of users for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The competence of users of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Decision-making latitude refers to the freedom that employees and managers have selecting from options provided by the revenue management system and the freedom to over-rule.

I believe that decision-making latitude for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The decision-making latitude of our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Questions About Organizational Factors

Top-management support refers to the interest, commitment, investment of resources, and "championing" by top-management personnel for the revenue management system.

I believe that top-management support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The top-management support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Marketing-support refers to the interest, commitment, investment of resources, and "championing" by the marketing personnel for the revenue management system.

I believe that marketing-support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The marketing-support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Sales-support refers to the interest, commitment, investment of resources, and "championing" by sales personnel for the revenue management system.

I believe that sales-support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The sales-support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Operations-support (rooms and front office) refers to the interest, commitment, investment of resources, and "championing" by operations personnel for the revenue management system.

I believe that operations-support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The operations-support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Reservations-support refers to the interest, commitment, and "championing" by reservations personnel for the revenue management system.

I believe that reservations-support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important	No Opinion

The reservations-support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good	I Don't Know

Existing information systems refers to the quality of the existing property management system, reservation system, or other systems that might interface with the revenue management system.

I believe that existing information systems for revenue (yield) management systems are, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The existing information systems for our revenue management system are

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Questions About the External Environment

Supplier-support refers to the competence, interest, commitment, and quality, of the staff and organization that supplies the revenue management system.

I believe that supplier-support for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The supplier support for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Customer behavior refers to the booking patterns, purchasing patterns, and tolerance to differential pricing exhibited by customers who book under a revenue management system.

I believe that customer behavior for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The customer behavior with respect to our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Middle-agent behavior refers to the attitudes, beliefs, actions, and tolerance to differential pricing exhibited by travel agents and other middle-agents who book on behalf of guests.

I believe that middle-agent behavior for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The middle-agent behavior with respect to our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Environmental-benevolence refers to general positive economic, political, legislative, and sociocultural conditions of the external environment.

I believe that environmental-benevolence for revenue (yield) management systems is, in general,

Extremely Unimportant	Quite Unimportant	Slightly Unimportant	Neither Unimportant nor Important	Slightly Important	Quite Important	Extremely Important		No Opinion

The environmental-benevolence for our revenue management system is

Extremely Poor	Quite Poor	Slightly Poor	Neither Poor nor Good	Slightly Good	Quite Good	Extremely Good		I Don't Know

Thank You For Completing this Important Questionnaire!

Appendix L

Listing of Respondents by Tracking Number (VALUE).

TRACK

Value	Frequency	Percent	Valid Percent	Cum Percent
1	1	.3	.3	.3
2	3	.8	.8	1.0
3	1	.3	.3	1.3
4	2	.5	.5	1.8
5	1	.3	.3	2.0
6	1	.3	.3	2.3
7	3	.8	.8	3.0
8	1	.3	.3	3.3
9	2	.5	.5	3.8
10	3	.8	.8	4.5
11	2	.5	.5	5.1
12	3	.8	.8	5.8
13	1	.3	.3	6.1
14	1	.3	.3	6.3
15	2	.5	.5	6.8
16	1	.3	.3	7.1
17	2	.5	.5	7.6
18	3	.8	.8	8.3
19	1	.3	.3	8.6
20	3	.8	.8	9.3
21	1	.3	.3	9.6
22	1	.3	.3	9.8
23	2	.5	.5	10.4
24	1	.3	.3	10.6
25	1	.3	.3	10.9
27	2	.5	.5	11.4
28	2	.5	.5	11.9
30	2	.5	.5	12.4
31	2	.5	.5	12.9
32	1	.3	.3	13.1
34	2	.5	.5	13.6
37	1	.3	.3	13.9
38	1	.3	.3	14.1
39	3	.8	.8	14.9
40	1	.3	.3	15.2
41	1	.3	.3	15.4
42	2	.5	.5	15.9
43	2	.5	.5	16.4
44	1	.3	.3	16.7
45	2	.5	.5	17.2
46	3	.8	.8	17.9
47	1	.3	.3	18.2
48	1	.3	.3	18.4
49	2	.5	.5	18.9
51	1	.3	.3	19.2
52	2	.5	.5	19.7
53	2	.5	.5	20.2
54	2	.5	.5	20.7

TRACK

Value	Frequency	Percent	Valid Percent	Cum Percent
55	1	.3	.3	21.0
56	1	.3	.3	21.2
57	3	.8	.8	22.0
58	1	.3	.3	22.2
59	3	.8	.8	23.0
60	2	.5	.5	23.5
61	1	.3	.3	23.7
62	1	.3	.3	24.0
63	2	.5	.5	24.5
64	3	.8	.8	25.3
65	4	1.0	1.0	26.3
66	3	.8	.8	27.0
67	2	.5	.5	27.5
68	4	1.0	1.0	28.5
69	2	.5	.5	29.0
70	2	.5	.5	29.5
71	2	.5	.5	30.1
72	2	.5	.5	30.6
73	3	.8	.8	31.3
74	3	.8	.8	32.1
75	3	.8	.8	32.8
76	2	.5	.5	33.3
77	1	.3	.3	33.6
78	1	.3	.3	33.8
79	2	.5	.5	34.3
80	2	.5	.5	34.8
81	1	.3	.3	35.1
82	2	.5	.5	35.6
83	1	.3	.3	35.9
84	2	.5	.5	36.4
85	2	.5	.5	36.9
86	3	.8	.8	37.6
87	2	.5	.5	38.1
90	1	.3	.3	38.4
92	2	.5	.5	38.9
93	1	.3	.3	39.1
95	1	.3	.3	39.4
96	1	.3	.3	39.6
97	3	.8	.8	40.4
98	1	.3	.3	40.7
99	3	.8	.8	41.4
100	1	.3	.3	41.7
101	2	.5	.5	42.2
102	2	.5	.5	42.7
103	2	.5	.5	43.2
104	1	.3	.3	43.4
105	2	.5	.5	43.9
108	2	.5	.5	44.4
109	1	.3	.3	44.7
110	1	.3	.3	44.9
111	1	.3	.3	45.2
112	1	.3	.3	45.5
114	3	.8	.8	46.2

TRACK

Value	Frequency	Percent	Valid Percent	Cum Percent
115	2	.5	.5	46.7
117	1	.3	.3	47.0
118	1	.3	.3	47.2
122	1	.3	.3	47.5
123	1	.3	.3	47.7
124	1	.3	.3	48.0
125	3	.8	.8	48.7
126	2	.5	.5	49.2
128	1	.3	.3	49.5
129	2	.5	.5	50.0
131	1	.3	.3	50.3
132	1	.3	.3	50.5
133	2	.5	.5	51.0
135	2	.5	.5	51.5
136	2	.5	.5	52.0
137	2	.5	.5	52.5
139	1	.3	.3	52.8
141	1	.3	.3	53.0
142	1	.3	.3	53.3
143	3	.8	.8	54.0
144	1	.3	.3	54.3
145	2	.5	.5	54.8
146	1	.3	.3	55.1
147	1	.3	.3	55.3
148	1	.3	.3	55.6
149	3	.8	.8	56.3
150	1	.3	.3	56.6
151	2	.5	.5	57.1
152	1	.3	.3	57.3
153	2	.5	.5	57.8
154	1	.3	.3	58.1
155	2	.5	.5	58.6
156	2	.5	.5	59.1
158	2	.5	.5	59.6
159	2	.5	.5	60.1
160	1	.3	.3	60.4
161	2	.5	.5	60.9
162	3	.8	.8	61.6
163	1	.3	.3	61.9
164	1	.3	.3	62.1
166	5	1.3	1.3	63.4
168	1	.3	.3	63.6
170	1	.3	.3	63.9
171	1	.3	.3	64.1
172	4	1.0	1.0	65.2
174	2	.5	.5	65.7
175	1	.3	.3	65.9
176	2	.5	.5	66.4
177	3	.8	.8	67.2
178	1	.3	.3	67.4
179	1	.3	.3	67.7
180	2	.5	.5	68.2
181	2	.5	.5	68.7

TRACK

Value	Frequency	Percent	Valid Percent	Cum Percent
182	1	.3	.3	68.9
185	1	.3	.3	69.2
186	1	.3	.3	69.4
187	3	.8	.8	70.2
188	2	.5	.5	70.7
189	3	.8	.8	71.5
190	2	.5	.5	72.0
191	2	.5	.5	72.5
192	3	.8	.8	73.2
193	4	1.0	1.0	74.2
194	2	.5	.5	74.7
196	2	.5	.5	75.3
197	1	.3	.3	75.5
198	1	.3	.3	75.8
200	1	.3	.3	76.0
202	3	.8	.8	76.8
203	3	.8	.8	77.5
204	2	.5	.5	78.0
206	3	.8	.8	78.8
208	1	.3	.3	79.0
210	2	.5	.5	79.5
211	1	.3	.3	79.8
215	1	.3	.3	80.1
217	1	.3	.3	80.3
221	1	.3	.3	80.6
222	1	.3	.3	80.8
301	1	.3	.3	81.1
305	1	.3	.3	81.3
306	2	.5	.5	81.8
308	1	.3	.3	82.1
310	1	.3	.3	82.3
311	1	.3	.3	82.6
317	1	.3	.3	82.8
320	1	.3	.3	83.1
321	1	.3	.3	83.3
323	2	.5	.5	83.8
324	1	.3	.3	84.1
330	2	.5	.5	84.6
332	1	.3	.3	84.8
333	1	.3	.3	85.1
334	1	.3	.3	85.4
338	1	.3	.3	85.6
339	1	.3	.3	85.9
340	1	.3	.3	86.1
344	1	.3	.3	86.4
348	1	.3	.3	86.6
349	1	.3	.3	86.9
353	2	.5	.5	87.4
357	1	.3	.3	87.6
364	1	.3	.3	87.9
367	3	.8	.8	88.6
372	1	.3	.3	88.9
373	2	.5	.5	89.4

TRACK

Value	Frequency	Percent	Valid Percent	Cum Percent
375	1	.3	.3	89.6
391	1	.3	.3	89.9
392	1	.3	.3	90.2
393	1	.3	.3	90.4
395	3	.8	.8	91.2
401	2	.5	.5	91.7
402	1	.3	.3	91.9
404	4	1.0	1.0	92.9
406	1	.3	.3	93.2
408	2	.5	.5	93.7
412	2	.5	.5	94.2
413	1	.3	.3	94.4
416	3	.8	.8	95.2
419	3	.8	.8	96.0
420	2	.5	.5	96.5
421	1	.3	.3	96.7
422	1	.3	.3	97.0
423	2	.5	.5	97.5
426	2	.5	.5	98.0
427	1	.3	.3	98.2
428	2	.5	.5	98.7
429	3	.8	.8	99.5
432	1	.3	.3	99.7
433	1	.3	.3	100.0
Total	396	100.0	100.0	

Valid cases 396 Missing cases 0

Note: Frequency represents the number of respondents from each property.

Appendix M

Pearson Correlation Coefficients for All Cases Using Original Method for Developing the Dependent Variables

	System #1	System #2	System #3
DESIGN	.5438*	.1846	.7135*
	(225) P.000	(24) P.194	(28) P.000
QUALITY	.5991*	.2618	.6247*
	(250) P.000	(26) P.098	(27) P.000
DATA	.5120*	.1393	.6221*
	(237) P.000	(23) P.263	(28) P.000
MAINT	.4403*	.1643	.3043*
	(224) P.000	(24) P.221	(29) P.054
COMPCOM	.3708*	.1784	.2771
	(230) P.000	(22) P.214	(29) P.073
FUNCTIO	.6507*	.3075	.6987*
	(250) P.000	(26) P.063	(28) P.000
OBJECTI	.5058*	.6155*	.3664*
	(248) P.000	(26) P.000	(27) P.030
CONTROL	.5033*	.0135	.5037*
	(236) P.000	(24) P.475	(28) P.003
INFOQUA	.6131*	.1835	.5948*
	(250) P.000	(24) P.195	(28) P.000
USERCOM	.3281*	.4279*	.5781*
	(239) P.000	(24) P.019	(27) P.001
ATMOS	.2778	.3366*	.2916
	(237) P.000	(26) P.046	(27) P.070
TRAIN	.2501	.2906	.3605*
	(246) P.000	(26) P.075	(28) P.030
ATTITUD	.5837*	.7259*	.6292*
	(249) P.000	(26) P.000	(30) P.000
COMMIT	.4932*	.6722*	.5705*
	(251) P.000	(26) P.000	(29) P.001
UNDER	.2107	.4509*	.4858*
	(252) P.000	(26) P.010	(29) P.004
COMPETN	.2220	.4287*	.4874*
	(252) P.000	(26) P.014	(30) P.003
DECISIO	.3397*	.3638*	.5974*
	(250) P.000	(24) P.040	(29) P.000
TOPMGT	.2980*	.3804*	.3696*
	(251) P.000	(26) P.028	(30) P.022
MARKET	.4278*	.3886*	.4964*
	(247) P.000	(24) P.030	(30) P.003
SALES	.3702*	.4731*	.5555*
	(247) P.000	(24) P.010	(29) P.001
OPER	.2568	.3354*	.4713*
	(249) P.000	(25) P.051	(29) P.005
RESV	.3267*	.2027	.4475*
	(253) P.000	(24) P.171	(29) P.007
EXIST	.3941*	.3605*	.4510*
	(236) P.000	(23) P.046	(29) P.007
SUPPL	.4436*	-.0905	.3077
	(208) P.000	(25) P.668	(27) P.059
CUST	.3502*	.0105	.3460*
	(230) P.000	(24) P.481	(28) P.036
MIDDLE	.2985*	.1877	.1614
	(228) P.000	(23) P.196	(28) P.206
ENVIOR	.3254*	.1426	.2794
	(174) P.000	(17) P.293	(26) P.083

(Coefficient / (Cases) / 1-tailed Significance)

" . " is printed if too few cases available to compute coefficient

* identifies values with significance <= .05 and correlations >= .30

Appendix N
Factor Analysis of Dependent Variables

System One

```
- - - -   F A C T O R   A N A L Y S I S   - - - -

Analysis Number  1  Listwise deletion of cases with missing values

Extraction  1  for Analysis  1, Principal-Components Analysis (PC)

Initial Statistics:
```

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
RELIABLE	1.00000	*	1	9.25793	40.3	40.3
COMPLETE	1.00000	*	2	1.71977	7.5	47.7
ACCURATE	1.00000	*	3	1.52016	6.6	54.3
RELEVANT	1.00000	*	4	1.40108	6.1	60.4
TIMLEY	1.00000	*	5	1.01308	4.4	64.8
ADAPTABL	1.00000	*	6	.90194	3.9	68.8
FRIENDLY	1.00000	*	7	.86990	3.8	72.5
USEFUL	1.00000	*	8	.71704	3.1	75.7
FLEXIBLE	1.00000	*	9	.69324	3.0	78.7
SECURE	1.00000	*	10	.64012	2.8	81.5
MANUALS	1.00000	*	11	.55883	2.4	83.9
REPORTS	1.00000	*	12	.50355	2.2	86.1
RESSALE	1.00000	*	13	.48543	2.1	88.2
OPRMKTG	1.00000	*	14	.42680	1.9	90.0
SALESDEC	1.00000	*	15	.38648	1.7	91.7
MYLOAD	1.00000	*	16	.37706	1.6	93.4
EMPLOAD	1.00000	*	17	.31375	1.4	94.7
GOAL	1.00000	*	18	.25177	1.1	95.8
IMAGE	1.00000	*	19	.23138	1.0	96.8
COMMIT	1.00000	*	20	.21418	.9	97.8
BETTER	1.00000	*	21	.18898	.8	98.6
OVERALL	1.00000	*	22	.17199	.7	99.3
IMPACT	1.00000	*	23	.15554	.7	100.0

PC Extracted 5 factors.

Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.74335	-.39848	-.01151	-.13714	-.11396
COMPLETE	.71552	-.25387	.14842	-.04864	.00758
ACCURATE	.70170	-.47139	.15233	-.07896	-.18850
RELEVANT	.69191	-.31448	.00347	-.25683	-.09485
TIMLEY	.68644	-.03850	.27775	-.16689	-.02878
ADAPTABL	.66612	-.12303	.37543	-.00846	-.24440
FRIENDLY	.41147	.33625	.47919	.14567	-.04470
USEFUL	.77500	-.01587	-.19832	-.19603	.12305
FLEXIBLE	.64095	-.19621	.36481	.09908	-.05821

SECURE	.28289	-.03892	.39694	.22501	.70078
MANUALS	.38825	.52342	.37432	.15829	-.03330
REPORTS	.60265	.24697	.25339	-.04026	.14622
RESSALE	.57586	-.26476	-.26670	.47245	.15755
OPRMKTG	.38636	-.17564	-.02813	.72923	-.11414
SALESDEC	.71691	.03500	-.31905	.13516	.27820
MYLOAD	.44113	.53799	-.11212	.02699	-.13781
EMPLOAD	.39158	.19519	-.19510	.45273	-.39824
GOAL	.76582	.13410	-.32808	-.00148	.11612
IMAGE	.52480	.35089	-.05616	-.14746	-.12953
COMMIT	.61436	.04060	-.24322	.14574	-.01154
BETTER	.83526	.05966	-.26991	-.17465	.16158
OVERALL	.80637	.11310	-.05424	-.10092	-.09206
IMPACT	.77631	.28586	-.15061	-.26531	.05502

---- F A C T O R   A N A L Y S I S ----

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
RELIABLE	.74329	*	1	9.25793	40.3	40.3
COMPLETE	.60087	*	2	1.71977	7.5	47.7
ACCURATE	.77955	*	3	1.52016	6.6	54.3
RELEVANT	.65260	*	4	1.40108	6.1	60.4
TIMLEY	.57851	*	5	1.01308	4.4	64.8
ADAPTABL	.65959	*				
FRIENDLY	.53521	*				
USEFUL	.69378	*				
FLEXIBLE	.59561	*				
SECURE	.78082	*				
MANUALS	.59099	*				
REPORTS	.51139	*				
RESSALE	.72087	*				
OPRMKTG	.72572	*				
SALESDEC	.71264	*				
MYLOAD	.51632	*				
EMPLOAD	.59306	*				
GOAL	.72559	*				
IMAGE	.44022	*				
COMMIT	.45961	*				
BETTER	.83068	*				
OVERALL	.68463	*				
IMPACT	.78048	*				

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 8 iterations.

---- FACTOR ANALYSIS ----

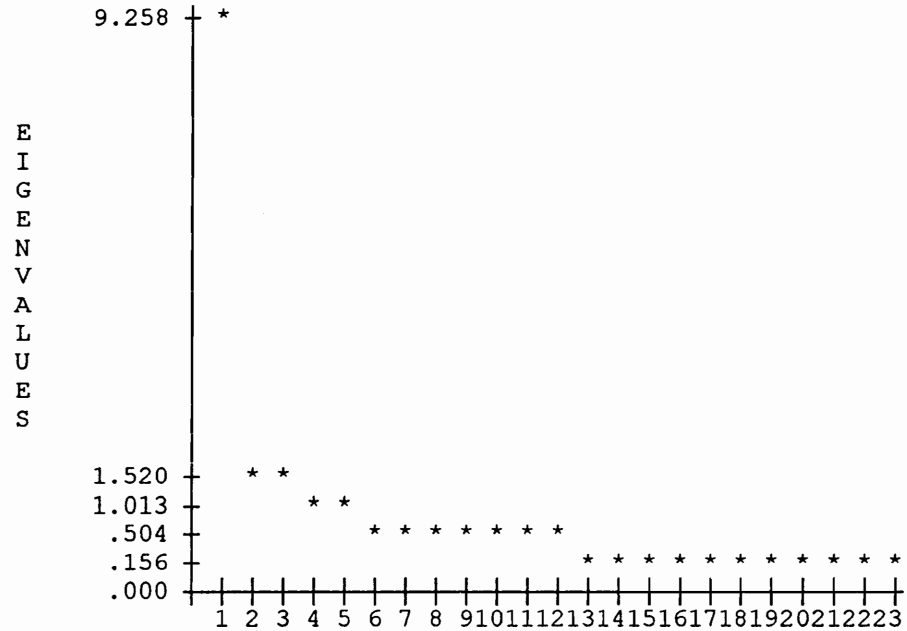
Rotated Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.38166	.75514	-.05209	.15705	-.00071
COMPLETE	.32173	.65890	.12746	.14986	.15655
ACCURATE	.20189	.83913	-.00159	.18600	.00794
RELEVANT	.39737	.70259	-.02016	.01498	-.02084
TIMLEY	.30817	.59853	.33636	-.02175	.10813
ADAPTABL	.11730	.69035	.38479	.14533	-.00833
FRIENDLY	.03909	.20961	.67952	.08765	.14253
USEFUL	.70276	.43029	.07473	.05331	.07960
FLEXIBLE	.10849	.64067	.30240	.21751	.18606
SECURE	.06894	.11164	.20903	.07242	.84538
MANUALS	.14135	.03876	.74460	.08560	.08802
REPORTS	.36736	.29221	.48777	.00138	.23049
RESSALE	.38761	.26094	-.11777	.65549	.24290
OPRMKTG	.01466	.18811	.10540	.81775	.10148
SALESDEC	.71259	.19982	.04324	.33083	.23154
MYLOAD	.47345	-.06010	.48802	.10696	-.19736
EMPLOAD	.21855	.04771	.28300	.59801	-.32451
GOAL	.76967	.24219	.13220	.23472	.04436
IMAGE	.48401	.16354	.38776	-.01417	-.16927
COMMIT	.52314	.23345	.10821	.34584	-.01114
BETTER	.81226	.38087	.10306	.08642	.08805
OVERALL	.59674	.45928	.31018	.13270	-.06140
IMPACT	.76318	.30332	.31988	-.05520	-.02577

Factor Transformation Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR
FACTOR 1	.65861	.61877	.32231	.26476	.09682
FACTOR 2	.29542	-.59545	.71408	-.15594	-.15470
FACTOR 3	-.59397	.37263	.58146	-.22716	.34446
FACTOR 4	-.23954	-.23927	.14203	.90741	.20444
FACTOR 5	.26227	-.25778	-.16713	-.17487	.89791

Scree Plot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System Two

---- FACTOR ANALYSIS ----

Analysis Number 1 Listwise deletion of cases with missing values

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
RELIABLE	1.00000	*	1	9.07252	39.4	39.4
COMPLETE	1.00000	*	2	3.10629	13.5	53.0
ACCURATE	1.00000	*	3	2.51274	10.9	63.9
RELEVANT	1.00000	*	4	1.83758	8.0	71.9
TIMLEY	1.00000	*	5	1.57479	6.8	78.7
ADAPTABL	1.00000	*	6	1.26317	5.5	84.2
FRIENDLY	1.00000	*	7	1.01871	4.4	88.6
USEFUL	1.00000	*	8	.89474	3.9	92.5
FLEXIBLE	1.00000	*	9	.64854	2.8	95.3
SECURE	1.00000	*	10	.41237	1.8	97.1
MANUALS	1.00000	*	11	.27109	1.2	98.3
REPORTS	1.00000	*	12	.19921	.9	99.2
RESSALE	1.00000	*	13	.13742	.6	99.8
OPRMKTG	1.00000	*	14	.05081	.2	100.0
SALESDEC	1.00000	*	15	.00000	.0	100.0
MYLOAD	1.00000	*	16	.00000	.0	100.0
EMPLOAD	1.00000	*	17	.00000	.0	100.0
GOAL	1.00000	*	18	.00000	.0	100.0
IMAGE	1.00000	*	19	.00000	.0	100.0
COMMIT	1.00000	*	20	-.00000	-.0	100.0
BETTER	1.00000	*	21	-.00000	-.0	100.0
OVERALL	1.00000	*	22	-.00000	-.0	100.0
IMPACT	1.00000	*	23	-.00000	-.0	100.0

PC Extracted 7 factors.

---- FACTOR ANALYSIS ----

Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.62365	.62390	.02168	.16582	-.20893
COMPLETE	.58114	.34038	.27332	.02219	.58044
ACCURATE	.82084	-.33247	.00711	.01340	.17413
RELEVANT	.73207	-.27401	.12799	-.28474	-.15445
TIMLEY	.42720	.28311	.44537	-.28395	-.26687
ADAPTABL	.56934	.41333	-.38139	.17438	.00919
FRIENDLY	.57023	-.13255	-.69549	.23634	.02668
USEFUL	.41596	-.41557	-.16503	-.13324	.58384
FLEXIBLE	.53759	.51038	-.49597	.10776	.26236
SECURE	.28572	.28483	-.13077	-.45274	.43864

MANUALS	.48591	.55534	.11205	-.39095	-.24508
REPORTS	.30221	.35537	-.01246	.39115	-.02269
RESSALE	.48270	-.62292	-.39110	.17373	.02307
OPRMKTG	.88384	.23935	-.09198	.32444	-.06995
SALESDEC	.56782	-.32401	.59928	.39133	-.00143
MYLOAD	.73936	-.46182	-.18426	-.17614	-.23237
EMPLOAD	.71884	-.34834	-.28489	-.20892	-.30775
GOAL	.37809	-.41032	.49018	.45148	.16274
IMAGE	.68056	.31161	.34458	.40127	.03915
COMMIT	.63936	.09511	.08043	-.45092	.26461
BETTER	.61822	-.18173	.50854	-.27535	.15973
OVERALL	.91076	-.04696	-.14416	-.03073	-.17258
IMPACT	.89814	-.05775	.10019	-.11434	-.31287

	FACTOR 6	FACTOR 7
RELIABLE	.08015	.23844
COMPLETE	-.19648	-.23553
ACCURATE	-.19779	-.21530
RELEVANT	-.18914	.20457
TIMLEY	-.12383	.46263
ADAPTABL	-.38223	.00759
FRIENDLY	-.21615	.19977
USEFUL	.15659	.03546
FLEXIBLE	.03251	-.02180
SECURE	.11421	.37475
MANUALS	-.12432	-.31735
REPORTS	.76835	-.06485
RESSALE	-.00856	.07763
OPRMKTG	-.03548	-.01186
SALESDEC	-.05633	.04703
MYLOAD	.25425	-.08618
EMPLOAD	.32211	-.03799
GOAL	-.06928	.31831
IMAGE	.12797	-.05092
COMMIT	.26592	.18103
BETTER	.06255	-.32586
OVERALL	-.14713	-.23794
IMPACT	-.01769	.01894

---- F A C T O R   A N A L Y S I S ----

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
RELIABLE	.91310	*	1	9.07252	39.4	39.4
COMPLETE	.95977	*	2	3.10629	13.5	53.0
ACCURATE	.90035	*	3	2.51274	10.9	63.9
RELEVANT	.80994	*	4	1.83758	8.0	71.9
TIMLEY	.84221	*	5	1.57479	6.8	78.7
ADAPTABL	.81710	*	6	1.26317	5.5	84.2
FRIENDLY	.96964	*	7	1.01871	4.4	88.6
USEFUL	.75736	*				
FLEXIBLE	.87745	*				
SECURE	.73073	*				
MANUALS	.88613	*				
REPORTS	.96585	*				
RESSALE	.81081	*				
OPRMKTG	.95847	*				
SALESDEC	.94507	*				
MYLOAD	.95098	*				
EMPLOAD	.96278	*				
GOAL	.88802	*				
IMAGE	.86052	*				
COMMIT	.80112	*				
BETTER	.88526	*				
OVERALL	.96146	*				
IMPACT	.93167	*				

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 12 iterations.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.07105	.56242	.07788	.07651	.59006
COMPLETE	-.11780	.41645	.27411	.74813	.01914
ACCURATE	.62021	.34148	.37459	.46896	-.09229
RELEVANT	.64231	.13332	.29634	.17564	.40004
TIMLEY	.08237	.03061	.21670	.08308	.85385
ADAPTABL	.11578	.86919	-.03898	.13201	.16823
FRIENDLY	.49634	.76791	.08393	-.27349	-.17289
USEFUL	.38994	.05683	.24109	.14802	-.42753
FLEXIBLE	.08224	.78065	-.19166	.13120	-.03196
SECURE	-.00824	.17344	-.13269	.03847	.18107
MANUALS	.15057	.27292	-.36605	.58275	.55298
REPORTS	.07279	.11241	.03729	.00891	-.01429
RESSALE	.69881	.24440	.30239	-.19349	-.34307
OPRMKTG	.39675	.69294	.28925	.24970	.23139
SALESDEC	.27499	-.01133	.85060	.30422	.15759
MYLOAD	.95195	.05142	.09034	.09820	.01909
EMPLOAD	.94530	.09567	-.03933	.00861	.08326
GOAL	.13186	-.02251	.93131	.01656	.03199
IMAGE	.09115	.36778	.46418	.39855	.26897
COMMIT	.37303	.05959	.03554	.28947	.26809
BETTER	.40568	-.17569	.28956	.73948	.14206
OVERALL	.70292	.50782	.09852	.40657	.17867
IMPACT	.70351	.28180	.22289	.28640	.45954

---- F A C T O R   A N A L Y S I S ----

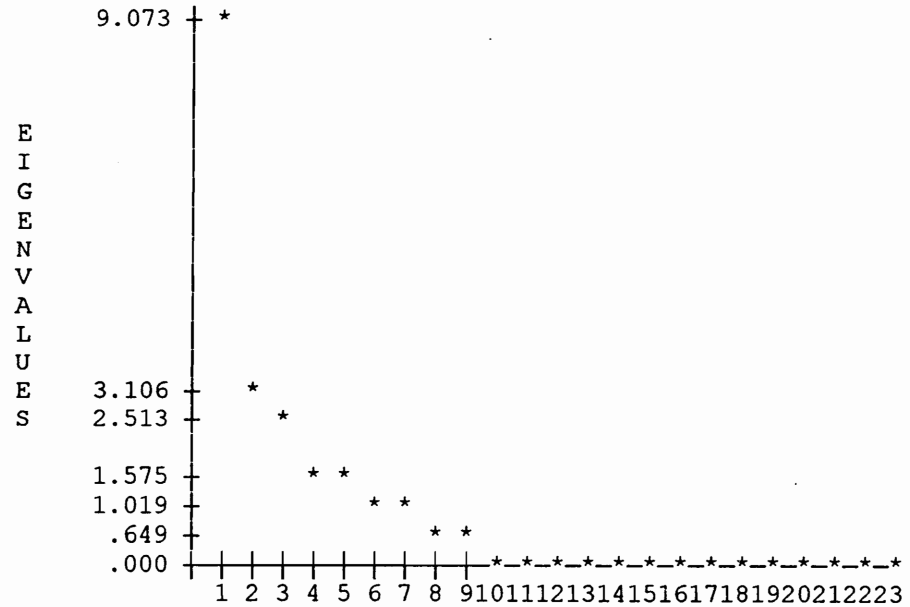
	FACTOR 6	FACTOR 7
RELIABLE	.10512	.46967
COMPLETE	.36181	.07974
ACCURATE	.12563	-.12056
RELEVANT	.21702	-.23196
TIMLEY	.22561	-.02570
ADAPTABL	.02993	-.00787
FRIENDLY	.11868	-.08826
USEFUL	.58003	-.05320
FLEXIBLE	.32746	.31475
SECURE	.80538	.00803
MANUALS	.00091	.09800
REPORTS	.05725	.97107
RESSALE	.05611	-.11410
OPRMKTG	.01719	.34791
SALESDEC	-.12304	.11523
MYLOAD	.10071	.11753
EMPLOAD	.11744	.19413
GOAL	.03402	.01848
IMAGE	-.00059	.51990
COMMIT	.68800	.16776
BETTER	.19355	.03869
OVERALL	-.02435	.04432
IMPACT	.04725	.11053

Factor Transformation Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
FACTOR 1	.63259	.47325	.30048	.36437	.25478
FACTOR 2	-.55419	.42043	-.38070	.18161	.43798
FACTOR 3	-.26784	-.52260	.53149	.44128	.41085
FACTOR 4	-.22548	.36662	.54971	-.21311	-.30494
FACTOR 5	-.35056	.10570	.21765	.28235	-.54252
FACTOR 6	.19408	-.42224	-.12965	-.15091	-.14098
FACTOR 7	-.09778	.04795	.34051	-.70115	.40898

	FACTOR 6	FACTOR 7
FACTOR 1	.23231	.18419
FACTOR 2	.08386	.37328
FACTOR 3	-.07900	.05399
FACTOR 4	-.47790	.38180
FACTOR 5	.66330	-.06735
FACTOR 6	.24413	.81547
FACTOR 7	.45254	-.09230

Scree Plot



System Three

---- FACTOR ANALYSIS ----

Analysis Number 1 Listwise deletion of cases with missing values

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
RELIABLE	1.00000	*	1	10.77364	46.8	46.8
COMPLETE	1.00000	*	2	2.15305	9.4	56.2
ACCURATE	1.00000	*	3	1.71127	7.4	63.6
RELEVANT	1.00000	*	4	1.47542	6.4	70.1
TIMLEY	1.00000	*	5	1.39379	6.1	76.1
ADAPTABL	1.00000	*	6	1.19858	5.2	81.3
FRIENDLY	1.00000	*	7	.82897	3.6	84.9
USEFUL	1.00000	*	8	.74218	3.2	88.2
FLEXIBLE	1.00000	*	9	.56278	2.4	90.6
SECURE	1.00000	*	10	.46514	2.0	92.6
MANUALS	1.00000	*	11	.42220	1.8	94.5
REPORTS	1.00000	*	12	.29942	1.3	95.8
RESSALE	1.00000	*	13	.23007	1.0	96.8
OPRMKTG	1.00000	*	14	.19865	.9	97.6
SALESDEC	1.00000	*	15	.15482	.7	98.3
MYLOAD	1.00000	*	16	.10704	.5	98.8
EMPLOAD	1.00000	*	17	.08519	.4	99.1
GOAL	1.00000	*	18	.06298	.3	99.4
IMAGE	1.00000	*	19	.04859	.2	99.6
COMMIT	1.00000	*	20	.03453	.2	99.8
BETTER	1.00000	*	21	.02302	.1	99.9
OVERALL	1.00000	*	22	.02055	.1	100.0
IMPACT	1.00000	*	23	.00813	.0	100.0

PC Extracted 6 factors.

Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.49550	.31062	-.09762	-.25421	.66526
COMPLETE	.60024	.32149	-.41383	.19994	.35421
ACCURATE	.70478	.35655	-.18353	-.10896	.07737
RELEVANT	.68887	.41621	-.32823	-.22802	.12304
TIMLEY	.64986	.49735	.10984	.14653	-.04684
ADAPTABL	.62217	-.04658	.30583	.46066	-.04718
FRIENDLY	.65492	.39150	-.15294	.13699	-.42769
USEFUL	.71240	.44728	.02641	.00398	-.30444
FLEXIBLE	.71468	-.17962	.39902	.03446	.16318
SECURE	.28016	-.08635	.11882	.44676	.27740
MANUALS	.60671	.23819	.39264	.24912	.11973
REPORTS	.71372	.32173	.01287	.20613	-.28358
RESSALE	.81136	-.36323	-.31106	-.05342	-.06645

OPRMKTG	.84222	-.36804	-.28592	-.07282	-.17304
SALESDEC	.80718	-.31886	-.27217	-.02185	.18340
MYLOAD	.80819	-.21616	-.10088	.08880	-.06197
EMPLOAD	.69176	-.32674	-.09568	.34452	-.21502
GOAL	.70778	-.32119	.03969	.08905	.31346
IMAGE	.53600	.04820	.67951	-.13791	.14921
COMMIT	.71345	-.38149	.05862	-.03209	-.09752
BETTER	.56937	.06755	.24704	-.62628	-.27927
OVERALL	.83198	-.25018	-.07700	-.29052	-.01372
IMPACT	.72073	-.09659	.35508	-.33067	-.00101

	FACTOR 6
RELIABLE	-.06403
COMPLETE	-.07146
ACCURATE	.02310
RELEVANT	.17265
TIMLEY	.18641
ADAPTABL	.11218
FRIENDLY	-.00066
USEFUL	.24939
FLEXIBLE	.15438
SECURE	.60129
MANUALS	-.48489
REPORTS	-.26771
RESSALE	-.13879
OPRMKTG	-.02978
SALESDEC	.07420
MYLOAD	-.22784
EMPLOAD	-.13434
GOAL	-.26913
IMAGE	-.16162
COMMIT	.36865
BETTER	.00448
OVERALL	.03314
IMPACT	.16171

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
RELIABLE	.86282	*	1	10.77364	46.8	46.8
COMPLETE	.80545	*	2	2.15305	9.4	56.2
ACCURATE	.67592	*	3	1.71127	7.4	63.6
RELEVANT	.85245	*	4	1.47542	6.4	70.1
TIMLEY	.74015	*	5	1.39379	6.1	76.1
ADAPTABL	.70982	*	6	1.19858	5.2	81.3
FRIENDLY	.80727	*				
USEFUL	.86317	*				
FLEXIBLE	.75390	*				
SECURE	.73815	*				
MANUALS	.89051	*				
REPORTS	.80764	*				
RESSALE	.91353	*				

OPRMKTG	.96267	*
SALESDEC	.86691	*
MYLOAD	.77371	*
EMPLOAD	.77742	*
GOAL	.78430	*
IMAGE	.81876	*
COMMIT	.80442	*
BETTER	.86001	*
OVERALL	.84640	*
IMPACT	.79036	*

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 11 iterations.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
RELIABLE	.09017	.03815	.19086	.87754	.21205
COMPLETE	.33091	.39145	-.23119	.67648	.13066
ACCURATE	.28395	.53068	.20314	.51213	.09505
RELEVANT	.25357	.54980	.24137	.64217	-.11346
TIMLEY	.04995	.68832	.19410	.29043	.23807
ADAPTABL	.33130	.34774	.07141	-.07548	.45383
FRIENDLY	.28886	.84098	.07283	.05839	.08844
USEFUL	.16071	.81388	.32838	.16023	.06061
FLEXIBLE	.38543	.10196	.45763	.13399	.41006
SECURE	.08810	.05928	-.03843	.10612	.00645
MANUALS	.18052	.32221	.06828	.18597	.84543
REPORTS	.34276	.70940	.04381	.08741	.41582
RESSALE	.89873	.20197	.15805	.18830	.06671
OPRMKTG	.90372	.27455	.23739	.11106	-.00164
SALESDEC	.79376	.11759	.17665	.36884	.03310
MYLOAD	.74823	.28300	.12540	.14186	.31169
EMPLOAD	.75553	.29603	-.04899	-.12009	.26640
GOAL	.66448	-.05741	.11335	.30364	.46646
IMAGE	.06515	.06877	.56699	.10585	.67930
COMMIT	.62632	.16577	.43460	-.01087	-.02730
BETTER	.22425	.30920	.81013	.06906	.06672
OVERALL	.70427	.19685	.48865	.25570	.06384
IMPACT	.34747	.18330	.72045	.15050	.23166

	FACTOR 6
RELIABLE	.04202
COMPLETE	.12067
ACCURATE	.03302
RELEVANT	.04859
TIMLEY	.29185
ADAPTABL	.51223
FRIENDLY	-.00663
USEFUL	.19430
FLEXIBLE	.44655

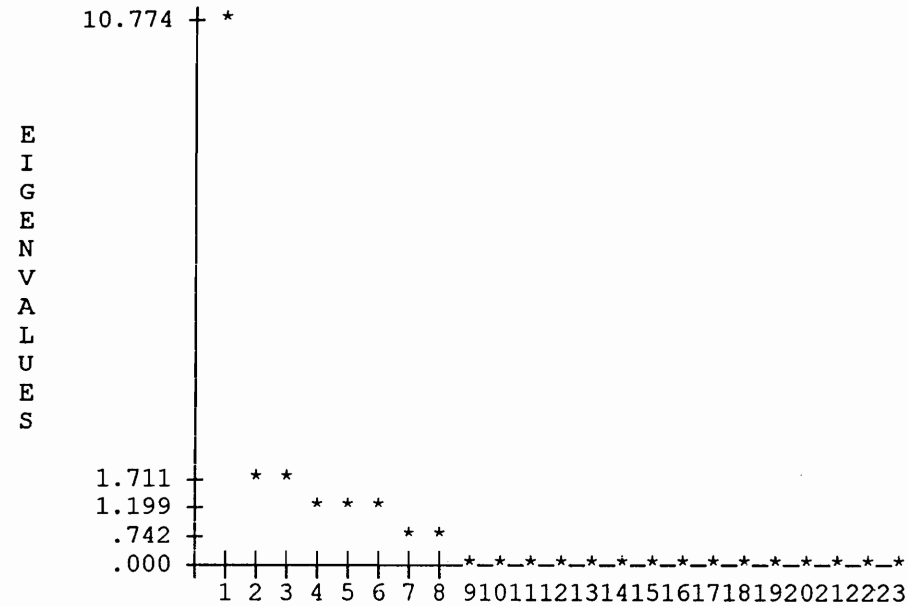
SECURE	.84504
MANUALS	-.01012
REPORTS	-.06670
RESSALE	-.01128
OPRMKTG	.04352
SALESDEC	.23383
MYLOAD	.02798
EMPLOAD	.17652
GOAL	.12975
IMAGE	.12508
COMMIT	.44149
BETTER	-.22041
OVERALL	.05844
IMPACT	.20166

Factor Transformation Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5
FACTOR 1	.64873	.47357	.34584	.31921	.30292
FACTOR 2	-.62821	.64994	-.06793	.39070	.08610
FACTOR 3	-.37663	-.13738	.50672	-.34211	.63454
FACTOR 4	.06006	.19233	-.73172	-.24858	.32836
FACTOR 5	-.10287	-.53563	-.11887	.75267	.21505
FACTOR 6	-.16870	.10264	.26358	-.01109	-.58662

	FACTOR 6
FACTOR 1	.20400
FACTOR 2	-.13509
FACTOR 3	.25067
FACTOR 4	.50436
FACTOR 5	.27501
FACTOR 6	.73979

Scree Plot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System One - Factor Analysis of Dependent Variables with Highest Loadings

---- F A C T O R   A N A L Y S I S ----

Analysis Number 1 Listwise deletion of cases with missing values

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
SECURE	1.00000	*	1	1.92877	38.6	38.6
OPRMKTG	1.00000	*	2	.98239	19.6	58.2
MANUALS	1.00000	*	3	.84832	17.0	75.2
BETTER	1.00000	*	4	.79817	16.0	91.2
ACCURATE	1.00000	*	5	.44236	8.8	100.0

PC Extracted 1 factors.

Factor Matrix:

	FACTOR 1
SECURE	.48698
OPRMKTG	.59111
MANUALS	.46491
BETTER	.75721
ACCURATE	.74343

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
SECURE	.23715	*	1	1.92877	38.6	38.6
OPRMKTG	.34942	*				
MANUALS	.21614	*				
BETTER	.57337	*				
ACCURATE	.55269	*				

WARNING 11310
FACTOR CANNOT ROTATE A ONE-FACTOR SOLUTION.

System Two - Factor Analysis of Dependent Variables with Highest Loadings

---- FACTOR ANALYSIS ----

Analysis Number 1 Listwise deletion of cases with missing values

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
MYLOAD	1.00000	*	1	2.44006	34.9	34.9
SECURE	1.00000	*	2	1.17750	16.8	51.7
ADAPTABL	1.00000	*	3	.99172	14.2	65.8
REPORTS	1.00000	*	4	.83427	11.9	77.8
TIMLEY	1.00000	*	5	.73389	10.5	88.2
COMPLETE	1.00000	*	6	.50193	7.2	95.4
GOAL	1.00000	*	7	.32064	4.6	100.0

PC Extracted 2 factors.

---- FACTOR ANALYSIS ----

Factor Matrix:

	FACTOR 1	FACTOR 2
MYLOAD	.26514	.56959
SECURE	.72718	-.32036
ADAPTABL	.74009	-.23455
REPORTS	.44014	-.21989
TIMLEY	.48599	.41674
COMPLETE	.83570	-.14738
GOAL	.40613	.67207

---- FACTOR ANALYSIS ----

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
MYLOAD	.39473	*	1	2.44006	34.9	34.9
SECURE	.63142	*	2	1.17750	16.8	51.7
ADAPTABL	.60275	*				
REPORTS	.24207	*				
TIMLEY	.40986	*				
COMPLETE	.72011	*				
GOAL	.61662	*				

---- F A C T O R   A N A L Y S I S ----

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 3 iterations.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2
MYLOAD	-.01937	.62798
SECURE	.79357	.04094
ADAPTABL	.76650	.12339
REPORTS	.49201	.00156
TIMLEY	.24662	.59079
COMPLETE	.81269	.24424
GOAL	.06045	.78292

---- F A C T O R   A N A L Y S I S ----

Factor Transformation Matrix:

	FACTOR 1	FACTOR 2
FACTOR 1	.89314	.44977
FACTOR 2	-.44977	.89314

System Three - Factor Analysis of Dependent Variables with Highest Loadings

---- FACTOR ANALYSIS ----

Analysis Number 1 Listwise deletion of cases with missing values

Extraction 1 for Analysis 1, Principal-Components Analysis (PC)

Initial Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
FRIENDLY	1.00000	*	1	2.31090	38.5	38.5
BETTER	1.00000	*	2	1.11176	18.5	57.0
RELIABLE	1.00000	*	3	.99842	16.6	73.7
MANUALS	1.00000	*	4	.71040	11.8	85.5
SECURE	1.00000	*	5	.48277	8.0	93.6
OPRMKTG	1.00000	*	6	.38574	6.4	100.0

PC Extracted 2 factors.

---- FACTOR ANALYSIS ----

Factor Matrix:

	FACTOR 1	FACTOR 2
FRIENDLY	.69845	-.18967
BETTER	.64288	-.55784
RELIABLE	.47997	.35723
MANUALS	.71203	.38948
SECURE	.33301	.65580
OPRMKTG	.74934	-.23498

---- FACTOR ANALYSIS ----

Final Statistics:

Variable	Communality	*	Factor	Eigenvalue	Pct of Var	Cum Pct
		*				
FRIENDLY	.52380	*	1	2.31090	38.5	38.5
BETTER	.72448	*	2	1.11176	18.5	57.0
RELIABLE	.35799	*				
MANUALS	.65869	*				
SECURE	.54098	*				
OPRMKTG	.61672	*				

---- F A C T O R   A N A L Y S I S ----

Varimax Rotation 1, Extraction 1, Analysis 1 - Kaiser Normalization.

Varimax converged in 3 iterations.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2
FRIENDLY	.68079	.24562
BETTER	.84663	-.08774
RELIABLE	.18796	.56803
MANUALS	.35946	.72765
SECURE	-.10377	.72816
OPRMKTG	.74847	.23773

---- F A C T O R   A N A L Y S I S ----

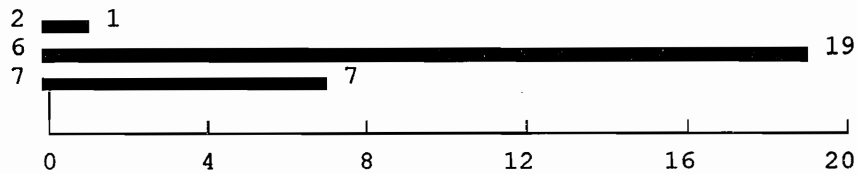
Factor Transformation Matrix:

	FACTOR 1	FACTOR 2
FACTOR 1	.81883	.57403
FACTOR 2	-.57403	.81883

Appendix O
Examination of Properties by Size and Type

System One Properties With More Than 500 FTEWs

PROPL

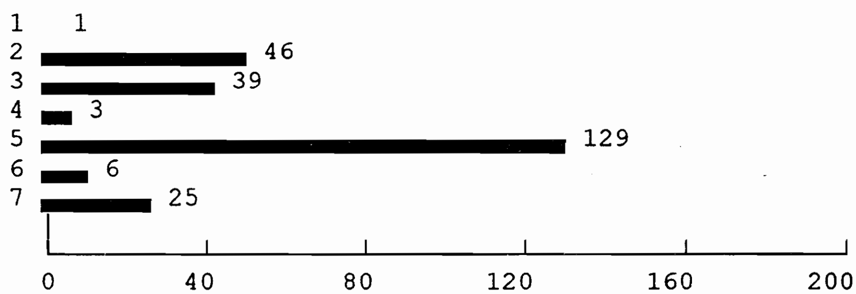


Valid cases 27 Missing cases 0

1=Highway, 2=Airport, 3=Downtown, 4=Industrial Park, 5=Suburban, 6=Convention, 7=Resort.

System One Properties With Less Than 501 FTEWs

PROPL



Valid cases 249 Missing cases 1

1=Highway, 2=Airport, 3=Downtown, 4=Industrial Park, 5=Suburban, 6=Convention, 7=Resort.

Robert Kenneth Griffin

curriculum vita

Education:

1990 - *Master of Business Administration* - Emphasis in Management Science. Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1988 - *Master of Science* - Hotel Administration. University of Nevada, Las Vegas. Emphasis in Human Resource Management. *Thesis: "A Concurrent Criterion-Related Validation Study of the Batrus Hollweg Service Questionnaire for Tableservice Food-Servers."* Las Vegas, Nevada.

1987 - *Certified Hotel Administrator.* Educational Institute, American Hotel & Motel Association. East Lansing, Michigan.

1985 - *Eastern Airlines Travel Consultant.* Eastern Airline's System-One Reservation System. Trained in Airlines Reservation System, Salesmanship, and Travel Agency Marketing. Miami, Florida.

1980 - *American Airlines Travel Consultant.* American Airline's Sabre Reservation System. Trained in Airlines Reservation System, Salesmanship, and Travel Agency Marketing. Dallas/Ft. Worth, Texas.

1976 - *Certified Firefighter.* Miami-Dade Community College. Miami, Florida.

1975 - *Bachelor of Science* - Business Administration. Florida State University. Tallahassee, Florida.

Awards & Honors:

1991 - *Outstanding Graduate Student of the Year - Department of Hotel, Restaurant and Institutional Management.* Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1991 - *Eta Sigma Delta - International Honorary Hospitality Management Society.* Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1990 - *Kappa Omicron Nu - Honor Society.* Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1989 - *Presidential Fellowship.* Virginia Polytechnic Institute and State University. Blacksburg, Virginia.

1988 - *Phi Kappa Phi - Honor Society.* University of Nevada, Las Vegas. Las Vegas, Nevada.

1988 - *Boyd Scholarship.* University of Nevada, Las Vegas. Las Vegas, Nevada.

Teaching Experience:

Asst. Prof. - Department of Hotel, Restaurant, and Travel Administration, University of Massachusetts.

- Fall 1993 to Present, Amherst, Massachusetts

Asst. Prof. - Department of Restaurant, Hotel, and Institutional Management, Texas Tech University.

- Fall 1992 through Summer 1993, Lubbock, Texas.

Instructor - Department of Hotel, Restaurant, and Institutional Management, Virginia Polytechnic Institute and State University.

- Fall 1991 through Spring1992, Blacksburg, Virginia.

Managerial Experience:	*General Manager -*	Hialeah Travel Services, Inc. Pacifico Import/Export Costa Rica Tours, Inc. Panama Tours, Inc.
		• 1981 - 1985. Hialeah, Florida.
	U.S. Operations - Manager	Club Pacifico de Panama, S.A. Club Lago, S.A.
		• 1981 - 1985. Hialeah, Florida.
	Marketing Director -	Club Pacifico de Panama Club Lago, S.A.
		• 1977 - 1980. Hialeah, Florida.
	General Manager -	Club Pacifico de Panama, S.A.
		• 1971 - 1976. Isla Coiba, Republic of Panama.

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