An empirical investigation of the adoption and usage of electronic data interchange in the hotel industry

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UMI®
AN EMPIRICAL INVESTIGATION OF THE ADOPTION AND USAGE OF
ELECTRONIC DATA INTERCHANGE
IN THE HOTEL INDUSTRY

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A dissertation submitted in partial fulfillment
Of the requirements for the

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An Empirical Investigation of the Adoption and Usage of Electronic Data Interchange in the Hotel Industry

is approved in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

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ABSTRACT

An Empirical Investigation of the Adoption and Usage of Electronic Data Interchange in the Hotel Industry

By

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This dissertation examines the application of Electronic Data Interchange (EDI) adoption and use in the hotel industry. EDI is a type of interorganizational information system that facilitates the exchange of business documents in structured, machine processable form. The research model links EDI adoption to four usages: purchasing, accounting, financing and strategic. Based on relevant literature, six theories were selected from which, nineteen hypotheses were proposed for the relationships between EDI adoption and usage.

The data were collected through a self-administered questionnaire that was mailed out to 1200 hotel manager with the title of purchasing managers, controllers, and management information systems managers. The managers had the option of mailing in the questionnaire or go to the following Web Site:

http://www.unlv.edu/faculty/ramdeen/EDIsurvey.htm and fill out the questionnaire then submit. The usable responses were 287 (23.92 rate).
The hypotheses were tested using multiple regression analysis. The analysis supports the following hypothesis: 1) EDI purchasing and financing usage is positively related to property size, 2) trading status is positively related to purchasing use, 3) business presence/feedback and quality is positively related to strategic use, 4) uncertainty is positively related to purchases and strategic use, 5) analyzability is positively related to strategic use, and 6) interdependence is positively related to purchase and strategic use.

EDI is one of the many ways hotels may exchange information. This study shows that EDI can be use by hotels for purchasing, financing and strategic purposes. For hotels to improve their internal usages of EDI two conditions must be accomplish. First, hotels must improve the information flow between their trading partners. Second, the information flow must be sufficient to stimulate intraorganizational usages.

It is anticipated that the role of EDI in hotels will continue to grow in the future. Presently, EDI in hotels are more confine to purchasing (purchase or purchase order processing), and strategic use (long-term procurement contracts and linkages to electronic funds). In the future, EDI could become an important tool for hotels to use in conducting business in both an interorganizational and intraorganizational way.

Research on EDI is still in a growth stage. By identifying and testing relevant intraorganizational variables, this study offers insights to practitioners managing internal activities within hotels that are currently using or planning to use EDI. Further, the dissertation provides avenues for future research aimed at understanding the applications of EDI technology and its administrative capabilities that could benefit both practitioners and academics.
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ACKNOWLEDGEMENTS

This dissertation denotes the completion of many years of efforts. Although I am the individual who is rewarded with the Ph.D. degree many others deserve rewards for their work and support in this endeavor. First, I would like to thank the Dean, Dr. Stewart H. Mann, and my department Chairperson, Professor Patti Shock, for their patience, understanding, and support during the last two years working for the College of Hotel Administration while pursuing my doctorate degree.

So many people have touched my life and helped me towards my goals that these pages could not possibly thank them all. However, as a group I would like to thank the faculty and staff in the College of Hotel Administration, and others at University of Nevada, Las Vegas (UNLV) who provided instruction and administrative support.

I owe a tremendous amount of gratitude to Dr. Andy Feinstein, my dissertation chair. He provided guidance in my academic development and in my career pursuits. As an adviser he has worked many hours on my behalf providing suggestions and assistance throughout my dissertation research.

Other members of the committee have been diligent and supportive in my dissertation work. Dr. John T. Bowen Director of the Ph.D. program was very helpful and supportive to me throughout my career at UNLV and provided some valuable advice on issues of research design and analysis. Dr. Michael Sullivan and Dr. Tony Lucas were
instrumental in providing valuable contribution towards improving the reliability and validity of the research through the use of more advanced statistical techniques.

Special thanks to Dr. Stowe Shoemaker for his valuable contribution in developing my survey instrument, and also for providing the source from which the sample was drawn for the survey. Special thanks also to my colleague and friend Jocelina Santos, for the encouragement and support provided during all those trying times in various classes and the dissertation process itself.

Last, but certainly not least, I want to acknowledge my family, especially my mother and deceased father. In countless ways, their existence throughout my life formed and molded the person that I am today. I will always be thankful for their values, knowledge, life experiences, and love. I have accomplished this work in honor of their sacrifices and their love for me.
CHAPTER 1

INTRODUCTION

Advances in computer and communications technology have expanded the traditional role of information systems (IS) from the creation, storage, transformation and transmission of information within an organization (intraorganizational systems), to the establishment of interorganizational systems (IOS) that exchange or share information among organizations (Kumar and Crook, 1999). Droge and Germain, (2000) have described IOS as including the hardware, software, transmission facilities, rules and procedures, data/databases, and expertise that can be shared between two or more organizations. The development and use of standards and formats for business data that can be considered as hardware and software independent, and transmittable over different types of networking services, irrespective of the type of protocol and communication speed, has ushered in a class of IOS referred to as Electronic Data Interchange (EDI).

What is EDI? There are several definitions of EDI in various publications. Each definition emphasizes a particular feature of EDI: The definition that will be used in this study is one adopted from Emmelhainz (1993). Electronic Data Interchange is an interorganizational, intraorganizational, computer-to-computer exchange of business documentation in a standard, machine-processable format in a timely manner. This definition distinguishes EDI information flow from traditional information flow shown in
Figure 1. There are a number of key points in this definition that make EDI very different from other forms of paper or electronic communications. “Interorganizational” means that EDI technology can be use for electronic processing and communication of information between trading partners. “Intraorganizational” is the use of EDI within an organization to support internal business processes between individuals, and departments. “Computer-to-computer” indicates a direct link between computer systems. “Business documentation” implies the use of official paper to support transaction flow. For example, items such as customer name, product number, quantity, unit price, and total value can be structured into an invoice or purchase order document. “Standard” means that there should be no discrepancies between the data in a purchase order and the data in an invoice because of the agreed upon method used in presenting the data. “Machine processable format” means that the data must be in some pre-established structured format and can be read and understood by the computer without human interpretation.

Figure 2 illustrates the four major groups of EDI applications that can be used in a hotel business environment. Trade Data Interchange (TDI) is the electronic transfer of trading documents such as purchase orders, invoices and acknowledgements between hotels and their trading partners. Financial Electronic Data Interchange (FEDI) is the electronic transmission of payments deposits, and remittance information between a payer, payee and their respective banks. Electronic Funds Transfer (EFT) is an automatic transfer of debits and credits between banks, where funds flow directly from the payer’s banks to the payee’s bank. Value Added Banks (VAB) are banks that act as communications and network intermediaries for their customers, combining both TDI and FEDI services (Ramdeen, 1999).
Figure 1  Traditional and EDI Information Flow

Adapted from: Emmelhainz (1993) and Sokol (1995)
### TDI (purchase order from hotel)
- **NAME**: TDI
- **DESCRIPTION**: Trade Data Interchange
- **DEFINITION**: Trading information flowing between the hotel and trading partners. No bank is involved.
- **EXAMPLE**: purchase order invoice and remittance
- **PARTICIPANTS**: Hotel-to-Vendor, Vendor-to-Hotel

### TDI (invoice from trading partners)
- **NAME**: TDI
- **DESCRIPTION**: Invoice Data Interchange
- **DEFINITION**: The movement of payments and deposit of related information between the hotel, banks and vendors.
- **EXAMPLE**: bank statement, deposit notice, and payments.
- **PARTICIPANTS**: Hotel-to-Bank, Bank-to-Vendor

### FEDI (purchase order from hotel)
- **NAME**: FEDI
- **DESCRIPTION**: Financial Electronic Data Interchange
- **DEFINITION**: The movement of payments and related information between the hotel, banks and vendors.
- **EXAMPLE**: bank statement, deposit notice, and payments.
- **PARTICIPANTS**: Hotel-to-Bank, Bank-to-Vendor

### FEDI (invoice from trading partners)
- **NAME**: FEDI
- **DESCRIPTION**: Financial Electronic Data Interchange
- **DEFINITION**: The movement of payments and related information between the hotel, banks and vendors.
- **EXAMPLE**: bank statement, deposit notice, and payments.
- **PARTICIPANTS**: Hotel-to-Bank, Bank-to-Vendor

### VAB (value added bank)
- **NAME**: VAB
- **DESCRIPTION**: Value Added Bank
- **DEFINITION**: A bank that provides both TDI and FEDI service to the hotel in order to facilitate trading with vendors.
- **EXAMPLE**: bank processed hotel's trade data
- **PARTICIPANTS**: Bank-to-Hotel, Bank-to-Bank, Bank-to-Vendor

---

Adapted from Emmelhainz (1993)

Figure 2 Four major groups of EDI applications that can be used in a hotel business environment
The purpose of this study is to explore the usage of EDI within the hotel industry. This study is motivated by three major factors. First, there is a broad diffusion of EDI usage across most industries and several success stories reported (Thierauf, 1990. Baker, 1991; Wall, 1996; and Kalakota and Whinston, 1996). Second, EDI was projected to be the ultimate technology for reengineering business operations as companies strive to be competitive and profitable (Johansson, Mehu, Pendelburg and Wheeler, 1994; Swatman, Swatman, and Fowler, 1994). Third, there is a conspicuous absence of empirical investigation of EDI usage in the hotel industry. This creates an opportunity to examine whether the concept of EDI has been utilized in the hotel industry.

Statement of the Problem

While EDI usage has been the focus of considerable research in the major industries, there is no empirical study of EDI usage in the hotel industry. The purposes of this dissertation are to determine the major factors that can influence the use of EDI within the hotel industry, and then examine areas within the hotel industry to determine that EDI usage is appropriately employed. The following research questions are explored.

1. Are there any significant descriptive variables that might explain why some hotel used EDI?

2. What are some of the areas where hotels might employ the use of EDI?

Objectives of the Study

The research objectives of this study are derived from the research model in Chapter 3, Figure 25. The model proposes three demographic variables, ten channel variables, and
six task variables. The model indicates that these variables have direct effect on the usage of EDI within the hotel industry, namely in the areas of purchasing, accounting, financing, and strategic planning.

The first objective of this study is to empirically test the impact of the demographic variables on each of the four categories of EDI usage. The second objective is to determine whether the ten channel variables proposed in the model represent factors that could influence EDI usage in the hotel industry. The third objective is to identify which of the six task variables directly impact the usage of EDI within the hotel industry. These three research objectives lead to the investigation of the following hypotheses.

**Hypotheses Relating to Profile Variables as Predictor of EDI Usage**

H1: The size of the hotel will positively influence the use of EDI.

H2: The hotel trading status will positively influence the use of EDI.

H3: The type of ownership will positively influence the use of EDI.

**Hypotheses Relating to Channel Variables as Predictor of EDI Usage**

H4: Perceived ease of use will positively influence EDI usage.

H5: Perceived usefulness will positively impact EDI usage.

H6: Perceived business presence of EDI will positively impact EDI usage.

H7: Perceived feedback will positively impact EDI usage.

H8: Perceive access will positively influence EDI usage.

H9: Perceived quality will positively influence EDI usage.

H10: Perceived economic awareness will positively impact EDI usage.

H11: Perceived distance will positively influence EDI usage.

H12: Perceived timeliness will positively affect the usage of EDI.
H13: Perceived communication configuration will positively affect EDI usage.

Hypotheses Relating to Task Variables as Predictor of EDI Usage

H14: Task complexity will positively affect EDI usage.

H15: Task uncertainty will positively affect EDI usage.

H16: Task communication will positively affect EDI usage.

H17: Task analyzability will positively affect EDI usage.

H18: Task predictability will positively affect EDI usage.

H19: Task interdependence will positively affect EDI usage.

The hypotheses are stated in the Alternative form (of which confirmation is desired) rather than the Null (of which refutation is desires). Like prior research on EDI adoption by Sultan and Chang, 2000; Kettinger, 1997; Premkumar, Ramamurthy, and Nilankanta, 1994; Grover, 1993; and Pfeiffer, 1992 this research, also states the hypotheses in the Alternative form.

A mail survey method was used to investigate these research hypotheses. Based on an extensive literature review, an instrument was developed and was pilot tested. The instrument was later mailed to 1,200 managers (purchasing managers, chief financial offices and management information system managers) from 400 hotels randomly selected from American Hotel Motel Association (AHMA).

Reliability and validity of the instrument was established with the necessary statistical tests, such as Cronbach’s alpha and factor analysis. Because this study used the cross-sectional survey method, causal inferences can be derived only based on existing theory and research.
Justification

In the hotel industry, there are three types of conditions that are definitely appropriate for conversion to an EDI system. These conditions are: people-intensive business environment; conditions that require rapid information procession; and speedy delivery of goods, and paper-intensive business processes.

The hotel industry is a people intensive business that creates a good opportunity for conversion to EDI. Often in hotels, people are being used a “paper pushers”, performing somewhat rote tasks such as handling, reading, validating, and correcting information on paper documents. By eliminating paper documents, while providing access to the same information from computer-readable and process file, a hotel positions itself to automate paper-pushing tasks. EDI can help the hotel to move people out of the paper loop into the information loop in a user-friendly and useful way (Emmelhainz, 1993).

Hotels normally require rapid information processing and speedy delivery of goods. Here EDI is a virtual necessity. Even in the most elementary form of EDI implementation, electronically transmitted and received transactions are processed in a more timely manner than its paper counterparts. EDI is more than a convenience, it is a necessity for doing business in many industries such as, retailing, automotive, healthcare, banking, transportation, and grocery (Sokol, 1995).

The business environment of a hotel is paper-intensive. Figure 3 illustrates the traditional paper based transaction systems. The traditional paper based system represents a tremendous amount of duplication of effort because copies of paper documents tend to get distributed and used as separate entities by multiple department users within the hotel. Each functional area in the hotel therefore, recreated the wheel. The purchasing
Adapted from: Emmelhainz (1993)

Figure 3  Traditional Paper Based Transactions Flow
department originates the purchase order, then accounts payables department receive a copy to match with vendor's invoice, and the receiving department uses another copy to ensure proper shipment of items. Here, each department will individually perform data entry to get the information into their various computer systems. The time and resources used for these process tasks along with the numerous errors injected into the information at each turn, increase the average processing cost of outgoing paper documents.

In Figure 3 the data are repeatedly keyed manually twenty two (22) times (Emmelhainz, 1993). It is estimated that 70 percent of all business transactions are re-keyed from one computer system to another (Kulkami and Heriot, 1999).

A hotel using EDI transaction flow in Figure 4 to process outgoing and incoming transactions receives information in electronic, machining-readable form. Information arrives faster and can be distributed automatically. In Figure 4 the data were keyed in manually only three (3) times. Such data are typically more accurate than those derived from traditional paper-based systems because they are verified for completeness and adherence to standard syntax prior to transmission (Emmelhainz, 1993).

There are three major reasons why EDI is important to the hotel industry. First, EDI can eliminate time delays associated with mailing and processing of data common to traditional paper-based systems. Data are repeatedly keyed manually 22 times in a paper-based system (see Figure 3), while using EDI it is manually keyed only three (3) times (see Figure 4). EDI can reduce the average traditional paper-based system of procurement cycle from six (6) to three (3) days (Tobey, 1995). Second, EDI can produce significant cost savings. A survey of 1500 EDI users found that companies can save between $1.60 and $ 5.20 per document processed (Tobey, 1995). Third, EDI creates an opportunity to
Adapted from: Emmelhainz (1993)

Figure 4 EDI Transactions Flow System
increase the quality of information and service provided, while at the same time improving productivity (Sokol, 1995).

This dissertation is motivated by four major deficiencies of past research efforts. First, the examination of 3005 articles written on EDI from June 1992 to May 2001 (2020 on the Neon Web Network and 985 on the ABI Inform) revealed no empirical research relating to the study of EDI adoption and diffusion within the hotel industry.

Second, EDI is both a technology as well as an administrative innovation. Therefore, it can only be explained through the use of several theoretical constructs. Third, existing studies on EDI focus almost entirely on technological innovations, with the exclusion of administrative innovation. This research will examine how administrative innovation can be used to redesign organizational procedures in order to harness the advantages offered by EDI. Fourth, market research organizations or management consultant firms frequently execute surveys on EDI utilization. However, rarely do those surveys address the core questions of what measures should be taken to overcome the perceived and/or real impediments to a rapid growth of EDI, let alone capitalize upon the empirical data gathered to test hypotheses related to EDI usage.

There is a general shortage of empirical research on EDI within the hotel industry. Consequently, the primary motivation for this study is to provide empirical research to narrow the knowledge gap associated with EDI usage within the hotel industry. From the perspective of practitioners, the study could be useful in providing a framework for evaluating EDI usage with the intention to stimulating proliferation of EDI systems in the hotel industry. For academicians this study will seek to contribute to theory building and confirmation by examining empirical data gathered.
Therefore, this proposed study is positioned to fill two voids in the current literature on EDI, first, by empirically testing the relationship between the antecedent variables and EDI usage in the hotel; second, by identifying the areas of EDI usage within the hotel operation.

This study examined nine theories that were commonly used in empirical research to explain the concept of EDI adoption and diffusion. Six of these theories (communication theory, database theory, innovation and diffusion theory, network and externalities theory, interorganizational theory, and cost benefit theory) were selected based on the seven steps (origins, measuring, logical adequacy, usefulness, generalizability, parsimonious, and testability) for theory analysis developed by Walker and Avant (1995). These six theories were found to be suitable for explaining the adoption and usage of EDI in the hotel industry.

Delimitations of the Study

The following are constraints and restrictions placed on this research.

1. The list of derived dependent variables in the research model is based on past studies of EDI usage and cannot be viewed as an exhaustive list of all possible EDI usage.
2. While most of the independent variables are adopted from prior literature, several of the items might be improved.
3. Several of the independent variables are based on single-item measures, although these single items are derived from the literature review.
4. In the model there is no examination of the relationship between varying management levels or types of decision-making and task use of EDI.
5. Due to constraints of questionnaire size, response rate and current knowledge of important variables related to EDI usage only three sets of variables that have the potential to influence EDI usage are examined.

Definitions

Operations and conceptual definitions that are critical to this study are defined below.

Adoption of EDI. Is defined as using computer hardware and software applications to support operations, management, and decision making in the business environment.

Communication. Is the process in which participants create and share information with one another in order to reach a mutual understanding.

Construct. Constructs are the basis for forming causal relationships, as they are the “purest” possible representation of a concept.

Cronbach alpha. Commonly used measure of reliability for a set of two or more construct indicators. Values range between 0 and 1.0, with higher values indicating higher reliability among the indicators.

Diffusion of EDI. Is the process by which EDI applications are communicated through certain channels over time among firms within the business community?

Factor loadings. Correlation between the original variables and the factors, and the key to understandings the nature of a particular factor. Squared factor loadings indicate what percentage of the variance in an original variable is explained by a factor.

Factor rotation. Process of manipulating or adjusting the factor axes to achieve a simpler and pragmatically more meaningful factor solution.
**Factor score.** Composite measure created for each observation on each factor extracted in the factor analysis.

**Model.** Specified set of dependence relationships that can be tested empirically—an operationalization of a theory.

**Path analysis.** Employing simple bivariate correlation to estimate the relationships in a system of structural equations.

**Reliability.** A set of latent construct indicators consistent in their measurements.

**Theory.** A systematic set of relationships providing a consistent and comprehensive explanation of a phenomenon.

**Validity.** Ability of a construct’s indicators to measure accurately the concept under study.

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**Chapter Summary**

In this chapter, a synopsis of the need for this research study was presented. After a brief introduction, the problem was stated. The theoretical foundation of the study was followed by presentation of the significance of the research hypotheses. Significance of the research hypotheses was stated in three categories: hypotheses related to profile variables, channel variables and task variables. Finally, justification of the study was provided, followed by the definitions of terms pertaining to this study.

**Organization of the Study**

This thesis is organized into five major chapters. In Chapter 1, an overview of EDI is presented, followed by statement of the problem, sub-problem, justification, research
hypotheses that are tested, delimitation of the study, and additional definitions of concepts relevant to the research.

The organization of this study follows the steps of the functionalist paradigm toward theory building: selection of a topic and statement of research question(s); survey of the literature which leads to models and a set of hypotheses; designing the research; analysis of data, and interpretation of the results in order to refine the theory (Gioia & Pitre, 1990; Schende & Hofer, 1979). In this chapter, the statement of the problem theoretical foundation, significance of research and definition of terms are presented.

In Chapter 2, the literature on the variables of the theoretical foundation supporting adoption and diffusion are established. In the second section, the relationship of the theories to the research is described. In this third section, theory formalization is explained. In the fourth section, general system theory is introduced as a new theoretical concept that could be used to explain adoption and diffusion of EDI in the hotel industry. In the last section, an integrated theoretical model for EDI practice in hotels is presented.

In Chapter 3, the research design and research method of this study are detailed. The first section presents an introduction. The established objectives for the questionnaire and survey design are presented in the second section. The third section examined the target population and survey procedures. The discussion of validity issues: randomization, common method variance, and non-response bias were presented in the fourth section. Construction of the instrument and measures are presented in the fifth section. The sixth section, hypotheses related to adoption is restated for semantic clarification through the use of extensive literature review and the model developed is shown in Figure 25.
Following a description of the research model in section seven, an explanation of the pilot study and analyses is presented in section eight.

In Chapter 4, the results of implementing the research design and methodology are presented in three sections. In the first section, descriptive statistics for the variables used in the model and assumptions of multivariate tests are described. In the second section, the research model is tested through the use of regression analysis. In the final section, for each usage construct, a separate regression is used to test the hypotheses that are reported.

In Chapter 5, the discussion and implications of findings are offered in five sections. In the first section, the results of the restated hypotheses are discussed and interpreted. In the second section is a detailed discussion of validity of findings, including statistical conclusion, internal construct and external validity. The proposed research variables and revised research model are presented in the third section. Following implications of the study for both theorists and practitioner, the future research implications, are presented.
CHAPTER 2

REVIEW OF LITERATURE

Introduction

This chapter presents a review of literature supporting the many ways in which EDI usage can occur within the business environment. The literature review is helpful in two ways. First, it locates similar or related studies, and second, it helps one to evaluate the relevancy of these studies to the research questions of interest.

There are three basic types of sources used to search for information related to the research questions. First, general references are sources used at the beginning. These general references include journal article indexes (ABI-Inform, General Business Files ASAP, and Digital Dissertation) and Library Catalog by author, title, and subjects. In effect the general references provided information on where to look and locate other sources such as articles, dissertations, books and other documents, that deal directly with research questions. Second, were primary sources that include publications in which individuals do empirical studies on EDI and report their findings in refereed journals. Third, are secondary sources that refer to publications, in which the authors described the work of others. The most commonly used secondary sources are textbooks. Other secondary sources used are trade journals and monographs.
The general references are used first to locate primary and secondary sources of EDI usage. For a quick overview of the problems associated with EDI usage the secondary sources are used. For detailed information regarding the adoption and diffusion of EDI, primary sources were investigated.

The Foundation of EDI

The logical starting point for dealing with the concept of EDI is to examine the theoretical framework that underpins EDI electronic communication. Since EDI can be considered an innovation with technological and administrative characteristics there are several theoretical concepts used to explain the EDI discipline. Some of these theories focus on one aspect of EDI. For example, Brown (1996) used ground theory; Bell (1993) used theories of externalities; and Davis (1997) used agency theory. This study examined six theories (Communication, Database, Innovation & Diffusion, Network & Externalities, Interorganizational and Cost/Benefit Theory) illustrated in Figure 5 to explain the discipline and practice of EDI in relationship to its usage.

EDI is a practice discipline. Its practitioner is directly engaged in providing technology and administrative services to business of all sizes. The breadth of EDI practice and the varied endeavors that support it indicate that EDI is a complex discipline. Every complex discipline has theoretical development, and EDI with its complexity and varied dimensions is no exception as a practice discipline.

Theory development provides a way of identifying and expressing key ideas about the essence of EDI practice. Through theory development that essence may be explored in
Figure 5  A Framework for Evaluating Hotel EDI Business Applications
terms of general or more delimited descriptions of explanations of the business firm's usage, benefits, adoption, diffusion environment, and EDI—the metaparadigm concepts. For example, the essence of practice may be studies in a delimited way by focusing on specific events that occur in specific contexts such as transactions movement during purchasing or just-in-time strategies of firms using EDI. In contrast a more abstract theory development may focus on the overall architecture of the firm environment as it relates to EDI adoption and diffusion. Regardless of how grand or delimited in scope, EDI theory development is aimed at helping academics and professionals to understand EDI practice in a more complete and insightful way.

Interest in theory development associated with EDI emerged for two basic reasons. First, EDI theory development is a means of clearly establishing EDI as a practice discipline with a “body of knowledge.” Therefore, interest in the body of knowledge stemmed in part from the extrinsic value of the body of knowledge to the practice discipline of EDI. The second reason for interest in EDI theoretical development is motivated by the intrinsic value of theory for EDI. Simply stated, growth and enrichment of theory are important to EDI as a field of study regardless of other values it might have (practical or economic). Commitment to practice based on sound reliable knowledge is intrinsic to the idea of a professional and practice discipline. As the foundation for professional knowledge, theory provides a more complete picture for practice than factual knowledge alone. Theories include more aspects of practice and integrate them more fully than factual knowledge. In addition, theories that are well developed not only organize existing knowledge but also aid in making new and important discoveries to advance the discipline (Walker & Avant, 1995).
Theory Analysis and Evaluation

Dubin (1976, p.33) points out, “It is impossible to separate theory and research since the function of each is dependent upon the realization of the other”. A theory can be defined as “a system of constructs and variables in which the constructs are related to each other by propositions and variables are related to each other by hypotheses” (Bacharach, 1989, p. 498). In his work, Whetten (1989) states four building blocks of theory development: (1) what, (2) how, (3) why, and (4) who, where, when. What refers to factors that should be considered as part of the explanation of the phenomenon of interest. How explains the relation of factors. Why describes the logic underlying the model. Who, where, when confine the generalizability of the theory. According to Whetten (1989), why is the most difficult part of theory development and usually embraces borrowing a viewpoint from other fields. Fry and Smith (1987, p. 130) state:

Theories of organization address themselves to real-world problems through two distinct goals of science: the quest for (a) understanding, and (b) prediction. Understanding means possessing knowledge about the relationships among the units of a theory and places our focus on the process of how the theoretical system operates. The primary focus of prediction is on outcomes so that we can foretell the values of the units making up a system, in order to anticipate the condition or state of a system as a whole.

The quest for understanding and prediction is addressed in this study by developing a model that bears perspectives that are borrowed from communication theory, database theory, innovation & diffusion theory, network & externalities theory, interorganizational theory and cost/benefit theory. The relationship between EDI adoption and diffusion and
its relations to hotel usage was examined by employing the above theories. As Jemison (1981) argues, integration of ideas and findings from different disciplines helps increase our understanding of the phenomena being studied.

Definition and Description

A theory is a set of interrelated relational statements about a phenomenon that is useful for description, explanation, prediction, and control (Hempel, 1965; Reynolds, 1971; Chinn & Jacobs, 1987; Hardy, 1974). It is usually constructed because it expresses a new unifying idea about a phenomenon that answers previously unanswered questions and provides new insights into the nature of the phenomenon. A theory attempts to provide a parsimonious, precise example, or model, of the "real world" or the world as it is experienced (Blalock, 1969).

Theory analysis is the systematic examination of the theory for meaning, logical adequacy, usefulness, generality, parsimony, and testability. It is clear that a theory purporting to explain or predict something should provide the events that affect it and how it affects other phenomena (Kaplan, 1964).

In the analysis strategies, the theory is broken into parts. The parts are examined individually and in relation to each other. In addition, the theoretical structure as a whole is examined for such things as validity and approximation to the "real world."

Purposes and Uses

There are two basic purposes for doing theory analysis. The first is to determine the strengths of the theory, and the second is to determine the weaknesses of the theory. In
addition to these two primary focuses, theory analysis is used to help determine if there is a need for additional development or refinement of the theory.

Theory analysis is useful because it provides a systematic, objective way of examining a theory that may lead to insights and new formulations not seen before. This then adds to the body of knowledge of the discipline. As Popper (1965) has pointed out, science is interested in novel ideas and interested in theories because it is their very novelty or interest that provides the scientist with the impetus to put them to empirical test. Theory analysis is one way of determining "what" needs to be put to the test and often suggests "how" it can be done.

Six major theories (see Figure 5) are examined to determine their possibilities of being useful in either an educational, business practice, or research setting. The primary purpose for doing the theory analysis prior to using the theory in education and business practice is to determine the strong points that the theory offers to guide EDI business practice. A secondary purpose is to look for weak points in the theory or the linkages not yet determined between concepts. The reason for this is to provide evidence that the research needs to justify conducting a study on some new or unclear relationships within the theory.

Procedures Used For EDI Theory and Research Analysis

The steps in theory analysis are (1) to determine the origins of the theory, (2) to examine the meaning of the theory, (3) to analyze the logical adequacy of the theory, (4) to determine the usefulness on significance of the theory, (5) to define the degree of generalizability, (6) to define the parsimony of the theory, and (7) to determine the
testability of the theory. These steps have been synthesized from the works of Popper (1961, 1965), Reynolds (1971), Hardy (1974), Fawcett (1980, 1989), and Chinn and Jacobs (1987). Each of the steps will be defined here briefly and then discussed individually in detail.

The origins of a theory refer to the original development of the theory. The analyst will be interested in what prompted its development, whether or not it is inductive or deductive in form, and whether or not there is evidence available to support or refute the theory. From the reading it is determined how much research supports and how much refutes the statements in the theory. To do this the hypotheses in the research studies are examined.

If they are in the “null” form, stating that there will be no relationship between the variables and the hypothesis is rejected, it supports the theory (Kerlinger, 1986). If it is accepted, implying no relationship, then it refutes the theory. This sounds confusing, but it is only a function of the way the mathematics work. Rejecting a “null” hypothesis is like stating a double negative in English grammar; two “no’s” make a “yes.” If the hypothesis is rejected it refutes the theory and if it is accepted it supports the theory.

The origin of a theory and the purpose for which it is developed are often very helpful to the researcher in understanding how the theory is put together and why. In addition, we can find out if the theory is developed deductively (from a more general law) or inductively (from data). If the theory is developed from another theory or from some other hypothesis, it can be considered deductive in origin. If the theory is generated by observing relationships from data or from field research or from business practice, it is considered inductive in origin. When attempting to determine logical adequacy the
inductive or deductive form will be important. Finally, it is often helpful to identify any underlying assumptions of the theory. The assumptions on which theories were built can be important in interpreting them. They may also be important when considering the usefulness of the theory. Once these preliminary activities are accomplished the formal analysis begins.

The meaning (Hardy, 1974) of a theory has to do with the theory's concepts and how they relate to each other. Essentially, the meaning is reflected in the language of the theory. So examining the meaning implies examining the language the theorist has used.

To analyze the meaning of a theory, it is necessary to examine the language of the theory. To do this one must look at the concepts and statements within the theory. The steps are to identify the concepts, examine their definitions and use, identify the statements, and examine the relationships between concepts as demonstrated in the statements.

The logical adequacy (Hardy, 1974) of a theory would be the logical structure of the concepts and statements independent of the meaning of those concepts or statements. The researcher will be looking for any logical fallacies in the structure of the theory. In addition, the accuracy with which predictions can be made from the theory will be examined. Determining the logical adequacy of a theory can get very complicated if it is inclined toward linguistic philosophy that is based on formal logic. Since this is basically an empirical study it is not necessary to go into linguistic philosophies. However, the following are taken into consideration: (1) Is there a system whereby predictions could be made from the theory independent of its content? (2) Can researchers in the discipline in which the theory is developed agree on those predictions? (3) Does the actual content
make sense? And, (4) Are there obvious logical fallacies (Hardy, 1974)?

The usefulness of the theory has to do with how practical and helpful the theory is to the discipline in providing a sense of understanding and/or predictable outcomes (Reynolds, 1971). If the theory provides new insights into a phenomenon, if it helps the researcher to explain the phenomenon better or differently, or if it helps the researcher to make better predictions, then it is a useful theory (Berthold, 1968). It adds significantly to the body of knowledge. If the theory does none of these things it is not a useful theory.

To determine the usefulness of a theory, the analyst must consider three issues: (1) How much research has the theory generated (Reynolds, 1971)? (2) To what EDI problem is the theory relevant (Bamum, 1989)? And (3) Does the theory have the potential to influence EDI practice, education, administration, or research (Meleis, 1990)? It is at this point in the analysis that the content becomes important. One cannot answer these three questions without considering the content of the theory. If the theory contains subject matter that is already in the business domain, it should shed new light on the phenomenon or should provide information that allows clarification, new predictions, or the exertion of control where none previously existed. If the theory covers subject matter that has not been in the business domain, it should make some significant difference in that field of business in which it is developed. The theory should generate a significant number of research studies if it is useful. It should be relevant, or at least potentially relevant, to EDI practice setting. It should be capable of influencing, or potentially capable of influencing, EDI practice, education, administration, or research (Meleis, 1990).
Generalizability, or transferability, refers to the extent to which generalizations can be made from the theory. The more widely the theory can be applied, the more generalizable it would be. The criterion of generalizability or transferability (Lincoln & Guba, 1985) refers to how widely the theory can be used in explaining or predicting phenomena. Generalizability can be determined by examining the boundaries of the theory and by evaluating the research that supports the theory. The boundaries of the theory are content related and have to do with how wide the focus of the content would be. The wider the focus of a theory, the more generalizable it is likely to be. The more broadly it can be applied, the more generalizable it would be.

The research evidence that supports the theory is also important in determining generalizability. If the research evidence is sound, meaning valid and with adequate sample size and reproducible, the theory would be more generalizable than one in which there is little support or the research support is of poor quality. In order to determine the adequacy of theoretical support some skill in research critique is required.

Parsimony refers to how simply and briefly a theory can be stated and still be complete in its explanation of the phenomenon in question. In other words it is how simple or complex the theory is in explaining the phenomenon it purports to explain. A parsimonious theory is one that is elegant in its simplicity even though it may be broad in its content. Perhaps the best example of parsimony is from Einstein’s theory of relativity, $E = mc^2$. This particular statement of the theory revolutionized physics and is very broad in its boundaries but is very simple in its expression. That is parsimony, to explain a complex phenomenon simply and briefly without sacrificing the theory’s content, structure, or completeness (Fawcett and Downs, 1985).
Not all theories are developed to this point. Most theories, especially those in the behavioral sciences, cannot be reduced to such a mathematical model. The researcher must examine the theory to see if its formulations are as clear and as brief as they can be. The propositions or relational statements should be precise and should not overlap. If there are several statements, one should determine if some of them could be reduced to one or two broader, more general, relational statements (Mullins, 1971).

In addition, it is necessary to look for a model or diagram of the theoretical relationships. Many theorists provide models as a way of helping themselves and others visualize the relations of the concepts to each other. If such a model is provided, it should accurately reflect the verbal material in the theory. It also actually helps make the theory clearer. If it does not help clarify the verbal material, it is not a useful model and does not aid in increasing the parsimony of the theory (Stember, 1986).

Testability has to do with whether or not the theory can be supported with empirical data. If a theory cannot generate hypotheses that can be subjected to empirical tests through research, it is not testable. There is some discussion among philosophers of science as to whether or not the criterion of testability is crucial to theory (Hempel, 1965; Popper, 1965; Reynolds, 1971). The debate seems to center on whether or not a theory that provides a great deal of understanding but that by its nature is un-testable is a legitimate theory. It seems that even a theory that by its nature is un-testable as a whole may yield testable hypotheses and relational statements that lend support to the total theory.

For a theory to be truly valid, it must be testable at least in principle. This implies that hypotheses can be generated from the theory, research carried out, and the theory
supported by the evidence or modified because of it. A theory that has strong empirical
evidence to support it would be a stronger theory than one that does not. If a theory
cannot generate hypotheses, it is not useful to researchers and does not add to the body of
knowledge (Dobin, 1978).

Each of these seven steps is important in the selection of the six theories in Figure 5
that is used to explain the EDI discipline. According to Walker, and Avant (1995), no
theory analysis would be complete without including all seven steps. The value assigned
to each theory rests primarily on what the analysis reveals. However, it will also reflect
the researcher’s own feelings and biases to a certain extent. This is to be expected.
because no research is ever completely objective.

Table 1 summarized theory analysis using the seven steps. This analysis is to provide
an insight into the relationships among the concepts and linkages to each other that the
strategy provides. In addition, this analysis shows up the strengths of the theory as well as
its weaknesses. From the analysis it is determined whether or not the theories are useful
for EDI practice and/or research or whether the theories need additional testing and
validation before use. Where a theory indicates untested linkages through the analysis,
then, those linkages should be later tested. This can help to strengthen the theory and
adds to the body of knowledge.

The major limitation of theory analysis is that analysis only examines parts and their
relationship to the whole. It can only expose what is missing, but cannot generate new
information. In addition, theory analysis requires evaluation and criticism of supporting
evidence. If the researcher is limited in the critical skills of research evaluation, important
Table 1
Criteria Used to Evaluate Theory and Research in Prior EDI Studies

<table>
<thead>
<tr>
<th>Criteria for Evaluation</th>
<th>Communication Theory</th>
<th>Database Theory</th>
<th>Innovation and Diffusion Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Origins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the original development of the theory inductive?</td>
<td>Yes: Stated</td>
<td>Yes: Stated</td>
<td>Yes: Implied</td>
</tr>
<tr>
<td>Was the theory deductively developed?</td>
<td>Yes: Stated</td>
<td>Yes: Stated</td>
<td>Yes: Implied</td>
</tr>
<tr>
<td>2. Measuring</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Were the concepts clear and consistent?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Were the propositions structured and consistent?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3. Logical Adequacy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the theory empirically adequate?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Was operational adequacy evident?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4. Usefulness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was the theory practical and helpful to the discipline?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5. Generalizability</td>
<td></td>
<td></td>
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<tr>
<td>Was the sample size adequate and randomly selected?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>6. Parsimonious</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Was the theory stated clearly and concisely?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>7. Testability</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Were the concepts empirically observed?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Were the propositions measured?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### Table 1

<table>
<thead>
<tr>
<th>Criteria for Evaluation</th>
<th>Network &amp; Externalities Theory</th>
<th>Interorganizational Theory</th>
<th>Cost/Benefit Theory</th>
</tr>
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information regarding the soundness of a theory may be disregarded or misinterpreted. This results in a limited analysis and may yield unsatisfactory results.

Theory analysis provides vital information for the further development of a theory. It is a very helpful strategy for exposing areas that need further work. However, theory analysis is the process of systematically examining a theory for its origins, meaning, logical adequacy, usefulness, generalizability, parsimony, and testability. Each of these seven steps stands alone in a theory analysis and yet each is related to the other. This paradoxical relationship is generated by the act of analysis itself. To do a thorough analysis, one must consider each of the steps, giving them all careful attention. The results of each of the steps are interdependent on the results of the others (Kuhn, 1970).

If concepts are undefined and statements are only definitional in nature, the logical adequacy, usefulness, generalizability, parsimony, and testability of the theory is affected. If the meaning is adequately handled but the logical structure is missing or fallacious, then usefulness, generalizability, parsimony, and testability are severely limited. If a theory is not testable and does not generate hypotheses, it is not useful, generalizable, parsimonious, or particularly meaningful. So each step is independent and yet interdependent as well. It is this interdependence that makes the strategy so useful in theory construction. The analysis strategy provides a mechanism for determining the strengths and weaknesses of the theory prior to using it as a guide to practice or in research. With theory analysis, linkages that have not been examined become obvious. This, in turn, should lead to additional testing, thus adding support to the theory or pointing out where modifications need to be done (Lakatos, 1970).
Theory analysis often leads to new insights about the theory being examined, thus adding to the body of knowledge. Finally, theory analysis is one way of promoting additional theory construction by pointing out where additional theoretical work is needed. When pointing out where additional theoretical work is needed, it is helpful to remember that comparing anything to the ideal tends to stifle development (Zetterberg, 1965). The best approach is to compare the analyzed theory to similar theories at the same stage of development.

Why use theories to explain the concept of EDI? Theories provide scientific analysis and standardization, with agreed-upon definitions, and set referents. These six theories (see figure 5) were not just abstract or academic. They provide a more efficient explanation regarding the discipline of EDI. Some of these theories are descriptive (how things exists) or prescriptive (how things should be done). By analyzing these theories the researcher obtains a sense of how scholars and practitioners attempted to discuss, predict, and recommend practices and outcomes in the area of EDI adoption and diffusion. The following discussion will provide detailed information on the six theories selected.

Information Theory

Information theory is sometimes called communication theory (Pierce, 1980). Information theory is the science that deals with the concept “information”, its measurements and its applications (Van der Lubbe, 1997). The earliest attempts to define a measure of information were made by Nyquist (1924). Fisher (1925) and Hartely (1928) in their general theory of communication. However it was Shannon (1948) that laid the foundation for information theory by extending the general theory of
communication to include new factors such as the effect of noise in the communication channel, and the probability of error and the rate of data transmission specified independently. He came to realize that communication at its most fundamental level was a probabilistic process. Shannon's work on information theory came from the above realization.

Application of Information Theory

Information theory is a discipline centered around a common mathematical approach to the study of the collection and manipulation of information. It provides a theoretical basis for such activities as observation, measurement, data compression, data storage, communication, estimation, decision-making, and pattern recognition. Many complex and expensive systems are built for automating or expanding these operations. As the systems become more sophisticated and performance requirements are increased, one must rely more and more on mathematical models to design systems that meet the performance requirements (Feinstein, 1954, Fano, 1961, and Gallager, 1965).

Information theory provides a guide to the developments of information-transmission systems based on a study of the possibilities and limitations inherent in natural law. There are many perspectives, rooted in mathematics and physics, from which one can seek this understanding; information theory is one such perspective. Information theory is the study of how the laws of probability, and of mathematics in general, describe limits on the design of systems. A most important reason for the study of information theory is the insight that it affords into the design of information-transmission systems. By developing a clear concept of information and its transmission,
a much deeper understanding of the purposes and limitations of a technique are obtained. This insight can guide research and systems design into more productive directions and has been one of the major successes of information theory.

By far the most important area of application of information theory at the present time is to the problems of communication. Currently, the optimum method (or family of methods) for transmitting data over a noisy channel is, in general, unknown. This is especially true when the information content of the data is greater than the information capacity of the channel, which is often the case since many information sources have a continuously distributed output, and hence infinite information content. It is not possible to transmit the output sequence of such a source over any real channel without distortion. By introducing the concept of the information capacity of a channel or of the information content of a source under a given distortion measure, information theory describes exactly the optimum performance of communication systems. In addition, it develops a theoretical framework, which provides a means for rationally designing such communication systems (Cover, 1972; Slepian and Wolf 1973; and Blahut, 1987).

Digital point-to-point communication systems, including satellite communications, telephone-line modems, and magnetic recording systems, now use sophisticated waveforms in which the data streams are interlocked in complex ways. Data are no longer transmitted and received one bit at a time serially; rather it is transmitted and received at the higher level of bit packages or bit streams. Information theory provided the guidance for the development of these modern methods and also shows how much room for improvement remains.
Digital multi-terminal communication systems are more complex than digital point-to-point communication systems, and their theory is less well understood. At the present time, researchers are developing many digital, multi-terminal systems in an ad hoc way, while theoreticians are grappling to provide a rich enough theory that can aid researchers with new methods and new insights.

Models of Communication

The single most important contribution to the widespread interest in communication models today is Shannon’s 1948 paper on: “A Mathematical Theory of Communication” (Johnson and Klare, 1961). Shannon’s general communication model defined the communication systems using five elements shown in Figure 6.

First in the process is the information source, which produces a sequence of messages or chain of messages communicated to the receiving terminal. The message may be of various types such as e-mail or fax. In the next step, the message is formed into signals by a transmitter. The transmitter operates on the message to produce a signal suitable for transmission over the channel. The channel is merely the medium used to transmit the signal from transmitter to receiver. It could be a pair of wires, coaxial cable or a band of radio frequencies. The fourth element of a general communication system is the receiver. The receiver decodes the information from the signal received and reconstructs the message. Finally the received message reaches the destination (a person or thing) that the message is intended to reach. Within this communication system there exists noise. Noise, in information theory, is anything that impedes communication. Communication
Adapted from: Shannon (1948)
Figure 6  Shannon's Schematic diagram of a general one-way communication system
in Shannon’s model is described as a linear, one-way process. The model states five functions to be performed and notes one dysfunctional factor, noise.

The contemporary criticism of Shannon’s model is its linear, one-way flow of information. Critics insisted that communication is a two-way process of message exchange. Schramm (1954) created one of the first two-way models of communication. However, it is DeFleur (1970) who built on Shannon’s linear general communication one-way model to embody the concept of two-way interactional or transactional communication. He emphasized communication as a process of message exchange rather than message transmission (see Figure 7).

Figure 7 presents a schematic model for the basic components of an interactional communication. DeFleur (1970) indicated that in the communication process meaning is transformed into message. He shows how the transmitter transforms message into information by passing through a channel. The receiver decodes the information into a message that is transformed at the destination into meaning. DeFleur add feedback to Shannon’s model to produce a more effective way of communicating to the destination, thus supplementing Shannon’s model in a very important way.

DeFleur’s interactional communication model describes mediated, asynchronous communication in which messages are alternately exchanged among parties like electronic mail (e-mail) systems. DeFleur’s model is considered to be a transactional model of communication in which both parties are actively and simultaneously exchanging information. This type model is suitable for communication between organization (Gayeski, 1993) It is important to take into account that exchange of
Adapted from: DeFleur (1970)
Figure 7 Two-way Communication Channel
information between organizations is conducted through individual or groups at different locations involving the use of different number of media technologies. DeFleur's communication model with its concepts of two-way communication is used to assist with the development of an EDI communication model.

Database Theory

The second major component of EDI systems besides a communication module are databases. The architecture of database systems is commonly described by a three-level organization, which is illustrated in Figure 8 (Elmasri and Navathe, 1994). Essentially, it distinguishes between an internal and an external view of a database, where the former is relevant for systems professionals who are interested in particular design and implementation features of the database systems, and the latter refers to the perspective of end-users who access the database for the purpose of executing (business) transactions.

To bridge the gap between both views, a conceptual schema is created which, in machine readable form, describes the information contained in the database. This schema is known as the database management system (DBMS), which is an integrated software package that controls access to and manipulation of the contents of the database system on all three levels. Moreover, the conceptual schema requires that internal and external views be always consistent with it (Riccardi, 2001; Davis & Olson, 1995).

Given the assumption that the database serves an entire organization, a typical user would only be interested in a certain portion of the database, the external view of that particular user. A description of a view has been called a schema, and therefore external
Adapted from: Elmasri and Navathe (1994)

Figure 8 The Three Levels of Architecture of a DBMS
views are defined by subschemas that are subsets of the conceptual (logical) schema of
the overall database (Riccardi, 2001; Sloman & Kramer, 1987).

Several, not necessarily mutually exclusive methodologies for database design, are
found in practice. Besides the more frequently used top-down approach, which seeks to
determine a suitable design through a process of continuous refinement, the “view
integration” method, according to which user views are elicited (e.g., through interviews)
and later combined into the conceptual (logical) schema, has received considerable
attention (Navathe, Elmasri and Larson, 1986; Yannakoudakis, 1988; and Spaccapietra
and Parent, 1990). The conceptual schema is a comprehensive description of the entire
information content of the database in a logical sense, which means that those objects and
relationships between objects that are relevant to the organization are being described in a
machine-processable data description language (DDL) in terms of data structures and
referents (Frank and Taylor, 1976). At the same time, the conceptual schema provides
data independence and shields the external views, which are used by application
programs to access the database, from details about the physical storage of the data. In
this way, the conceptual schema represents a formalized model of the particular “slice of
reality” about which the organization needs to keep data (Klein and Hirschheim, 1987).
Finally, the internal view represents the lowest level of the architecture, the schema of
which specifies how the data are actually stored on storage devices, access paths, etc. The
term “conceptual”; is reserved for an even more abstract (“semantic”) definition of the
database that is completely independent of any database model. This conceptual level
describes the organization’s data in terms of entities and relationships between those
entities (Ozsu & Valduriez, 1991; Peckham & Marynski, 1988).
The motivation for such a three-level database system architecture emerged from the desire to separate the end-user requirements for access to the organization's data as much as possible from the technical considerations associated with gathering, storing, and administrating this data. To accept such a layered architecture of database systems, it is easy to see how a typical end-user accessing the system invokes a series of communication processes. First, by means of some query language (QL), data manipulation language (DML), or application program, the user selects a message from the set of all messages available (or derivable) through the external view. This message is then forwarded via a mapping function to the conceptual/logical schema of the database. If the message meets certain integrity constraints, it is mapped to the internal schema where the requested operation is physically executed. The system eventually returns one or several messages (e.g., information or status messages) to the user. Thus, accessing a database can be viewed as a communication process (Elmasri & Navathe, 1994).

Three-level Architecture

In this section the generalized architecture of a database system called the American National Standards Institute/Standards Planning and Requirements Committee (ANSI/SPARC) model is described. A large number of commercial systems and research database models fit this framework. The architecture, shown in Figure 8, is divided into three levels: (1) the external level, (2) the conceptual level, and (3) the internal level.

The view at each of these levels is described by a scheme. A scheme is an outline or a plan that describes the records and relationships existing in the view. The word scheme, which means a systematic plan for attaining some goal, is used interchangeably in the
database literature with the word schema. The word schemas is used in the database literature for the plural instead of schemata, the grammatically correct word. The scheme also describes the way in which entities at one level of abstraction can be mapped to the next level (Codd, 1990 a & b; Walsh, 1983; Davenport, 1981).

**External or User View**

The external or user view is at the highest level of database abstraction where only those portions of the database of concern to a user or application program are included. Any number of user views (some of which may be identical) may exist for a given global or conceptual view (Hogan, 1990; Litwin & Abdellatif, 1986).

Each external view is described by means of a scheme called an external schema. The external schema consists of the definition of the logical records and the relationships in the external view. The external schema also contains the method of deriving the objects in the external view from the objects in the conceptual view. The objects include entities, attributes, and relationships. (The terms view, scheme, and schema are sometimes used interchangeably when there is no confusion as to what is implied.)

**Conceptual or Global View**

At this level of database abstraction all the database entities and the relationships among them are included. One conceptual view represents the entire database. This conceptual view is defined by the conceptual schema. It describes all the records and relationships included in the conceptual view and, therefore, in the database. There is only one conceptual schema per database. This schema also contains the method of deriving the objects in the conceptual view from the objects in the internal view (Rogers and Kincaid, 1981; Ram & Chastain, 1979).
The description of data at this level is in a format independent of its physical representation. It also includes features that specify the checks to retain data consistency and integrity (Hogan, 1990; Mark & Roussopoulos, 1987).

**Internal View**

This view is at the lowest level of abstraction, closest to the physical storage method used. It indicates how the data will be stored and describes the data structures and access methods to be used by the database. The internal view is expressed by the internal schema, which contains the definition of the stored record, the method of representing the data fields, and the access aids used.

**Mapping Between Views**

Two mappings are required in a database system with three different views as shown in Figure 8. A mapping between the external and conceptual views gives the correspondence among the records and the relationships of the external and conceptual views. The external view is an abstraction of the conceptual view, which in its turn is an abstraction of the internal view. It describes the contents of the database as perceived by the user or application program of that view. The user of the external view sees and manipulates a record corresponding to the external view. There is a mapping from a particular logical record in the external view to one or more conceptual records in the conceptual view (Stallings, 1994; Sheth & Larson, 1990).

Similarly, there is a mapping from a conceptual record to an internal one. An internal record is a record at the internal level, not necessarily a stored record on a physical storage device. The internal record of Figure 8 may be split up into two or more physical

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records. The physical database is the data that is stored on secondary storage devices. It is made up of records with certain data structures and organized in files. Consequently, there is an additional mapping from the internal record to one or more stored records on secondary storage devices. This may have been implemented using some form of nonlinear addressing. The internal record is assumed to be linearly addressed. However, this complexity is managed by the DBMS and the user need not be aware of its presence nor be concerned with it (Stallings, 1994; Campbell-Grant, 1988).

Mapping between the conceptual and the internal levels specifies the method of deriving the conceptual record from the physical database (Walsh, 1983). Again, differences similar to those that exist between external and conceptual views could exist between the conceptual and internal views. Such differences are indicated and resolved in the mapping (Frank, 1988; Sarich, 1988).

Such mapping between the conceptual and internal levels is a correspondence that indicates how each conceptual record is to be stored and the characteristics and size of each field of the record. Changing the storage structure of the record involves changing the conceptual view to internal view mapping so that the conceptual view does not require any alteration (Bass, 1989; Tsichritzis & Lochoisky, 1982).

The conceptual view can assume that the database contains a sequence of records of each conceptual record type. These records could be accessed sequentially or randomly. The actual storage could have been done to optimize performance. A conceptual record may be split into two records, with the less frequently used record (part of the original record) on a slower storage device and the more frequently used, record, on a faster device. The stored record could be in a physical sequence, or one or more indices may be
implemented for faster access to record occurrences by the index fields. Pointers may exist in the physical records to access the next record occurrence in various orders. These structures are hidden from the conceptual view by the mapping between the two.

Three levels of abstraction, along with the mappings from internal to conceptual and from conceptual to external, provide two distinct levels of data independence: logical data independence and physical independence (Elmasri and Navathe, 1994).

Logical data independence indicates that the conceptual schema can be changed without affecting the existing external schemas. The change would be absorbed by the mapping between the external and conceptual levels. Logical data independence also insulates application programs from operations, such as combining two records onto one or splitting an existing record into two or more records (Bakkenist, 1990; Kemezis, 1987; Tsichritzis & Lochofsky, 1982).

Physical data independence indicates that the physical storage structures or devices used for storing the data could be changed without necessitating a change in the conceptual view or any of the external views. The change would be absorbed by the mapping between the conceptual and internal levels.

Logical data independence is achieved by providing the external level or user view of the database. The application programmers or users see the database as described by their respective external views. The DBMS provides a mapping from this view to the conceptual view. The view at the conceptual level of the database is the sum total of the community view (current and anticipated) of the database. There will be many external views, but only one conceptual view of a database. The users are only interested in that
portion of the database that is described by their external view. It is an abstraction of the physically stored data and the user manipulates this abstraction (Rob and Coronel, 2000).

**Data Dictionaries and Administration**

A data dictionary, in concept, is somewhat like a word dictionary. Within a data dictionary reside the terms used to identify the data elements used in computer applications, as well as the terms used to define the components found in computer networks. Data and information are defined in terms of fields, records, files, databases, and data elements. Network components include terminals, computers, peripheral devices, and communication lines. Each field, record, file, database, data element, terminal, computer, peripheral device, and communication line can appear in a data dictionary, along with its attributes and characteristics (Fortier, 1997).

The term data dictionary can imply either of two things (Wertz, 1986): (1) a set of files or a database containing the kind of information mentioned above, or (2) a software product consisting of some programs and having the potential for creating the set of files or a database containing the kind of information described in the first entry. Webster's dictionary had to be written originally and it requires periodic maintenance and modification. The same is true for a data dictionary. The schematic in Figure 9 illustrates a data dictionary, both files and database, and an application.

One way to look at a data dictionary is to visualize it as an automated documentation tool. The files or database of a data dictionary can constitute a central repository of an organization's computer application and network documentation (Burns, 1989).
Adapted from: Walsh (1983)
Figure 9 Data Flow in a Typical Data Dictionary/Database Management System Environment
Data dictionary software, like any other software product, arrives at a computer installation on a reel of magnetic tape. Performing the system generation (SYSGEN) is basically the same process as that performed to install other software products. The SYSGEN with this particular type of software product, however, is only a single step in a rather elaborate series of tasks that need to be accomplished if a data dictionary is to be implemented properly and serve its intended function (Walsh, 1983).

When database management systems and data dictionaries came into common usage in the mid-1970s, a function called database administration came into existence. One of the functions of database administration turned out to be the translation of the database requirements, as stated by application development analysts, into the semi-technical descriptive statements required by the database management system or the data dictionary system. These semi-technical descriptive statements are required by database management systems because they define database characteristics and attributes to the database management system. In installations where there is no data dictionary system, the statements are prepared by individuals in the database administration function. These individuals are often called database administrators. The statements they prepare are compiled by the data definition language facilities of the database management system. In their compiled form, these descriptions are stored in an internal library, which is itself a set of computer files. In this form, they contain the information used by the data manipulation language facilities of the database management system to store and retrieve data elements (Atzen, 2000).

Installations with database management systems generally have a data dictionary system. In environments with conventional (non-database) systems, a data dictionary
system is handy to have, because it can be used as a documentation aid. In a database environment, a data dictionary system is virtually indispensable. Once installed, it is an aid to the database administrators, but it also introduces further responsibilities. The DBAs, as the guardians of the dictionary, must become familiar with the workings of the data dictionary system, as well as with the content of the data dictionary files or databases (Flowers, 1996).

Installations where a data dictionary is used may require additional work to get applications implemented. The trade-off is additional work for the sake of control and documentation. In an environment where there is a data dictionary, the statements prepared by the DBAs are entered into the data dictionary, rather than into the database management system. The descriptive information in the statements going into the data dictionary includes that which must ultimately reach the database management system for compilation into a form that the data manipulation language facility uses. However, a lot more information is required to realize the full potential of the data dictionary. For instance, data dictionaries have the ability to hold alternate names for entities such as fields and data elements. The alternated names, known as aliases, are useful for references installations where application programs are written in several programming languages. Data dictionaries also have the ability to hold "where used" information; that is, a given data element definition in a data dictionary may be referenced by several application programs. This information can be stored with the data element definition. Relationships between entities, such as those that may exist in a database environment, can be stored in the data dictionary. A given data element may be related to another data element in some other database structure, or a data element may have a relationship to
some other file. This information can be stored in the data dictionary. For example, sales
order information stored in the data element may be related to customer number and
customer descriptive information in another data element or file. This last type of
information may be kept in the data dictionary, and it may also be passed to the database
management system for inclusion in their compiled form as used by the data
manipulation language for storing and retrieving. In addition, as shown earlier, a data
dictionary has the capacity for all kinds of other information that is not necessarily
needed by the database management system (Abiteboul, Hull, and Vianu. 1995).

A data dictionary system does not necessarily require double work. If statements
containing database, data element, and other types of information are entered into a data
dictionary, they do not have to be reentered manually into a database management
system, as long as the two systems are compatible. If the two systems are incompatible,
then double work may be required, or an interface process may have to be developed. In
situations where compatibility exists, the data dictionary system has a feature that can
create the statements of descriptive information required by the database management
system. Through manipulations made possible by procedures, these statements can be
passed from the data dictionary to the database management system with no manual
intervention. Many data dictionary systems have additional manual work-saving abilities,
such as the creation of programming language file descriptions or database structures that
are used by application programs. These structures are stored in a facility known as a
library. By making these available, application programmers are freed from the task of
coding them when writing their programs; they need merely write a statement that can
‘call’ the required definition or structure in from the library. As the program is being
compiled, that statement retrieves the file definition or database structure from the data
dictionary for inclusion in the compilation process. Figure 9 shows schematically the
flow of information in a typical data dictionary/database management environment.

A data dictionary system has an output facility by which the contents of the
dictionary's files or databases can be displayed. The displays can take the form either of
reports that are printed on continuous form paper or of formatted displays on cathode ray
tube (CRT) devices. CRT access implies data dictionary database or files that are
accessible on-line. Most data dictionary products have features that allow on-line access.
Security procedures are required to assure that access to information is restricted to those
who should see it, and updating privileges ought to be restricted to DBAs (Wertz, 1982).

In a typical situation involving an on-line data dictionary system, a database
management system is also quite probably present. In an integrated environment where a
data dictionary and a database management cohabitate, there is a two-fold relationship
between them. While the data dictionary is a support tool for the database management
system, it may also use the facilities of the system. The data dictionary uses a group of
files, or perhaps a database, in which it stores data describing other files and databases.
The data dictionary files or databases are themselves supported by the database
management system (Leong-Hond and Plagman, 1982).

The schematic in Figure 10 shows this arrangement. The data files or database
contains information about all of the other files of databases, which contain information
about business functions. The data dictionary is one of nine applications under the
operational control of the database management system. This illustration shows all the
applications and files as separate entities. The degrees to which they can be integrated are
Figure 10 Data Dictionary System With Data Management System
functions of the application designer's capabilities and of the database management system's facilities. That aside however, the illustration depicts an environment where the database management system and the data dictionary system are integrated with one another (Rob and Cornel, 2000).

Database management systems and the more sophisticated database/data communications systems have the potential of making a great deal of information easily and readily available to a large number of individuals. With any of these systems, it is generally quite easy to prepare a set of data description language statements, get them into a data dictionary, have them compiled, and then write some data manipulation instructions to retrieve and even update information in a database. But then the questions of security arise (Rob and Coronel, 2000).

For the purpose of security, it may be advisable in some installations to put the data dictionary in the exclusive domain of the database administration function. The DBAs can be designated as the only individuals who can prepare the data definition language statements. Their job is to prepare these statements and to get them into the data dictionary, as well as into the structure and definition libraries. Their task is also to get the statements compiled and into the database management system in the executable form used by the data manipulation language statements included in application programs. Access to the features of the data dictionary, and to the features of the database/data communications system that perform these takes, is prohibited to all except the database administrators and the systems software technicians. Judgment is required in individual situations, because a price is to be paid for instituting such a policy. For the sake of some security and control, the individual efforts of some of the more enterprising application
analysts and programmers are somewhat inhibited when they have to submit requests 
(usually in written form) to database administrators to get data definition statements 
compiled and ready for use (Wertz, 1986).

The standard type of security procedures for data dictionary databases is similar to 
those in use for nearly all on-line files and databases. Primary data dictionary databases 
ought to be copied (dumped) onto a backup medium periodically as a protection against 
accidental or malicious damage to the primary databases. Keeping logs of all activity 
against a data dictionary furnishes an audit trail, as well as providing a recovery 
mechanism that can be used, together with a backup copy, in reconstructing a damaged 
database (Walsh, 1983).

Another fairly standard way of inhibiting malicious or accidental damage to data 
dictionary databases, or to any databases for that matter, is by restricting access. This can 
be accomplished by allowing access to data dictionary databases through a limited 
number of terminal devices, to a limited number of individuals identified by 
identification codes and passwords, or to specific transactions. Such security procedures 
make it reasonably difficult for most individuals to access protected databases through 
unauthorized devices. It is also difficult for most individuals to access databases if they 
cannot properly identify themselves with a code and a password. Restriction by 
transaction type inhibits authorized individuals with authorized devices from accessing 
databases in an unauthorized fashion.
Security Aspects of Electronic Data Interchange Communication

Encryption

In an EDI network, data encryption is particularly helpful when combined with effective key managements. Data encryption protects a network in several ways. It protects against unauthorized access and eavesdropping, prevents alteration, and authenticates users. Although encryption will not protect against viruses that enter the system through authorized channels such as disk media, encryption can prevent unauthorized callers from gaining access and using the system (Parfett, 1992).

The most commonly used encryption technique is DES (Data Encryption Standard), which scrambles data using a complex nonlinear ciphering algorithm. The key used to perform this operation is a fifty-six-bit binary word, usually a random number. If the user on the receiving end has an encryptor with the same key, that user can decrypt the ciphertext to produce the original data. If the sender’s key does not match the receiver’s key, the data will not be decrypted. To make it even more difficult, the cipher can also be fed back to the encryptor in one of several approved modes of operation to make the ciphertext dependent upon the characters preceding it. This makes repeated messages and blank fill (in which even the spaces between messages and message elements are encrypted) produce a different stream of ciphertext each time they are sent, thereby frustrating attempts at data substitution or an eavesdropper’s attempted analysis. As a result, commercial networks have a high degree of protection (Parfett, 1992).

The cost of encrypting a network has been dramatically reduced, including equipment and administrative expenses. Modern encryptors are descendents of military equipment that was too cumbersome and expensive for practical commercial use. Currently, the
equipment has become inexpensive. Efficient production techniques and design decisions created to reduce production costs while retaining a high degree of security have helped make this equipment less expensive. The goal has been to provide appropriately priced protective equipment for use with low-cost terminals and personal computers.

**User Authentication Techniques**

Solutions to computer security, in many cases, hinge on the concept of a single secret password, a word known only by the legitimate user of the system or the information. The major problem with this type of user authentication is that if the password for an account is compromised, then the entire security base is at risk. Most computer-security software protects the system and the information by defining who can access what, at what time, and under what circumstances, rather than permitting unrestricted access. The password is a form of a more generic subclass of computer-security techniques known as user authentication. User authentication is the specific task of verifying that users are who they claim to be. If the security manager is completely assured of the user's identities, security is enhanced and the manager can more easily define what each user can access.

In addition to password systems, user-authentication techniques include token devices. A token device consists of a physical key, much like a key to a house or automobile that permits access to specific computer systems. The keys now on the market vary in design and appearance but all accomplish the same thing. They open access to a computer system (Marcella and Chan, 1993).

For an even greater level of assurance, users can rely on a biometric device. A biometric user-authentication device relies on a physical attribute of the user. Biometric
systems also have different approaches. There are fingerprint systems, signature-recognition systems, or retinal scans.

**Computer Viruses and Security**

Fundamentally, a computer virus is a program that "infects" other programs by modifying them to include a copy of it. With this "infection," a virus can spread from one program to other programs, user to other users, computer to other computers, and network to other networks, thereby corrupting programs and data (Marcella and Chan, 1993).

Although it has been proven mathematically impossible to create a perfect defense against viruses in any system. EDI or otherwise. limited functionality systems do offer a feasible defense against viruses and other similar attacks for many environments.

Currently, there are products on the market designed to provide limited protection against computer viruses. Unfortunately, most offer little more that a false sense of security. Recent studies, however, have stimulated a new generation of products, which are expected to offer better protection and greater convenience than their predecessors. These "integrity shells" will likely be improved over time to provide extensive services, such as integrated backups and restores, integrated networking capabilities, and high integrity information exchange between computer mainframes and microcomputers (Emmelhainz, 1993).

**Personnel Security Programs**

Going beyond the security aspects of hardware and software in electronic communication, there is a need to look at personnel security programs. Personnel security programs are typically weak in companies. Such programs do not do a good job of
checking up on employees once they have begun to perform their duties. In particular, companies do not: (1) use attitude surveys to monitor the level of employee moral; (2) consider an employee's level of security consciousness during his or her performance assessment; (3) use job rotation as a means of evaluating an employee's security-related behavior; (4) use the regular vacation of a key employee to perform a miniaudit of that employee's work; and (5) identify employees whose particular responsibilities make them potential security risks (Marcella and Chan, 1993).

In addition, personnel security programs need to be improved not only internally, but also externally with trading partners. The reason should be clear: there could well be collusion between people in a company and its trading partners that could result in a substantial loss for all companies within an EDI network. Hence, there is need for cooperation between a company and its trading partners on this important personnel security matter.

**Security of Global Networks**

The preceding security aspects are not limited to hardware, software, and people within the United States, but extend to all parts of the world. As vendors develop more internationally EDI-based products, users, including multinational companies and government agencies, will have to balance the virtues of greater accessibility and information sharing with their need to maintain adequate security. Security must be factored into tomorrow's international, multi-vendor EDI networks as an important consideration. However, it must be dealt with today. And this is not just a user issue; it is a vendor issue as well. Fortunately, the International Standards Organization (ISO) serves as the vehicle for determining the standards for integrating data processing and
telecommunications resources into cohesive, enterprise-wide networks. It has developed a model for building products that meet interoperability standards – the Open Systems Interconnection (OSI) Reference Model (Marcella and Chan, 1993).

Significant work has been done in crafting a plan for OSI security standards. Six security standards are currently being examined, covering authentication, confidentiality, access control, integrity, non-repudiation, and audit trails (Marcella and Chan, 1993).

**EDI Communication Model**

Having introduced the general requirements of information processes as well as the basic structure of databases, it is a fairly straightforward endeavor to derive an EDI communication model that helps to comprehend the amalgam of problems reported in the literature about EDI implementation in practice, such as the need to change internal application systems or the proliferation of EDI standards, which are perceived as being major inhibitors to the diffusion of EDI. The EDI model depicted in Figure 11 essentially is a composition of two databases between a communications system for message handling.

The purpose of communication is to transfer information between sender/receiver and source/destination in order to influence the actions of the receiver. In order for communication process to achieve the desired results, the functional mappings are required to meet certain correspondence constraints. Functions such as input and output device must be compatible to each other in the sense that the sender and receiver may have dissimilar internal representation forms for information but have reached agreement ex ante (negotiation process) of how information is coded into the message between them. This means that they have agreed on a common symbolic or other form of
representation (Lindsay and Norman, 1977). Secondly, functions such as transmitter encoding and receiver decoding along with channel encoding and decoding, must be aligned so that receiver decoder may be the inverse of transmitter encoder (See Figure 11). Third, the information is selected and transmitted by sending agent in order to influence the behavior of the recipient. Successful communication therefore requires that the sender have a correct causal model regarding the determinants of the recipient’s behavior.

Capitalizing upon the notation introduced earlier, suppose a business transaction is executed between two partners A and B, each of which uses a database as depicted in Figure 11. For this purpose, a transaction message is sent from database A to database B. Independent of the communications mechanism employed, the transaction can only be completed if the semantic associated with that message is a subset of the semantic captured in both databases. Indeed, an established business relationship between both business partners implies that this condition is fulfilled.

Messages Delivery

Conventional Methods

When database extracts have been into messages that comply with the formatting rules defined by the EDI message standard, in order for the transaction to transpire, those messages must somehow be delivered to the addressee. Delivering messages has two prerequisites. A transport mechanism to move a message over a physical distance and a routing mechanism to control the message transport between the endpoints of the communications process, via sending and receiving location. With EDI, several
Figure 11 EDI Schematic Communication Model

Adapted from: Shannon (1948), DeFleur (1970), and Elmasri and Navathe (1994)
alternative means of message delivery are available, notably those that were based on
networks with value-added telecommunication services. EDI messages could also be
stored in files on standard physical storage devices, such as tapes or floppy disks, which
could then be distributed by a postal service to the message recipients, who would mount
the devices onto a reader for message retrieval or submission to the respective application
system for further processing.

While such a physical delivery method does not capitalize on the speed advantage
offered by transmitting messages via telecommunication lines, it eliminates the need for
the receiving organization to manually re-enter the data into the internal data processing
systems. Being based on proven technologies for data storage and on a mature
distribution system, this method is very reliable and especially appropriate in cases where
a comparatively large volume of data must be exchanged periodically between
communication partners such that clerical data handing accounts for the bulk of the
transmission delays incurred. As a consequence, physical delivery of EDI messages
stored on data carriers amenable to automatic processing is still widely used in practice
(Morris, 1989), and can be expected to remain a viable alternative to using
telecommunication networks for some applications, at least as long as WAN transmission
rates are several degrees of magnitude slower than writing to and reading from secondary
storage devices (FitzGerald, 1988).

Exchanging messages through the conventional mail system between trading partners
is unnecessarily slow since it foregoes the advantages of telecommunications to transmit
data almost instantly between processing systems over arbitrary distances. The benefits
EDI has to offer in terms of reducing the delays of commercial transactions can only be
fully exploited when the transaction-specific information that has been coded according to the rules of the EDI language is relayed to the recipient by telecommunications. Therefore, while acknowledging the viability of physical data carrier EDI for a limited number of commercial applications, the term EDI conventionally implies utilization of a telecommunications network.

While in theory an almost infinite number of different communication protocols can be chosen by any two communication partners, in practice the choice is restricted (but increasingly less so) by the limited number of alternative communication networks available. Their technical characteristics specify the functionality of the lower-layer protocols of the respective communications architecture and the interface to the application-oriented upper layers (Herbert, 1990). In addition to considering an organization's other internal and external communication requirements and the perceived necessity to integrate those with EDI activities, the decision of which network and which communication protocol to select for the purpose of EDI will be determined by such factors as: the expansion of the network in terms of reaching the targeted EDI trading partners, the anticipated traffic volume since it qualifies or disqualifies networks due to the achievable transmission rates, the network interface capabilities/requirements of the trading partners, transmission security which relates to the error detection and correction mechanisms provided, and by the tariff structure which determines the transmission costs incurred (Palmer, 1988).

**Basic Methods of Electronic Communication**

In order for EDI to function smoothly, companies must establish the required electronic link to move information. Methods used for communication and transfer of
information are: (1) point-to-point configuration, (2) value-added networks, and (3) third-party networks. MIS management and top-level executives need to understand these methods to realize EDI benefits in a cost-effective manner.

Before discussing these methods, it should be noted that EDI documents, that are moved electronically, were made of three basic parts. A complete document, such as a purchase order, known as transaction set. The transaction set contains individual data segments, such as a company name and address. Each data segment within a given EDI standard has its own identifier.

**Point-to-Point Configuration Between Companies**

Point-to-point configuration links one company's computer to another company's computer via a communication network. Both companies must use the same standards and conventions for setting up formats for various transactions and conform to required modem line speeds. Both companies are responsible for developing and monitoring their individual systems. If they have different computers or software packages, translation software is required. Such software can either be developed in-house or purchased or leased from software companies. Private leased lines of public switched lines (dial-up services) are used for transmission of data (Emmelhainz, 1993).

**Value-Added Networks**

This method provides "electronic mailbox" service for a company and its trading partners. All companies are responsible for developing protocols and format handling requirements; a public network, such as Tymnet or MCI, can be contracted to act as a communication carrier. The carrier provides "electronic mailboxes" where electronic documents may be stored for all companies. The "electronic mailbox" makes it
unnecessary for the companies to provide a dedicated computer for the purpose of awaiting incoming calls. It also provides the capability to consolidate EDI transactions, thereby allowing the user to send information to multiple receivers in a single dial-up session (Baker, 1991).

"Electronic mailbox" service arrangements facilitate adaptation by each company to its modem line speed, permit some flexibility in terms of using different protocols because receivers can translate retrieved messages in their format, and permit communication during different times of the day to take advantage of lower rates during off-peak times (Emmelhainz, 1993).

It should be noted that value-added networks (VANs) offer a second level of translation, not just from one company's computer to another, but also from one EDI standard to another. VANs can also take multiple transmissions and distribute them to electronic mailboxes and, in some cases, to FAX and electronic mail if a client wants to communicate with a supplier that has not yet implemented EDI. Most value-added networks market their own translation software as well. Control Data offers a value-added network called REDINET, designed for just-in-time inventory management systems and related industrial applications. IBM and several transportation companies have developed value-added networks through their EDI services division.

Most valued-added networks are equipped to handle any of the different EDI formats in use around the country. An EDI transaction arrives in the network in one format, and the VAN converts it to whatever standard is being used by the receiving company and routes it accordingly. The process is not always as simple as it sounds, especially when an EDI transaction has to go from one VAN to another. Besides different EDI standards,
different communications and modem protocols also come into play. Most of the time, when one value-added network sends a transaction to another value-added network, it needs to know the protocols in advance. X.400 Message Handling System emerges as an important communication protocol, primarily because it places a common electronic "envelope" around EDI transmissions sent between networks. This allows the receiving network to recognize the transaction (Baker, 1991).

Third-Party Networks

Third-party networks serve as electronic data interchange service bureaus in addition to providing "electronic mailbox" service available from value-added networks. The service bureaus could act as an EDI network for manufacturers and their suppliers, receive transaction sets in any protocol and translate these transactions according to the manufacturer's protocol. These networks take responsibility for all communication needs. The third-party networks reformat transactions to meet different standard, formats, or conventions, and even provide communication links and transmission of electronic documents to and from various transportation companies (Emmelhainz, 1993).

When suppliers of a manufacturer have many types of computer setups and use a variety of paperwork procedures, the third-party networks remove the problem of incompatibility of computers, thereby resulting in the inability of these computers to communicate with each other. For example, EDI-NET service of McDonnell Douglas allows a user to communicate with 117 different communication protocols. Hewlett-Packard, a manufacturer of computer hardware, uses EDI-NET services provided by McDonnell Douglas to ensure that EDI communication documents will be understood by suppliers. EDI-Net allows Hewlett-Packard to maintain its own computer system, but
permits the company to input purchase orders for various suppliers into the network. The EDI-NET uses translation software, converts these orders into the supplier’s format, and sorts and transmits to the supplier’s computer systems (Thierauf, 1990).

Suppliers receive the orders in their own format and continue processing according to the requirements of their own systems. Hewlett-Packard has also started exchanging forecasting data with suppliers through EDI-NET. The data were automatically aggregated and translated, then forwarded to waiting suppliers. Third-party networks also perform more complicated tasks when they provide EDI services (Thierauf, 1990).

Method for Selecting an EDI Communication System

A straightforward EDI system required the supplier to purchase a compatible personal computer, a communication device such as a modem and related communication software, and telephone line hookups. Many software packages are available that will support one or two standards and protocols used by companies in major industries.

Going beyond this straightforward approach, an MIS manager should consider certain factors in selecting the appropriate method for an EDI system. These factors include the distance the data are transported, required delivery time frame, volume of transactions, number of destinations, frequency of transport, compatibility of recording media, cost, and security and reliability. If a company’s volume is large with manufacturers using similar standards, conventions, and protocols, and sharing similar documents or if a company has a great deal of business with one supplier, then a point-to-point network is preferable (Emmelhainz, 1993).
If, on the other hand, a company has a low volume of transactions with a large number of suppliers who use different standards or protocols, then it may be better served by using either a value-added or a third-party network method. Similarly, if the company emphasizes the integration between its EDI system and other existing functional systems that have different internal formats from those mandated by standards and protocols, then a value-added or a third party network method would be appropriate. Either method could make it possible for a manufacturing company to communicate with its suppliers and/or transportation companies even if their computers are not compatible.

Those companies that select electronic data interchange as their primary method of communicating business documents electronically are proactive in their approach to data processing. They realize that increased efficiency and savings can be achieved by transacting business in this manner. Those who become involved in EDI in a reactive fashion are responding to business pressure placed on them by customers who also acknowledge the savings and benefits to be derived from remaining competitive. Companies taking a proactive approach usually are larger firms having many suppliers. In such firms, EDI can be implemented successfully if all the factors involved are addressed and all departments affected by the introduction of EDI are involved as a team. Mid- to small-sized companies with few or possibly no data processing staff were the second-tier trading partners who typically elect to take a reactive approach to EDI. All companies need to understand the intent of EDI and how it affects all users from a broad perspective. To assist companies in adopting a proactive approach, a starting point is consideration of the basic standards needed domestically (nationally) for electronic communication (Sokol, 1995).
Theory of Network Externality

The third theory supporting EDI adoption and diffusion is network externality. The term 'network externality' stems from the well-known economic concepts of externality. In economic theory an externality exists when a person external to a transaction is directly affected (positively or negatively) by the events of the transaction. The concept of 'network externality' relates to the simple but fundamental observation that the user-value of a network is highly dependent on the number of already existing subscribers or clients. This means that the choice for a potential user to become a member of the network is dependent on the number of these participants. This basic but crucial statement has strong implications not only for the development trajectories of new networks, but also on some other important elements such as tariff structure, network interconnections, standardization processes, optimal dimensions of networks and inter-network competition. In other words, the existence of network externality has some far-reaching consequences for the actual operation and policy choices regarding networks. The notion of network externality is essentially related to the value of the network, expressed in terms of its subscriber-base.

To clarify the concept of network externalities, it would be useful to keep in mind the two important characteristics attributed to externalities in economic literature. The first element is interdependence, which describes an interaction between the decisions of economic agents. The second is non-compensation, implying that the one who creates costs (or enjoys benefits) is not obligated to pay for them (Nijkamp, 1977).
In the case of network externalities, the first element, interdependence, can easily be identified. The decision of a firm to join a network is strongly influenced by the number of existing subscribers, the number of firms who have already made the same choice.

The identification of the second characteristic of externalities, non-compensation, is more complex. For this purpose it is useful to make a distinction between the notion of the cost of purchase and that of the adoption of these technologies. In the case of an EDI network, the profitability of this technology depends only to a limited extent on the process of the equipment on the market (for example, the price of fax machines, modems, personal computers to link to networks). Much more relevant are the costs of adoption, such as the learning processes and the organizational changes which firms have to cope with in order to use and exploit these technologies. These costs stem from the behavior of other firms (the technology they adopt) and on the general level of penetration of the technology in the region (Antonelli, 1991). The higher the number of adopters, the higher the advantage obtained from the technology. This advantage is not incorporated in the cost of purchase, as the cost is not dependent on the number of already existing users. In this sense, the cost of adopting EDI technology does not reflect all benefits and advantages generated by that technology, and the 'non compensation' element is present. In other words, the actual economic value of EDI networks and services is only partially accounted for by the benefits that individual firms derive from EDI because (Saunder, Warford, and Wellenius, 1983):

a. subscribers may value the service by more than the amount that they are required to pay for it, for example, there might be consumer surplus that is not quantified;
b. new EDI subscribers not only incur benefits for themselves, but also increase the benefits of being connected to the system for those who have already joined. For example, there are subscriber network externalities:

c. willingness to pay a given price to use EDI reflects only a minimum estimate of the benefits incurred by the user and does not reflect the benefits received by the recipient of the data of those whom the user or recipient of the data then contact. in other words, there are user-related externalities.

The concept of network externality relates to the value of the network, which depends on the existing number of subscribers and differs from the mere cost of purchase of (access to) the network by that amount of advantage which an individual receives and does not pay for once the individual joins the network. From this perspective, network externalities are the economic reasons for the adoption of and entry into the network and are becoming the essential explanation for the diffusion of new interrelated technologies. Firms' decisions to join a new network depend also on the subscriber base of the network and the expectations that potential entrants have of the size of the subscriber base in the near future. Thus, the cost of purchasing the technology itself is not the only element in the decision-making process.

Classification of EDI Network Externalities

EDI seems to offer a highly appropriate context for studying network externalities and all the economic consequences involved. Because it can be considered to be a technology where the concept of externalities, and in particular of network externalities,
appears under different guises which influence both the efficiency and the dynamics of the entire EDI system.

The concept of network externality can be explained when allied to the EDI network. However a rigorous analysis needs to go far beyond this basic definition in order to define precisely the nature of network externalities. Far too broad a definition is given nowadays to this concept, and therefore it is necessary to organize in a systematic way the existing literature dealing with network externalities.

The typology of network externalities in Figure 12 shows how this concept is sometimes in reality similar to other more traditional economic concepts. To overcome confusion, a typology of network externalities is presented.

In the literature on network externalities, this concept is applied not only to the explanation of demand dynamics, but also to the interpretation of supply mechanisms.

The EDI system is characterized by the following strategic features, first, interdependence of firms' utility, since the decision of a firm to join the network is dependent on the behavior of other firms. When dealing specifically with the adoption of a new technology, interdependence between potential adopters and existing users exists. Through dynamic learning processes the latter may create for the former a reduction in search costs and market process for complementary input, maintenance and skills which stems from their greater experience in using the technology already adopted.

Second, interdependence between potential users and suppliers. On the one hand, the know-how and the experience accumulated by suppliers act as a driving force in the adoption process. In fact, the adopting firms assisted in the search for know-how and complementary inputs (organizational strategies) because of precise 'guidelines' provided
Figure 12 An Analysis of EDI Network Externalities
by the suppliers. On the other hand, the higher the number of adopters, the broader the
know-how of the supply will be. In other words, the relationship between supply and
demand generated cross-learning processes via the bridging interaction between demand
needs and supply knowledge.

The third factor is the interdependence between producers of complementary
technical components and products in the telecommunications sector. The interrelation of
sub-markets may provoke externalities, since the profit function of a producer can be
influenced by the economic transactions of other producers whose behaviors affects the
market prices of intermediary inputs.

The fourth factor is interdependence between users and productivity, since
advantages obtained by a firm in terms of its productivity can depend on the number of
already networked firms. The advantages obtained through the use and exploitation of
these technologies are a function of the number of firms already using them.

While the first two of these strategic features affect the utility function of a final
individual user, the last two act on the productivity of firms, the EDI service acting as an
input factor in the production function. These features relate to both service providers of
EDI technology and also to the adopting firms using EDI technology as final or
intermediate service (the EDI user sphere).

Figure 12 presents a typology of network externalities on the basis of the features of
the EDI market. In the top-right quadrant, network externalities relate to the adopters and
are the typical consumption network externalities acting on the utility function of an
individual final user (the economic features explained in the first point). Here, the
interdependence among utility functions of users of telecommunications networks is at
the basis of the traditional network externality concept presented above. The demand is increasingly explained through the interrelated decision-making processes of adopters, which in turn influences the growth rate of demand.

A well-known example of consumption network externalities is the so-called hardware/software paradigm (Katz and Shapiro, 1985, 1986; Stoneman, 1990), regarding the strong interdependent preferences dominating the choice of a consumer when buying a certain kind of hardware.

On the users' side, another kind of network externality is present, known in the literature as adoption economies (Antonelli, 1992), when dealing with the adoption of new technologies (the economic features explained in the first point above). In the diffusion processes of new EDI technologies, a crucial role is also played by collective learning processes as is common within all types of complex technologies. These processes seem to hide a sort of network externality mechanism because of non-paid-for advantages that potential users of the technology gain from the experience of long-established adopters. For potential adopters, non-paid-for advantages may emerge from lower search costs of complementary inputs, or from specific know-how concerning the use and maintenance of the technology, stemming from the consolidated experience on the use of these technologies accumulated by previous adopters.

However, these features, recently interpreted as an externality mechanism (Antonelli, 1992; David, 1992), may in reality be explained only in terms of the traditional concept of dynamic learning processes that are similar in their effects, but different in nature, from the traditional concept of network externalities. Learning processes stem in fact from the concept of dynamic economies of scale (Spence, 1981), while network
externalities stem from the non-paid-for benefits obtained by interdependent mechanisms. The difference between the two concepts may be more easily explained by recalling the traditional features of externality mechanisms, interdependence and non-compensation. In the case of learning processes the interdependence among users is present, and explains part of the diffusion mechanism. The second feature, non-compensation, is less evident and is what distinguishes learning processes and adoption economies from network externalities. In fact, one may easily argue that even if late adopters may gain from lower search costs for specific know-how on the use of these technologies stemming from consolidated experience of previous adopters, the following might well be relevant:

a) These advantages are paid for by late adopters in terms of loss of productivity during the period of non-adoption;

b) These advantages may actually be the result of a clear strategy of the first adopter, who could foresee in this behavior a source of profit, thus eliminating the unintended feature of an externality mechanism (non-compensation) and:

c) With network externalities the non-compensations valid for both the late and the previous adopters, in the case of learning processes the advantages are only in favor of the latter.

The same can be said for firms producing EDI technology. These act on the utility function of EDI users through transformation of information processes (bottom-right quadrant of Figure 12), due to the interdependence between potential users and suppliers, described in the second point on strategic features. Again, for the same reasons, users
benefit from these learning processes through dynamic economies of scale that are
different in nature from the concept of network externalities.

Network externalities in the EDI sector do not only affect the final user. The
intermediate user (or supplier) also acts under certain particular conditions (bottom-left
quadrant). EDI networks are built upon a series of interrelated technical components such
as terminals, transmission facilities and switching equipment, as well as intermediated
outputs in the extremely complex hardware/software environment. The interdependence,
expressed in the third point on strategic features mentioned, exists in vertical
relationships (intermediated inputs for EDI outputs) and also in horizontal final products
markets (advanced terminals, whose development stimulates value added network
services. In both horizontal and vertical interrelationships, the behavior of each economic
agent on the market (reduction of prices, new market niches) positively affects the profits
of the other interconnected producers, generating what can be interpreted as network
externalities. However, these kinds of advantages are typical input/output inter-linkage
economies, stemming from vertical integration in a sector. In other words, these
advantages may be associated with traditional economies of scale generated in a
vertically or horizontally strong market relationship (bottom-left quadrant in Figure 12).
Computers (hardware) and programs (software) have to be used together, and the greater
the sales of the hardware, the higher the profits for software producers due to the
technical interconnectivity of the two markets.

Finally, the interdependence in the productivity of different intermediate users (in the
fourth point mentioned on strategic features) constitutes an interesting situation. In this
case, it is possible to speak of network externalities related to the use of the service as an
input factor for other products, thus having an impact on the productivity level of firms (top-left quadrant in Figure 12). In this framework, both the concept of monetary (network) externalities (Scitovsky, 1954) and technical (network) externalities (Meade, 1954) may be useful. Monetary externalities arise whenever the profits of one producer are affected by the actions of other producers. In other words, monetary externalities act on input factors decreasing their costs, having positive effects on the output. This category differs from the 'technical external economies', defined by Meade (1954) as those advantages obtained by a firm for its output through the non-paid-for exploitation of the output and input factors belonging to other firms. The latter category sees external economies as a peculiarity of the production function; they act on the productivity input factors. Through the increase in input productivity, these external economies positively influence corporate output. For EDI network users, the use of the network generates an increase in input productivity (or profit advantages) only partially covered by the costs of joining the network. The non-paid-for advantages obtained by a subscriber joining a network have positive effects on the economic performance of the new subscriber. This holds true also for the existing subscribers who obtain non-paid-for advantages on their production functions if an additional member uses the network. If network externalities represent one of the (economic) reasons for entering the network, a better economic performance of firms would be the (economic) effect they produce on the productivity side.

From the above observations it can be concluded that in the EDI sector the classical concept of network externality relates only to final or intermediated users (in Figure 14 only the upper half). In recent years, the definition given to network externalities has
expanded to embrace network externalities in the production sphere (manufacturing firms and service providers), thus broadening the meaning to cover yet more traditional economic concepts.

While consumption network externalities in the context of the use of EDI (top-right quadrant in figure 14), as well as adoption economies, learning processes (bottom-left quadrant) and hardware/software economies (bottom-left quadrant) have been widely identified and analyzed in the literature, no work has been done on the measurement of the effects of network externalities on the productivity side. The advantages of users joining a network were reflected in the performance of these subscribers via the reduction of input factor costs or the increase in their productivity. This research provides a contribution by constructing a conceptual and methodological framework dealing with the basic strategic question of whether firms can gain from the network externality effect of EDI.

In the telecommunications context, network externalities exist when an individual’s demand for the network depends on the consumption of others. Prior research concerning network externalities has examined positive demand externalities where the values of participating in a network for each participation increase as the number of participants increase. A major focus of the prior research is on network growth characteristics where a monopolist manipulates the network subscription price in order to encourage participation past some critical mass point to reach a targeted profit maximizing network size (Artle and Averous 1973; Rohlf’s 1974; Oren and Smith 1981). The question of setting the price in order to move beyond the critical mass point known as the “start-up” problem. Oren, Smith, and Wilson (1982) extend the original analysis to include markets...
that can sustain nonlinear pricing. Dhebar and Oren (1985) include a dynamic feature of anticipation of future network size.

Prior research has not examined certain inter-organizational systems (IOS), which can exhibit negative network externalities. Inter-organizational systems are information systems shared by separate business entities so that they cross company boundaries (Cash and Konsynski, 1985). Electronic hierarchies are a type of IOS that links trading partners who had a pre-existing, ongoing business relationship prior to electronic integration (Malone, Yates, and Benjamin, 1987; Benjamin, Delong, and Scott-Morton 1990). Examples of IOS of this type are inter-corporate electronic mail systems, electronic data interchange (EDI) systems enabling suppliers and buyers to exchange standardized business documents, and inter-corporate electronic graphics data interchange of engineering documentation.

Consider externalities in the IOS context for the case where a large buyer initiates the system with its suppliers. Early joiners (suppliers) of the IOS may enjoy economic benefit from increased market share of higher price for the primary product (Sokol 1989; Nault 1990). However, if the potential subscribers are competing suppliers to the buyer, then the economic benefit to the supplier of being on the network may decrease as the number of participating suppliers increase. Therefore, for electronic hierarchies, negative network externalities may exist for suppliers due to the fact that as the number of suppliers on the network increases, these suppliers find it more difficult to reap the economic benefits from joining the network by demonstrating that they are more responsive to their customer’s needs. Seidmann and Wang (1992) show the conditions under which these negative or “competitive” externalities exist. In the case of negative
externalities, only a certain portion of the suppliers may find it economically beneficial to join the network. Therefore, the buyer may encounter initial spontaneous supplier adoption of the network, followed by a “stalling” problem once the economic benefit accruing to the suppliers from being an early joiner on the network has sufficiently dissipated. When the buyer encounters this stalling in the growth of the network, it may be beneficial for the buyer to subsidize certain reluctant suppliers’ costs to join the network in an effort to increase supplier participation.

In order to understand the adoption and usage of IOS distinction should be made between two different types of IOS users: initiators, who propose the network to their trading partners and plan how to get the most benefit from the technology, and followers, who usually adopt the technology in order to meet a trading partner’s requirement. Since followers are typically less committed to the technology, they usually lack long-term plans concerning how to utilize the technology and therefore do not reap many of the benefits possible to users of IOS. Research conducted by Stern and Kaufmann (1985) seems to support the existence of initiators and followers as two separate types of users of IOS. They found that of the EDI users they interviewed, firms either mandated adoption of the system, to their trading partners (initiators) or else they believed that their trading partners received the majority of the benefits from the system (followers). In a survey of 229 adopters of EDI, Hwang, Pegels, Rao, and Sethi (1991) found several significant differences between initiators and followers. Initiators of EDI systems tended to be larger companies who are more experienced with the technology, willing to invest more capital in the technology, and achieved a higher level of internal integration with other applications. All of these factors would influence a firms’ ability to reap benefits from the
system. Since many followers are not committed to the technology, either an explicit threat or outright subsidy may be needed to encourage them to adopt the technology.

In the past, initiators of IOS had been suppliers seeking to add value to their product and gain a competitive advantage over their rivals. More recently, however, dominant buyers in certain industries, particularly in the automotive, aerospace, and retailing industries, are finding that by initiating IOS with their suppliers, they can dictate more of the specific network characteristics, thus achieving even greater cost savings than when the system is supplier driven (Sokol, 1989). Often these buyer-driven EDI systems are accompanied by bar coding and shipping label scanner systems to improve efficiency on the receiving dock. These systems are due in part to the move toward just-in-time inventory programs as major manufacturers and retailers seek to reduce labor costs in material receiving and data entry, while improving the visibility and timeliness of incoming materials. See Mukhopadhyay (1993) for a review of recent research aimed at measuring the value of EDI.

Typically, initiating buyers first establish these IOS networks with eager suppliers who have traditionally demonstrated themselves to be committed to a long-term relationship with the buyer. McMillan (1990) discusses the impact of providing long-term incentives to suppliers who are particularly cooperative and committed to investing in ways to lower their own costs. Incentives such as long-term commitments with fewer suppliers, substantial risk sharing with risk averse suppliers, and commitment to a present time-path of price for the primary product are all mechanisms which the buyer may utilize to reward those suppliers who are eager to link electronically with the buyer.
However, what can the initiator do about its technically unsophisticated or small suppliers? In addition to the movement toward more buyer-initiated IOS, the trend is that buyers are finding it cost effective to subsidize certain suppliers' costs to join the network in an attempt to achieve full supplier participation (Computer world, 1990b and 1990c). With full supplier participation, the buyer is able to take full advantage of the technology by re-engineering many of its basic business processes.

As more trading partners join the network, the initiating firm is able to make a more credible threat to those who have not yet joined, making participation a prerequisite for doing business in the industry. Based on this argument, Benjamin, Delong, and Scott-Morton (1990) conjecture that EDI is quickly becoming a way of doing business and eventually will become a necessity much like the telephone.

Innovation and Diffusion Theory

The fourth theoretical concepts supporting EDI adoption and diffusion is innovative and diffusion theory. It is estimated that 70% of all business data manually entered into a computer were manually reentered into another (Rochester, 1989) and that about 25% of the total cost of transactions is due to data entry and reentry (Dearing, 1990). Obviously, this is a considerable waste of corporate resources. Literature in both trade press and research claim that EDI, a specific form of IOS, has the potential to alter the business operations dramatically in a number of industries (Barber, 1991; Dearing, 1990; Hart and Estrin, 1991; McFarlan, McKenney, and Pyburn, 1983; Niederman, Brancheau, and Wetherbe, 1992; Riggins, Kriebel, and Mukhopadhyay, 1990; Special Issue, 1991). EDI has emerged as one of the most critical issues facing U. S. corporations (Mukhopadhyay,
Kekre, and Kalathur, 1995). These signify the need to better understand the factors that enable successful implementation and diffusion of EDI within organizations and what impact it has on organizations.

Prior research on EDI/IOS highlighted how companies derived competitive advantage primarily based on case studies of few organizations (Clemons and Row, 1988; Vitale, 1986). Theoretical researchers have used transaction cost theory (Utterback, 1974) to examine the implementation of IOS, the benefits from these systems, and industry restructuring toward electronic markets based on these cooperative ventures (Bakos and Treacy, 1986; Malone, Yates, and Benjamin, 1987; Mukhopadhyay, 1993). These studies are based on narrow definitions of markets and restraining set of assumptions that may be quite impractical in the real world. There have been some empirical studies (Banerjee and Golhar, 1994; Grover, 1993; O'Callaghan, Kaufman, and Konsynski, 1992; Saunders and Clark, 1992) that have examined the factors influencing the adoption of EDI/IOS, primarily based on research on innovation adoption/diffusion (Rogers, 1983; Tornatzky and Klein, 1982) and trade literature on EDI. They have primarily looked at adoption and have not examined diffusion and the organizational outcomes from the diffusion. Therefore, some of the possible unexplored areas of past research relate to EDI diffusion and its impact on the organization and empirical study to support some of the contentions theoretical research.

Adoption and Diffusion of Innovations

The importance of innovations' attributes in influencing adoption and diffusion has been well documented in innovation literature (Rogers, 1983). Among as many as 25
attributes, the meta-analysis of Tomatzky and Klein (1982) suggests that compatibility, complexity, and relative advantages have emerged consistently to be important variables. Their study also points out that cost of an innovation has emerged as another key variable sometimes on its own or as part of relative advantage. Higher cost is negatively associated with adoption; but some researchers have argued that once an adoption decision has been made these higher costs can be positively associated with diffusion efforts because it is in the best interest of the organization to attempt to leverage the (high) sunk investment to its best advantages (Zaltman, 1973). Greater compatibility of the technology innovation with the existing technical systems, operating practices, and the value and belief systems of the adopting unit have been cited to be favorable to its adoption and diffusion (Cooper and Zmud, 1990; Ettlie, Bridges, and O'Keefe, 1984). Complexity of the innovation, described as the relative difficulty in understanding and using it (Rogers, 1983) has been usually observed to discourage its adoption and lead to greater difficulty in its implementation and further diffusion (Tomatzky and Klein, 1982).

A rationally behaving organization can be expected to adopt an innovation only if it believes that this prospective innovation offers significant benefits compared to alternative choices or the status quo situation. Innovation research has labeled this as relative advantage perceived by the adopting unit and has found it to be a key and consistent variable positively influencing adoption and diffusion (Rogers, 1983; Tomatzky and Klein, 1982). It has often been emphasized that for an innovation to be adopted and be really beneficial, there should also exist a genuine need (also labeled need pull) within the organization in the form of deficiencies of performance (example, low productivity, sloppy customer service), a recognition that the innovation can address
these deficiencies and a sense of urgency to address these issues (Anderson and Paine, 1975; Dutton and Duncan, 1987; Zmud, 1984).

Information Systems Implementation

Prior research in IS implementation has consistently emphasized the critical role that top management support plays in ensuring success (Laudon, 1991; Sanders and Clark, 1985; Sokol, 1989). A committed top management support can positively influence project selection and its successful implementation whereas a lack of it has often been cited to be a barrier to effective use of system (Guimaraes, Igbaria, and Lu, 1992).

Past research not only in IS and innovation but in organizations and marketing domains has emphasized the key role played by champions at various stages of the innovation adoption and diffusion process from building awareness of the IT innovation through to generation and maintaining a sustained momentum during its adoption and diffusion (Huff and Munro, 1985). It has been suggested that successful adoption, implementation, and diffusion of innovations can be traced to the critical role played by champions (Ettlie, Bridges, and O’Keefe, 1984; Maidique, 1980). They often play a crucial role in overcoming resistance to the innovation, organizing needed resources and being closely involved in various phases of adoption, implementation and transfer of the project (Grover, 1993).

But some researchers also state that mere attraction to an innovation’s superiority can often blind and bind organizational units to hasty and non-retractable investment decisions (Munro and Noori, 1988). It is imperative that evaluation of its suitability within the specific context of the adopting unit’s task environment is essential; there
should be adequate scope in the task environment to diffuse the use of the innovation and gain significant benefits (Zaltman, Duncan, and Holbek, 1973; Zmud, 1984). Normally, an innovation is implemented in one organizational subunit; but its diffusion to other parts of the organization is dependent on whether the innovation has adequate task scope in these other units or other processes. In the context of an inter-organizational system such as EDI, volume and frequency of transactions, the variety of products/services, diversity of partner-base, structure of the transactions (for example, message context/format), and nature of data itself (geometric, engineering versus business document) are some of the factors that influence the scope for (EDI) use within the task environment and thereby the extent of implementation success and diffusion of EDI (Meyers and Canis, 1992; Tornatzky and Klein, 1982).

IS research has also proposed that the capability of the IS function in terms of its sophistication-resources and skill base was positively associated with IS success (Raymond, 1990). The stage model of Nolan (1979) succinctly describes the levels of sophistication that organizations evolve through to reach a mature stage in managing various information resources. In its most ideal form, EDI includes movement of inter-firm business transactions to the internal systems for processing of the IS function is a crucial element to satisfactorily accomplish such a major technical goal and enable the firm to reap the full range of EDI benefits (Rochester, 1989).

While many innovations may get adopted in response to genuine need and/or various pressures, successful diffusion requires the organization to master the nuances, adapt to the changed processes, and satisfactorily manage the technology transfer. Successful implementation and diffusion of IT innovations require that individuals within the
adopter organizations learn new ways to perform intellectual tasks. This requires significant degree of learning to occur within the adopting unit over extended time periods (Attewell, 1992); this learning process involves unscrambling old procedures and attitudes, moving to a new pattern, and then cementing the new processes into the procedures of individuals and groups (Cash, McFarlan, McKenney, and Applegate. 1992).

EDI Research

Research on EDI/IOS can be classified into two broad groups: 1) theoretical/analytical and 2) field-based empirical research. In the first category, the potential adoption behavior of individual firms and the diffusion of IOS at the industry level are mathematically modeled; this line of research draws primarily from information economics, microeconomic production, macro-organizational, and industrial organization economics and applied game theories (Mukhopadhyay. 1993; Venkatraman and Zaheer, 1990). Using the tenets of transaction cost theory (Williamson, 1975), it has been posited that due to reduced cost of coordination through information technologies (such as EDI) market transactions between trading firms may eventually migrate away from vertical/hierarchical relationships (in the distribution channel) to one of electronic marketplace, as in computerized airline reservation systems, with buyers and sellers having no prior relationships (Malone, Yates and Benjamin, 1987). Mukhopadhyay's (1993) review of literature, specifically the analytical stream discusses methods to measure the economic benefits of EDI to adopter organizations. Riggins, Kriebel, and Mukhopadhyay (1990) examined the growth of IOS in the presence of network
externalities (individual demand for the network depends on the consumption of others) when the IOS is initiated by a large buyer. They develop a two-stage model and argue that the buyer will need to offer incentives (example, subsidize supplier costs, free software, educational seminar) to entice reluctant suppliers to join the network in the second stage; this can, however, lead to dysfunctional behavior even in the first stage if the suppliers have \textit{ex ante} expectations of such future incentives. Wang and Seidmann (1991), Venkatraman and Zaheer (1990) build in the identity of participants in addition to the number of participants (in the network) and develop a two-level hierarchical model for a single buyer with competing heterogeneous set of suppliers; they argue that regardless of the buyer's policy, subsidy or mandating, it will be only the buyer and the end consumers who may benefit from EDI adoption by suppliers rather than the suppliers themselves and that partial adoption by the supplier base may be optimal for the buyer.

For the second stream of research in EDI, namely empirical field studies, the major theory bases have been, (1) competitive effects of information technology (Porter and Millar, 1985; Sokol, 1989), (2) the sociopolitical framework for inter-organizational relationships (Stern and Kaufmann, 1985), (3) innovation adoption (Riggins, Kriebel, and Mukhopadhyay, 1990), and (4) IS implementation (Kwon and Zmud, 1987; Lucas, 1978). Reich and Benbasal (1990) selected one specific category of IOS and a sample of 11 firms in Canada and derived three separate models to explain the factors that motivate (supplier) firms to be first movers, the factors that influence the adoption rate of their customers, and the factors that affect the type and sustainability of competitive advantage for a company using such systems. Venkatraman and Zaheer, (1990) and Utterback, (1974), using a quasi field-experiment research design, examined whether the business of
the insurance carrier would be enhanced by agents who are electronically integrated *vis-à-vis* those who are not, and found only weak support for electronic integration's beneficial effects. Using the inter-organization framework, Hart and Estrin (1991) examined the factors influencing the adoption of inter-organizational networks (rather than EDI *per se*) to support exchanges of complex (design and manufacturing) data in the semiconductor industry. They observed that while benefits in terms of improved efficiencies and enhanced effectiveness (with higher internal IS integration) are possible, increased vulnerabilities for the linked partners also emerged due to greater interdependence.

Using the IS implementation and innovation adoption literatures. O'Callaghan, Kaufman, and Konsynski, (1992) examined the role of compatibility, relative advantage (in efficiency and customer service), and external influences (influences of previous adopters, of the initiating carrier, and of the industry) on EDI adoption decision of insurance agents. They also examined the post-adoption effects of EDI in terms of improved buyer-seller relationships and therefore the (increased) proportion of business the seller (carriers) did with EDI-linked buyers (agents). This field study of 1242 insurance agents found relative advantage to be the only variable influencing adoption decision and that such adoption did indeed enhance the carriers' business from EDI-interfaced agents. Holland, Lockett, and Blackman, (1992) examined 17 large US companies (presumably at the forefront in EDI developments) in diversified industries and proposed a "Strategic EDI Model" that should help management in long-term planning of EDI activity. Banerjee and Golhar (1994) attempted to develop profiles of users versus nonusers of EDI and proposed the key motivating factors as well as
difficulties that have a bearing on the EDI adoption decision based on a sample of 62 firms. Hwang, Pegels, Rao, and Sethi, (1992) undertook a large field study of 229 firms and examined the influences of three structural factors such as the size of the firm and eight organizational and industry factors such as championing, involvement of users/traders/vendors, user and trader training and EDI standard use on implementation success on competitive benefits. Very few studies have examined the effect of EDI on organizations. Srinivasan, Kekre, and Mukhopadhay (1990) examined the effects of EDI linkage in reducing shipment discrepancies through its facilitative influences in promoting better coordination (of increased frequency and timeliness of supplies required) in a JIT environment between Chrysler Corp. and its suppliers. Their study of 2746 shipments made over a six-month period by 193 suppliers to Chrysler supported their hypothesis of facilitative effects of EDI.

Innovation, Adoption & Diffusion Model

Research on the adoption of new technology is based on the theory of diffusion of innovations. There are several special aspects of the application of this theory to the case of new technology such as EDI. For example the interactive nature of EDI means that the value of the innovation to the adopter becomes greater with each succeeding adoption. Further, the degree of use of EDI technology becomes an important variable, in addition to whether or not adoption has occurred.

The diffusion of innovation theory plays a pivotal role in the process of technical change. The study of diffusion of innovation seeks to answer the question, why EDI should be adopted or not adopted instantaneously? If EDI technology is not diffuse it
would have negligible economic impact. Without a process of diffusion the return on EDI creation will be insignificant. Therefore the investment decision-making in relationship to EDI diffusion is important in the balancing of supply-side and demand-side elements in the diffusion process.

The model for innovation adoption and diffusion of EDI is shown in Figure 13. The prior conditions are the decisions and events occurring before the innovation development process. These prior conditions include, previous proactive problems, innovativeness and the firm's strategic vision. Next are the communication factors that include, knowledge and persuasion. Knowledge is to gain some understanding of how the existence of innovation functions. Knowledge reflects the characteristics of decision-making unit associated with the firm. While persuasion represents the perceived characteristics of innovation, that includes relative advantage, compatibility, complexity, trial-ability and observability (Rogers, 1995). Persuasion is to determine whether EDI innovation is favorable or unfavorable to the firm.

The innovative-decision process is the process through which the decision-making unit of an organization determines whether to adopt or reject EDI innovation. Innovation can be adopted early or later, while early rejection can lead to later adoption. When the firm puts the EDI innovation into use implementation occurs. At the implementation stage, there are acquisitions of additional information about EDI innovation, use of EDI innovation on a regular basis and continued use of EDI innovation. Confirmation occurs when the firm's decision-making units seek to reinforce the EDI innovation decision previously made, or reverse a previous decision to adopt or reject the innovation if
Adapted from: Rogers (1995)
Figure 13 Paradigm for Innovation Adoption and Diffusion of EDI
exposed to conflicting messages about EDI innovation. The confirmation stage deals with recognition of the benefits of using EDI innovation, integrating of EDI innovation into the firm’s internal organization, and promotion of EDI innovation to other trading partners.

The “infusion” stage is characterized by using the technology in a comprehensive and integrated manner to support higher-level aspects of organizational work and widespread transfer of the technology to other system applications within the organization. In the context of EDI, using EDI for transferring basic purchase orders or sales invoices electronically, although a first step, is not a full exploitation of the technology. EDI has to be “infused” or “integrated” with other internal system applications so that EDI information can be seamlessly transferred into producing, planning, delivery tracking, accounts payable/receivable, and payment systems, and deliver its true potential to the organization (Premkumer, Ramamurthy, and Nilankanta, 1994).

Theory of Inter-Organization

The fifth theory supporting EDI adoption is inter-organizational theory. In the past two decades organization development (OD) has expanded gradually from individual and group approaches to planned change to more comprehensive strategies encompassing the whole organization and its relevant environment. Movement in this direction has extended the domain of OD to wider aspects of the organization including planning and strategy, organization design, and environmental management. Attempts to deal with these more macro issues have frequently pushed OD beyond the organization’s boundaries to diverse segments of its environment. This open systems orientation is
evident in the recent OD literature (Alderfer, 1977; Galbraith, 1977; French and Bell, 1978; Margulies and Raia, 1978) and in the growing number of projects involving organization and environment interfaces (Grandori & Soda, 1995; Sydow, 1992; Motamedi, 1978; Tichy, 1977; Trist, 1976; Culbert et al., 1972).

Application of OD to organization and environment issues invariably leads to consideration of inter-organization relations. This follows from the simple fact that other organizations are a critical part of the environment of any organization. Since organizations frequently have problems establishing and maintaining necessary linkages with other organizations, there is a practical need to develop diagnostic and intervention strategies appropriate to inter-organizational relations. Unfortunately, OD practice in this area often proceeds with little theoretical or empirical direction. Relevant inter-organizational theory and research are currently not applied systematically to planned change making it difficult to diagnose inter-organizational problems and to generate specific solutions to resolve them (Auster, 1994; Alter & Hage, 1993).

The purpose of this chapter is to apply in a preliminary manner inter-organizational theory and research to hotel OD. The paper discusses (1) the need for OD to address inter-organizational issues: (2) a research-based framework for understanding inter-organizational relations: and (3) the implications of this perspective for OD.

Applying OD to Inter-organizational Relations

The major argument for applying OD to inter-organizational relations rests on an assessment of whether such linkages are problematic to the organization's effectiveness. This issue may be addressed by considering inter-organizational relations in the context
of the organization's need to manage environmental dependency. This perspective rests on the premise that organizations are open systems, dependent on their environments for resource exchange, yet requiring independence to operate rationally (Thompson, 1967; Jacobs, 1974; Aldrich, 1976; Pfeffer, 1978). Since environmental dependency places constraints on the organization's ability to function autonomously, it must manage such dependency to survive as an independent entity (Kotter, 1979). Organizations typically manage environmental dependency by establishing and maintaining resource exchanges with other organizations (Levine and White, 1961). To the extent that such exchanges allow the organization sufficient autonomy to operate rationally, the organization is in harmony or balance with its environment. Conversely, to the extent that they jeopardize the organization's independence, problems of survival arise.

Current theory suggests that the nature of the organization's environment affects its ability to manage environmental dependency (Emery and Trist, 1965; Thompson, 1967; Terreberry, 1968; Aldrich, 1975). Specifically, Aldrich (1975) identifies seven dimensions of the environment as important determinates of inter-organizational exchange:

(1) Stability refers to the degree of organization turnover in the environment. The more stable the environment, the more organizations can develop formalized exchanges with other organizations.

(2) Homogeneity represents the degree of similarity among the organizations in the environment. Like stability, the more homogeneous the environment, the more organizations can establish standardized relationships.
(3) Concentration involves the degree to which resources are evenly distributed among the organizations in the environment. To the extent that resources are concentrated in a few organizations, organizations can exploit their position in the environment by developing appropriate exchange strategies.

(4) Capacity refers to the relative level of resources available from organizations in the environment. The richer the environment, the more intense and reciprocal interactions between organizations are likely to be.

(5) Domain consensus represents the degree to which the organization's claim to a specific environmental niche is disputed or recognized by other organizations. The more there is domain consensus among organizations, the more cooperative their exchanges tend to be.

(6) Turbulence involves the extent to which organizations in the environment are undergoing changes. The greater the turbulence, the less organizations are able to formalize exchanges and plan for future relationships.

(7) Mutability refers to the extent to which other organizations in the environment are manipulable. The higher the mutability, the more there is leverage for influencing exchange processes.

The above-mentioned factors provide a preliminary indication of whether inter-organizational relations are likely to be problematic. When viewed as continuous variables, the environmental dimensions suggest that inter-organizational exchanges are more difficult to establish and maintain to the extent that the organization's environment is unstable, or heterogeneous, or dispersed, or lean, or domain conflicted, or turbulent, or immutable. Given each or a combination of these conditions, the organization is likely to
experience problems in managing environmental dependency, hence maintaining its autonomy.

The need to apply OD to inter-organizational relations arises in precisely these circumstances. When the organization's ability to manage environmental dependency is problematic, issues of development (or even survival) are likely to emerge in the context of inter-organizational relations. This may explain the growing movement of OD towards organization and environment issues. There is considerable speculation that contemporary organizations are facing increasing amounts of environmental complexity and change (Emery and Trist, 1965; Terreberry, 1968). If so, traditional attention to internal organization problem is likely to shift toward external demands, especially those from the more organized parts of the environment (Mizruchi & Galaskiewicz, 1993).

A Framework for Understanding Inter-organizational Relations

Inter-organizational theory and research are still in a formative stage. Current studies focus on the nature and consequences of inter-organizational exchange, especially among social service organizations (Zeits, 1974). Although existing research does not form a coherent body of knowledge attempts to provide integration seem promising. Specifically, two recent studies conceptualize and empirically examine motivations for and patterns of inter-organizational relations (Hall, et al., 1977; Schmidt and Kochan, 1977). When taken together, they provide a conceptual framework for explaining the development and consequences of inter-organizational linkages.
Motivation to Interact

A first step in understanding inter-organizational relations is to explain the motivational basis underlying interaction. Presumably, the basis of motivation affects the nature of subsequent interaction. Schmidt and Kochan (1977) address this issue using two competing approaches to interaction: exchange and power/dependency. They argue that the exchange perspective accounts for symmetrical linkages where both organizations are motivated to interact in order to maximize their joint benefits (Levine and White, 1961). Since both organizations perceive mutual benefits from interacting, such exchanges are characterized by a high degree of cooperation and problem solving. The power/dependency approach, on the other hand, accounts for asymmetrical linkages where one organization is motivated to interact but the other is not (Benson, 1975; Schmidt and Kochan, 1976). Here relationships form when the motivated party is powerful enough to induce the other to interact. Since motivation to interact is externally generated for at least one of the organizations, such linkages are characterized by a high degree of bargaining and conflict (Contractor & Lorange, 1988).

Schmidt and Kochan (1977) suggests that inter-organizational relations are based on either symmetrical or asymmetrical motives, the former resulting in complementary exchanges and the latter in power/dependency linkages. Moreover, they argue that an organization can enter into both types of relationships with different organizations in its environment, and that a given relationship may shift from one basis to another over time.

Based on exchange and power/dependency approaches to inter-organizational linkage, Schmidt and Kochan (1977) develop hypotheses relating motivation to interact with frequency of interaction. In a symmetrical situation, frequency of interaction is purported
frequency of interaction is hypothesized to be low when neither organization perceives benefits. In an asymmetrical relationship, frequency of interaction is purported to be high when the organization perceiving low benefits from interaction sees the motivated organization as (1) having goals which are compatible with its own; (2) being important to its functioning; (3) having greater influence over it; and (4) acting aggressively in pursuing its interests by using bargaining and conflict-oriented strategies of influence.

The hypothesis involving asymmetrical relations focuses on concepts central to power/dependency theories. Compatible goals reduce the likelihood that the organization perceiving low benefits will resist interaction because such situations pose little threat to the organization (Evan, 1966; Gutzkow, 1966). Importance, influence, and aggressiveness affect the balance of power between organizations; hence the organization perceiving low benefits may be forced to interact because it is dependent on the more important, influential, and aggressive organization (Harrigan, 1985).

Schmidt and Kochan (1977) present evidence to support these hypotheses. Although the data are cross-sectional, they suggest that the motivational basis for interaction affects the nature of relations between organizations. If this view is correct, attempts to understand inter-organizational relations must start from a motivational base. Since this assumes that organizations interrelate to maximize their self-interests, interaction is likely to be high either when both organizations perceive benefits from the relationship (symmetrical situation) or when one organization is induced by the other to relate because it is dependent on the other (Hennart, 1991; Thorello, 1986).
Mechanisms for Coordination

Hall and his colleagues (Hall et al., 1977) propose symmetrical situation, whereas Schmidt and Kochan (1977) focus on the motivational antecedents of inter-organizational relations, it is also necessary to understand the consequences of interaction. Here the major issue is whether interaction leads to coordination or conflict between the organizations. That different mechanisms promote inter-organizational coordination (rather than conflict) depending on the basis of the relationship. Specifically, three bases of interaction are identified: voluntary, standardized-voluntary, and mandated. Voluntary exchanges arise when organizations perceive mutual benefits from interacting. This is similar to Schmidt and Kochan’s (1977) symmetrical exchange. Standardized-voluntary relations emerge when organizations enter into formal agreements to structure the exchange. Like voluntary interactions, these exchanges are symmetrical yet formalized. Mandated relationships arise when laws or outside agencies govern the interaction. Aldrich (1976) suggests that these exchanges tend to be more intense, imbalanced in favor of one of the organizations, and associated with lower cooperation, and hence are similar to Schmidt and Kochan’s (1977) asymmetrical interaction.

Hall et al., (1977) hypothesize specific mechanisms likely to promote coordination under each type of exchange. In voluntary interactions, domain consensus and positive evaluations of each organization’s performance are purported to lead to coordination, even though attempts to exert power may still occur. In standardized-voluntary exchanges, issues of domain consensus and power relationships are likely to be resolved in formalizing the interaction; hence, mutual recognition of good performance is hypothesized to promote coordination. In mandated relations, domain consensus and
power relations are likely to be controlled by legal statutes: hence positive performance evaluations are purported to facilitate coordination.

Hall et al., (1977) present considerable evidence to test these assumptions. Their findings support the contention that coordination is achieved through different means depending upon the basis for interaction. When exchange is voluntary, the data showed that positive evaluations (i.e., positive assessments of performance, competence of personnel, and compatibility of philosophy), frequency of contact, and person-to-person contact are significant predictors of coordination. When interaction is standardized-voluntary, the findings revealed that power relationships, frequency of contact, and importance of contact are important contributors to coordination. When exchange is mandated, the data showed that positive evaluations (minus compatibility of philosophy), frequency of contact, and quality of communications are significantly related to coordination. Although the data generally support the author's hypotheses, the presence of power relations and the absence of positive performance evaluations as predictors of coordination in the standardized voluntary situation are contrary to expectation.

Inter-organization Framework

The above-mentioned studies (Hall et al., 1977; Schmidt and Kochan, 1977) may be integrated into a comprehensive framework for understanding inter-organizational relations. Schmidt and Kochan explain the motivational antecedents for interaction; Hall and his colleagues account for mechanisms that determine whether such interaction results in coordination rather than conflict. When taken together, the two studies provide
preliminary knowledge of the motivational antecedents and coordinative consequences of inter-organizational relations (Barrett & Konsynski, 1982).

The inter-organizational framework is summarized in Figure 14. It starts with the fundamental issue of why organizations are initially motivated to interact.

Depending on the motivational basis for interaction, symmetrical or asymmetrical, the model suggests that high interaction is likely to occur either when both organizations perceive mutual benefits from interacting or when one organization is induced to interact by the other organization because it is dependent on the other, that is, it sees the other as compatible in goals, important, influential, and aggressive. Given high interaction, the framework specifies mechanisms likely to lead to high coordination. It is important to note that the mechanism 'frequency of contact' is related to high coordination in all three situations studied by Hall and his colleagues (Hall et al., 1977). Since this variable appears to be a measure of interaction, it is deleted from the framework to avoid redundancy with the 'interaction' variable of the model. In the symmetrical situation, the model suggests that high coordination is achieved by different means depending on whether interaction is voluntary or standardized-voluntary. In the voluntary situation power relations and importance of contacts are both high. In the asymmetrical situation as exemplified by mandated exchanges, high coordination results form high positive evaluations and high quality of communications (Glaister & Buckley, 1996).

In its present state the framework is only a crude representation of inter-organizational relations. Further theory and research are needed to refine and extend the conditions affecting interaction and coordination. Most relations are neither purely symmetrical nor asymmetrical. Additional research is necessary to define these mixed-motive exchanges.
Motivation for Interaction

Symmetrical (Reciprocate)

Strong Interaction
If both organizations perceive the following benefits:
1. Cost Saving
2. Strategic
3. Economic
4. Competitive
5. Integration

Strong Voluntary Coordination
When organizations have the following high expectations:
1. Positive evaluations
2. Good relationship
3. Importance of contact

Asymmetrical (Power/Reliance)

Weak Interaction
If one organization perceives low benefits from the other due to the following conditions:
1. Influence
2. Aggressiveness
3. Compatibility
4. Importance
5. Fixed & Variable Cost

Strong Mandated Coordination
When organizations have the following high expectations:
1. Positive evaluation
2. Power relationship
3. Importance of contract

Adapted from: Cummings (1980)

Figure 14 A Framework for Understanding Interorganizational Relations
and to specify the factors likely to affect interaction. Similarly, more refined categories of exchange are necessary for more precise specification of the mechanisms for coordination. This is especially needed in respect of asymmetrical relationship. The present model is limited to mechanisms appropriate to mandated types of asymmetrical exchange. Research into other forms of asymmetrical linkage, such as protest groups seeking to influence corporate decisions, is needed to extend understanding of the coordinative mechanisms. Since the framework is based on cross-sectional research, longitudinal studies are needed to test the causal linkages implied in the model that is, the motivation-interaction-coordination premise. Such research is likely to uncover significant feedback relationships among the variables (e.g., the effects of coordination on subsequent motivation to interact), hence providing a more dynamic explanation of interorganizational relations (Kambil & Short, 1994; Oliver, 1990).

There has been a considerable increase in inter-organizational alliances during the 1980s, particularly in high-technology industries (Haagedorn, 1993; 1995; Hger and Morris, 1988; Mowery, 1988). Within the U. S. bio-technology industry, for example, firms without any formal co-operative ties to other firms have become increasingly rare, while the connectivity of firms within the industry has increased significantly (Powell, Koput and Smith-Doerr, 1996; Dyer, 1996; Badaracco, 1991).

If more than two organizations are linked through a networking relationship, then an inter-organizational network developed. At this point, it suffices to say that inter-organizational networking represents a particular form of organizing, or governing, exchanges relationships among organizations. While networking exchange relationships
among a limited number of organizations that retain residual control of their individual resources yet periodically they jointly decide over their use.

Irrespective of their precise definition, the rise and extending scope in practice of co-operative inter-organizational relationships raises a number of questions for research. Why do firms (increasingly) engage in inter-organizational co-operation and when? With whom are firms likely to ally and why? How do firms organize and control their cooperation? Which forms of network structure result? What are the outcomes and implications for the networked firms and for third parties?

Prior Literature on Inter-Organizational Systems

Interest in IOS can be traced to Kaufman’s, (1966) prediction that computer networks would improve coordination between organizations and radically alter traditional billing and payment procedures. The subsequent emergence of these networks has spawned a number of conceptual frameworks for understanding IOS and their competitive impacts. For example, Porter and Millar, (1985) and Clemons and McFarlan, (1986) assessed the impacts of IOS on the activities that comprise an organization’s value chain (Porter, 1980). Cash and Konsynski, (1985) argued that IOS could support all three generic strategies in Porter’s framework (low cost leadership, differentiation, and market focus). By processing information within the value chain more efficiently and effectively, such systems may help to revise established rules of competition and production costs. Moreover, innovative applications of IT could enhance product and service differentiation and establish tighter links with suppliers, distributors, and customers (Johnson and Vitale, 1988; Teece, 1986; Ives & Learmonth, 1984).
The empirical literature on the consequences of IOS reveals general support for their
economic advantages. Perceived economic benefits include the reduction of order-
processing and inventory costs, elimination of labor-intensive tasks, enhanced speed and
accuracy of communication, and increased market share (Kumar and Cook, 1996; Scala
and McGrath, 1993). Tangible economic advantage was demonstrated in Venkartaman
and Zaheer's (1990) field experiment, which showed that electronically integrated
insurance agents performed better than non-linked agents. The Mukhopadhyay, Kekre.
and Kalathur, (1995) study of nine Chrysler assembly centers showed that EDI was used
to improved the quality of information exchanged, reduced inventory and transportation
costs, and reduced administrative costs (see also Srinivasan, Kekre, and Mukhopadhyay.
1994). They concluded that, over a ten-year period, EDI use helped Chrysler to realize a
benefit of over $100 per vehicle, amounting to annual savings of $200 million. Other
studies support the tangible economic benefits of using EDI (Teo, Tan, Wei, and Woo,

While the reported outcomes of EDI have generally fulfilled expectations, there
remains a need to explain why beneficial consequences result. Beyond the use of
economic theory to explain reductions in transaction costs, relatively little research has
been focused on the organizational factors. Organizational factors include the design and
structure of both inter- and intra- organizational relationships. EDI clearly has the
potential to transform relationships between organizations, and learning how inter-
organizational relationships are altered may give additional insight into EDI's overall
economic effectiveness. For example, Meier, (1990) showed that the use of EDI
showed that investments in inter-organizational information systems positively affected the transactional climate between trading partners in the property and casualty insurance industry. Hart and Estrin and Copeland and McKenney, (1983) found that the use of inter-organizational networks by semiconductor producers reduced production and transaction costs but increased inter-dependencies and associated coordination costs. The greatest benefits are achieved where electronic inter-organizational networks are more integrated with internal computer system (Swatman and Fowler, 1993).

The economic advantages of EDI are likely to depend on EDI’s effects on the relationships among trading partners. To investigate these effects, the research model in Chapter 3 Figure 25 is drawn from research in organization science and marketing, for predicting the effects of EDI use on specific dimensions of inter-organizational relationships. The model also shows the effects of inter-organizational structure on cooperation and upon the satisfaction and performance of channel participants.

Cost Benefit Theory

Cost benefit theory is the sixth theory used in this research to support EDI adoption. As a cost-conscious, highly competitive electronic commerce environment comes of age, businesses are looking at electronic data interchange (EDI) in a new light. EDI communicates information pertinent for business transactions between the computer systems of companies, government organizations, small businesses, and banks (Bragg, 1996).

Over the last decade, EDI has changed not only how firms do business, but with whom they do business in a global marketplace. Prior to EDI, purchase orders,
acknowledgments, and invoices depended on postal systems and communication with trading partners are restricted to a few hours of the workday that overlap from time zone to time zone. Today, computers simplify and enhance communication between business practices like global procurement and sourcing (Bragg, 1996).

Using EDI, trading partners establish computer-to-computer links that enable them to exchange information electronically. This allows businesses to better cope with a growing avalanche of paper work: purchase orders, invoices, confirmation notices, shipping receipts, and other documents. With the aid of EDI, all these documents are in electronic form, which allows more work automation to occur and even alters the way business is done (Sokol, 1995).

Many industries see EDI as essential for reducing cycle and order fulfillment times. Manufacturers work with customers and suppliers to convert to an electronic exchange the huge volume of orders and records that now crawl back and forth on paper. In retailing, EDI can provide vendors with a snapshot of what stores are selling, enabling them to recognize and meet their customer’s needs much faster than in the past. In addition, it enables retailers and vendors to place orders and pay bills electronically, reducing time and the expense of paperwork (Emmelhainz, 1993).

The primary benefit of EDI to business is a considerable reduction in transaction costs, by improving the speed and efficiency of filling orders. Studies show that it takes up to five times as long to process a purchase order manually as it does electronically. In addition, the common interaction channel between trading partners can foster relationships. All this can result in important competitive and strategic advantages (Bragg, 1996).
In transaction cost economics the fundamental unit of analysis is the transaction. Transaction can take place across markets or within organizations. Whether a particular transaction is allocated to the market or to an organization is a matter of cost minimization. Transaction cost economics emphasizes that not only traditional production cost, but also transaction costs should be taken into account. The term transaction costs includes both costs of market transactions and costs of internal transactions (Douma and Schreuder, 1992).

Cost-Benefit Analysis

Cost-benefit analysis has, in many policy contexts, been considered to be any analytical method that enumerates the advantages and disadvantages of alternative actions (Bentkover, Covello, & Mumpower, 1986). When interpreted in strict economic terms, it is a pragmatic realization of the theory of welfare economics, providing a specific organizing framework and a set of procedures to summarize information and display the tradeoffs associated with these actions generally in monetary terms. While a number of past descriptions of the analysis have been so general as to permit many different types of methods for evaluating actions under the heading of cost-benefit analysis (CBA). This section focuses on the narrowest of these interpretations – the strict economic conception. In this setting, CBA judges actions based on an efficiency criterion. Positive aggregate net benefits imply the prospects for an improvement in the resource allocation over the status quo (Andrews, 1982).
Theoretical Foundations

Conventional economic analyses of static resource allocation decisions define an efficient allocation of resources in marginal terms with the Pareto criteria. These conditions are based on the principle that there will be an evaluation of all possible changes to the allocation of each resource. As part of this evaluation, changes in the use of factor inputs and in the allocation of outputs will be considered. In each case changes will be accepted provided they improve the welfare of at least one person without reducing the well being of anyone else. When there are no more of these opportunities, the governing the exchanges of all goods and services (including inputs), no externalities, and no other impediments to the allocation of resources will lead to a Pareto-efficient allocation of resources. Given the distribution of income and wealth, these conditions assure that resources are allocated to their highest valued uses (Just, Hueth, and Schmitz, 1982).

In formal terms, Pareto efficiency implies that the marginal benefit realized from having access to a good will exactly equal the marginal cost of producing it. For private commodities this assures equalization of these marginal benefits (in real terms) across individuals for each commodity and across productive uses for each factor input. For public goods (where consumption by one individual does not diminish the amount available to others), the sum of marginal benefits (across the individual consumers) will equal the marginal costs of provision (Krutilla, 1961).

Since Pareto efficiency is a theoretical ideal, three issues must be considered in the transition from this ideal to its interpretation in the cost-benefit "test" for evaluation actions. The first concerns the evaluation of movements toward an efficient allocation.
The Pareto criterion can be considered as a basis for comparing alternative states, in that one state can be judged superior to another when at least one individual's well-being can be improved without making anyone else worse off. Such an action is one of the sets of accepted reallocation that together define a Pareto-efficient point. Each action is usually termed a Pareto-superior state because it is considered a movement toward efficiency. When all such moves have been taken, the Pareto-efficient allocation is realized. As a rule, cost-benefit analysis has been used in these types of decisions, which are, at best, movements toward an efficient allocation but do not identify the efficient choice (Just, Hueth, and Schmitz, 1982).

In nearly all cases there are individuals who gain and those who lose, without corresponding compensation from the gainers to the losers. This is the second pragmatic adjustment accepted in moving from the ideal to the real-world implementation. CBA accepts an aggregate measure of the net benefits to judge actions. A finding of positive net benefits implies an improvement in the resource allocation. Therefore the analysis accepts the Kaldor-Hicks compensation principle. Potential (as opposed to actual) compensation is sufficient for actions to be judged improvements. Thus CBA relies on the criteria of a potential Pareto improvement (PPI) in judging changes in the resource allocation (Just, Hueth, and Schmitz, 1982).

The third issue relevant to the transition from the Pareto criterion to cost-benefit condition arises from the marginal conditions that characterize a Pareto change and the incremental (often fairly large discrete changes) associated with cost-benefit comparison. CBA focuses on the difference between increments to aggregate (across individuals) costs and to benefits as a result of the action under consideration. The existence of
positive net benefits confirms the efficiency of the base point or frame of reference (Bradford, 1970).

Fisher and Smith (1982) have proposed a simple diagram to illustrate the distinction. In Figure 15, a Pareto-efficient solution in terms of the aggregate benefits and costs for some desired service flow Q, holding all else constant. Figure 15 plots these aggregate functions as X(Q) and Y(Q), respectively. In terms of this one service flow, the Pareto-efficient conditions would require that the level of Q be selected so that the aggregate marginal benefits of Q are equal to the aggregate marginal cost, as at point Q*. As Figure 15 illustrates, the vertical distance between X(Q) and Y(Q) is largest at Q*. By contrast, cost-benefit analysis considers whether the change from a given state will be desirable, for example, from Q₁ to Q₂. Such a comparison for the benefit-cost "test" examines the incremental aggregate benefits P₁ P₂ in comparison with the incremental aggregate costs P₃ P₄. If the difference is positive, then action moves the allocation in the direction of an efficient allocation toward Q*. This will be true regardless of the position of Q₁ in relationship to Q* (it can be above or below Q*, provided the aggregate benefit and cost functions are well behaved). The adaptation of the theory of welfare economics to the benefit-cost criterion represents a substantial oversimplification. Nonetheless, the actual practice of using CBA in the evaluation of specific actions is not a routine translation of the theory just outlined. Consequently, some of the features of that practice will be described in order to highlight several of the important assumptions that underlie its use.
Figure 15: Comparison of Pareto Efficiency and Cost-Benefit From Fisher & Smith (1982)
The Concepts of Benefits

Cost-benefit analysis maintains that consumers' values should be the basis for measures of the benefits of an action. In defining them, economists have generally used an individual's willingness to pay for the good or service provided by the proposed action. When the commodities involved are exchanged in perfectly competitive markets, the market price measures the willingness to pay for the last unit consumed, and the area under the demand curve the total willingness to pay (with given income) for all that is purchased. Thus, for commodities, which are exchanges on such markets, a benefits measurement is reasonably straightforward. What is needed is to consider how the action being contemplated affects the availability of the commodity. Most of the economic theory of welfare measurement has maintained that actions affect the prices of the commodities involved. Thus, evaluating the benefits of an action that reduced prices would amount to estimating how the individual would value the price decline (McKenzie, 1983).

A more appropriate description is that benefit analysis often resembles detective work (National Academy of Science 1975). The analyst must appraise whether the action of individuals (or firms) in their observable resource allocation decisions provided clues about their respective valuations of the non-marketed goods or services. As with any form of detective work, there are several ways to find these clues. One means of classifying the approaches used to estimate these valuations is according to the assumptions they require and the degree to which they recognize the behavioral adjustments which households and firms can take in response to changes in the levels of these non-marketed goods. Each of the methods to estimate values requires that there be
some basis for linking the non-marketed commodity to a marketed good or an action undertaken by households that can be observed. Observation in this case usually means that the action involves market transactions. Linkages can be technical (or physical) or they can be behavioral. For the former it assumed any change in the level of the non-marketed commodity leads to a change in some other good or service.

The Concept of Costs

Costs are normally measured by the opportunity costs of the resources used in the allocation decision. While economists have tended to regard the cost estimation component of a CBA as the easiest, this may be a legacy of the early project orientation of the analysis. That is, when the action involves building a dam, improving a recreational facility, or modifying a stream to reduce the prospects for flooding, engineering estimates of the costs of the projects are constructed as part of its design. While there may be technical issues associated with the treatment of capital and operating costs, these costs are more direct than many benefit estimation problems. However, an increasing share of CBA activity has been directed to actions, such as regulations, that do not involve direct government provision of goods or services but rather indirect controls on how the private sector provides goods or service. Most health, safety, and environmental regulations would fall in this category. In this case, cost estimation requires second-guessing how the private sector will comply with each regulation. Even in the case of the so-called technology-based regulation, costs will vary with the type of plant, and size (Grubb, Whittington and Humphries, 1984; and Ferland, 1983). Information on these costs may be quite difficult to acquire, since firms have incentives to alter their responses or to conceal actual operating information.
The two methods for cost estimation when using CBA are: econometric cost models and engineering estimates. The majority of studies, both in specific project analyses and in evaluation of regulations, have relied on the latter. As a rule, the cost estimates needed are either too specific or detailed to be consistent with the more general ones which could be developed from econometric models, largely because of the state of the art of neoclassical modeling and data limitations (Kopp and Portney, 1983).

The increment to costs associated with the action under study is important for the CBA. This implies that the cost estimates must in both cases (ex ante and ex post) specify a baseline or reference position. To the extent the evaluation takes place over time, cost estimation will require both ex ante and ex post estimates as existing plants are scrapped and replaced. Thus, the baseline is not simply a single definition of a model plant (or set of plants) but can involve a time sequence of plants as they would evolve in the absence of the action as well as a specification of the form they would take with it. Engineering estimates routinely ignore the fact that retirement and scrappage decisions can be influenced by the policies under review, so that the whole nature of what are ex post retrofitting versus ex ante plant design costs can be affected by the action.

Therefore, it should be recognized that the quality of existing cost estimation practices is not an issue that relates exclusively to Cost-benefit analysis. It is also directly relevant to the interpretation and argued superiority of cost effectiveness as a basis for evaluating policy actions. That is, to the extent that the rationale for relying on cost effectiveness over CBA relies on the high quality of cost estimates and lower quality of benefit estimates, this conclusion is not warranted for most cases involving the evaluation of
regulations. Indeed, the more relevant issue is how to reflect the uncertainty in both cost and benefit estimates so as to enhance their value for policy purposes.

**Implications of Cost-Benefit Analysis**

The description of cost-benefit analysis is general and as such cannot account for the specific details that affect the quality and interpretation of cost-benefit results in each application. CBA identify the importance of (1) quantifying the degree of uncertainty in each set of cost-benefit estimates (in a policy relevant format), and (2) implementing a program of research that systematically evaluates the consequences of the pragmatic judgments that are part of the cost-benefit analyses (Sugden and Williams, 1978).

**Measuring EDI Costs and Benefits**

EDI is occasionally thought of and promoted as a cost-saving technology, and most survey of EDI users shows that obtaining cost reductions is not the primary reason for adopting EDI. Research indicated that improved information accuracy and customer service are cited as the most important benefits of EDI by the largest number of respondents (Emmelhainz, 1993). A study of large companies indicate that “the reason most commonly cited for implementing EDI is strong demand by customers” (Emmelhainz, 1993; Sokol, 1995).

Research shows that pioneer users of EDI, mainly the automotive, grocery, chemical, and other manufacturing industries indicated that only 13 percent of the companies had specifically quantified EDI costs and only 27 percent had specifically quantified EDI benefits, prior to implementing EDI (Emmelhainz, 1995).
Reasons for Documenting Costs and Benefits

To Promote EDI Within the Organization

Research shows that many of the early pioneers and strong supporters of EDI found that quantifying EDI costs and benefits was not necessary, there were a number of reasons why cost/benefits quantification was performed. First, regardless of how important EDI may be to a firm’s survival, many organizations still require some of economic justification. EDI can be economically justified, based upon tangible savings. It makes sense, therefore, to perform the analysis and to use the results in marketing EDI throughout the corporation (Emmelhainz, 1993).

To Assist with EDI Projections

In firms where no economic justification is required (top management is convinced that EDI is essential for survival), quantifying costs and benefits is still useful. The cost/benefit analysis not only will indicate the level of resources that must be budgeted for the adoption of EDI, it also show the financial changes that can be expected as the use of EDI grows within the organization (Emmelhainz, 1993).

To Facilitate EDI Strategy

Another important reason for doing a cost/benefit analysis is to help in the selection of an EDI implementation strategy. The costs to implement EDI and the resulting benefits vary considerably depending upon the type of EDI system implemented. A cost/benefit analysis of the various EDI options, along with a review of resources available, will help to determine the type of EDI system to implement. If resources are likely to be limited in the first year of EDI operation, a company may choose to implement a system with a microcomputer as a front end to a mainframe. In this arrangement, initial costs would still
be low, and the organization has the option of expanding the system to a full mainframe operation in the future (Emmelhainz, 1993).

Behavior of EDI Costs and Benefits

By conducting a cost/benefit analysis, three important characteristics of EDI investment should be kept in mind. This is particularly true if EDI is going to be justified on an economic basis. The three points are (Emmelhainz, 1993):

1. Costs come early; savings come later.
2. Costs are easy to determine, benefits are not.
3. Both costs and benefits are fully dependent upon the type of strategy taken.

The Appropriate Time for Costs/Benefits Analysis

The adoption of EDI requires substantial amount of funding. This was even true if a simple microcomputer system is to be used. Training, purchase of development of software, purchase of any needed hardware (such as microcomputers and modem), and membership in EDI associations and standards groups will all result in costs before any EDI can actually be done. A large portion of EDI costs tends to be fixed, up-front costs.

It is generally believe, benefits tend to be variable as a function of EDI volume. In other words, the benefits will increase as the volume of EDI usage increases. Most EDI adoption efforts begin with the exchange of just a few documents with a small number of trading partners. Therefore, benefits are going to be small during the time when the costs tend to be very high (Emmelhainz, 1993).

Knowing when EDI costs and benefits start is important because in the early stages of EDI, it is very likely that EDI will “be losing money.” During the time when costs are
greater than benefits, it is important that the company remain committed to the EDI effort. It was usually during this time that the strongest internal promotional efforts are needed (Emmelhainz, 1993; Sokol, 1995).

**Estimating Costs and Benefits**

An essential point to take into account during a cost/benefit analysis is that it is generally easier to estimate costs than it is to estimate benefits. Costs usually historical figures, that can be directly determined. Costs for such things as EDI training, software, or VAN services can be determined exactly because the vendor sends a bill showing the cost; time and effort of internal staff to perform in-house development or to make modifications to existing programs (Emmelhainz, 1993).

The benefits from EDI are more difficult to assess. Forecasting the amount of inventory that will be saved, the amount of paperwork that will be reduced, and the effort of improving information accuracy is often subjective. The data needed to project benefits are usually not available or not correct (Emmelhainz, 1993).

Making the distinction between costs and benefits is of critical importance when carrying out the cost/benefits analysis. In most cases, it is likely that estimated costs will be accepted while estimated benefits will be challenged. The EDI analyst must be prepared to defend their analysis and to support the projected benefits that will materialized (Emmelhainz, 1993).

**Relationship to EDI Approach**

EDI can be expensive or low cost. Likewise EDI benefits can be very small or they can also be very substantial (Sokol, 1995; Emmelhainz, 1993)). An organization approach to EDI system can range form a stand-alone system to a total re-engineering of
a firm operations. Both costs and benefits increase as EDI is more integrated into, and used as a change agent for, operations (Emmelhainz, 1993).

Categories of EDI Costs

This section outlines the types of costs and benefits that are involved in an EDI implementation effort. The purpose of the discussion is to provide a framework for performing a cost justification. Figure 16 illustrates EDI cost/benefit analysis. The classifications of costs are fixed and variable, while benefits are categorized as direct or indirect.

Hardware Costs

The costs of EDI hardware include the purchase and maintenance of any computer equipment necessary to perform EDI. Most companies are likely to already have all the necessary hardware. While some may need to purchase either a microcomputer and/or a communications modem. These items could be purchased for a few thousand dollars. Some companies, as they begin implementation of EDI, purchase additional hardware to assist their trading partners (Emmelhainz, 1993; Bragg, 1996).

Software Costs

Software can be of two general categories: initial software development or purchase and ongoing maintenance costs. There are two factors that determine the level of software costs. The first is the configuration of the EDI system. If a microcomputer system is used, initial software costs for translation software could be low. While mainframe translation software will usually cost more (Sokol, 1995 Emmelhainz, 1993).
Regular maintenance of software is necessary to ensure that the software can handle updated versions of the standards. Maintenance costs also vary with type of system, ranging from a low cost for microcomputers to very substantial cost for mainframes (Bragg, 1996; Emmelhainz, 1993).

Another factor that could influence software costs is the degree to which EDI is to be implemented into internal applications. If EDI is implemented as a stand-alone function, no additional software beyond the translation software is needed. If, however, the EDI system is integrated with internal application system, and the internal application systems are bridged, additional software development is necessary. Software development costs coupled with modification can be very expensive (Bragg, 1996; Emmelhainz, 1993).

**Employment Costs**

The adoption of EDI requires the support of the MIS staff as well as the support and participation of EDI team members. While many companies allocate MIS support to the EDI effort and charge MIS time against the EDI project in computing project costs, most companies do not charge time of other EDI team members (such as functional managers) to the EDI project. However, any new personnel who are hired for the EDI effort are usually charged against the project (Emmelhainz, 1993; Sokol, 1995).

**Consultant Costs**

Organizations can obtain the services from an outside consultant to assist in the development of EDI strategy. The cost of hiring a consultant is usually a one-time fixed cost incurred early in the EDI effort (Emmelhainz, 1993).
Training Costs

Every EDI implementation effort is going to require some degree of training for company personnel as well as for trading partner personnel. Costs include training provided both in-house as well as by vendor. The most significant amount of training is usually incurred up front, with a limited level of ongoing training required to keep personnel abreast of changes in standards and technology (Emmelhainz, 1993).

Time Value Costs

Another cost that may be incurred when doing EDI is the loss of float. This is incurred if, because of EDI, payments to suppliers are made earlier than prior to the implementation of EDI. This variable cost is a function of the percent of payments handled electronically, the amount of cash flow lost, and the organization’s cost of money. Many organizations have removed this item as a cost by negotiating new “float-neutral” payment terms when EDI is used. In others, terms are negotiated that reflect an earlier payment. A word of caution is needed here, however: EDI does not, in any way, require earlier payment. Information, including payment information and value, has the capability of being transmitted more quickly, it does not have to be. The electronic payment due date can be the same as the paper due date (Emmelhainz, 1993).

Transmission Costs

Transmission cost of data occurs between trading partners. In cases where a VAN is used, both one-time and ongoing costs will be incurred. Most VANs charge an initial start-up fee and then also charge a per-message or per-transmission fee. The per-message or per-transmission fee is classified as a variable cost, based upon EDI volume. If a direct
link between trading partners is used, the communication costs will vary depending upon whether communication lines are private or public (Emmelhainz, 1993).

**Miscellaneous Operating Costs**

This will involve the direct costs of investigating EDI through books, magazines, and seminars. It does not cover internal implementation, and business planning. Cost can be assessed low for a small user, average for a medium user, and expensive for a large user (Sokol, 1995; Emmelhainz, 1993).

**Categories of EDI Benefits**

As stated previously, EDI costs are much easier to estimate than are EDI benefits. Although some benefits are obvious and measurable, such as a reduction in postal expense, other benefits are much less notable and much more difficult to compute, such as improved productivity of personnel. Outlined below are types of costs savings that could be realized with the adoption of EDI (Sokol, 1995; Emmelhainz, 1993).

**Payroll Savings**

The adoption of EDI reduces the number of clerical activities normally performed in a paper-based system. Therefore, the cost of performing these activities can be considered as costs savings under EDI. Activates that are usually reduced or eliminated by EDI include (Emmelhainz, 1993):

- Re-keying operations of data
- Mail processing costs (stuffing envelopes, addressing)
- Filing costs
- Reconciling various documents
Follow-up on incorrect, lost, or late documents

The savings that occurs from personnel costs are a function of a number of factors. The savings are variable based upon the percentage of EDI volume. The greater the EDI volume, the more savings will be realized. The dollar value of the savings will vary considerably based upon who currently performs the activities listed above. On some organizations clerical personnel perform follow-up, while in others, buyers do it. A third factor that will influence the actual amount of costs savings experienced is what is done with the “time saved” due to elimination of activities. Some companies have actually been able to cut staff due to EDI. Others have not cut staff, but have been able to assign present staff to additional activities. In these cases, savings have been estimated based upon the number of additional personnel who would have been hired existing personnel not been reassigned (Emmelhainz, 1993).

Savings from the Reduction of Paper

Since EDI replaces paper documents with electronic documents, paper costs are reduced with EDI usage. Saving comes from paper forms and storage and mailing costs are variable, and based upon the level of EDI usage (Emmelhainz, 1993).

Savings from Inventory

EDI usage can lead to reduction in inventory levels, resulting form a shorter order cycle time as well as decreased uncertainty in order cycle time. Inventory savings are a function of the number of days of inventory reduced and the cost of carrying the inventory( Sokol, 1995; Emmelhainz, 1993).
Benefits from Early Payments

If EDI can be used to receive cash payments earlier than through traditional methods.

The benefit of earlier payment is variable and based upon the number of payments received earlier. The amount of costs savings is a function of the additional time the money is available and the organization’s cost of money (Emmelhainz, 1993).

Costs Savings from More Timely and Accurate Information

Additional savings are possible form EDI due to availability of more timely and accurate information. Examples of these savings include (Emmelhainz, 1993):

Reduction in premium freight charges

Reduction in out-of-stock situations and lost sales

Reduction in production line shutdowns

Other Benefits

The benefits previously explained are those than can be measured by most organizations. EDI provides a number of additional benefits that cannot be easily quantified but that are often “factored into” the decision to implement EDI. Improved internal operations, closer relationships with vendors, maintenance of the customer base, and increased sales due to increased productivity of personnel all have a value to the company and should be considered in the EDI decision (Emmelhainz, 1993).

Analysis of Cost/Benefit

Measuring the total economic impact of EDI, a number of points should be taken into account. First, the calculation should be made over a multiple year time period. As stated, costs of EDI tend to be short term. While benefits tend to be long term. Therefore, the analysis should not be done on a one-year basis, but rather for the life of the EDI effort.
Second, the analysis should take into account the rate of growth of the EDI effort. Most of the benefits are variable, based upon the level of EDI volume, while most of the costs tend to fixed. The analysis should include an estimate of the volume of transactions that will be converted from paper to electronic means each year (Emmelhainz, 1993).

Not all organizations will perform an EDI cost/benefit analysis. This type analysis provides useful information. Most companies, analysis will provide economical justification for using EDI. This economic justification, coupled with strategic advantages available through EDI, will prove useful in promoting EDI usage within the organization (Emmelhainz, 1993).

The Relationship of the Theories to the Research

The six theories discussed offer four functions to EDI practice. These four functions are, describing, explaining, predicting, and controlling practice. These theories organized the relationships between the complex events that occur in an environment that use EDI to make an organization more proficient in the way they conduct business. Simply stated, these theories provide a way of thinking about and looking at the practice of EDI within the business community.

In order to practice EDI with a theoretical approach, it is essential to have an understanding of the development and meaning of theory. These six theories on EDI discipline basically provide ideas about the way researchers and practitioners look at EDI situations in order to achieve certain goals. Researchers and practitioners must understand the relative merit of EDI theories for practice.
Figure 17 shows the core identification model of EDI theory components. The concepts are central to the entire development of the theory. They are including in all other components of theory. The four component of theory were related sequentially to one another. Concepts relate to definitions, definitions to propositions, propositions to models and models to theory. The process of developing EDI theory from concepts to models was an inclusion process. The four core components will be discussed next.

**Concepts**

The first step in EDI theory formalization is the identification and classification of its major concepts. A concept was defined as a word or collection of words expressing a mental image of some phenomenon. The concept summarizes seemingly related observations and experiences associated with EDI. Concepts are classified on the basis of the extent of their observability or their measurement characteristics (Kaplan, 1964).

**Definitions**

The second step in theory formalization is identification of the definitions of the concepts used in the theory. Concepts are the basic building blocks of theories and therefore must be precisely defined so that the meaning of one concept may be distinguished from the meaning of another. A definition is a statement of intention to use a concept in a particular way. Although definitions are arbitrary labels that are not verifiable, they usually are determined by convention. At any given stage of theory development, some definitions of concepts are taken as understood and others are newly introduced. Usually, a new theory adds only a few newly defined concepts, using instead definitions taken from previous theories (Kerlinger, 1986).
Adapted from: Torres (1986)
Figure 17  Core Identification of EDI Theory Components
Types of Definitions. Two types of definitions are needed to make the concepts of a theory empirically testable. The constitutive definition defines a concept with other concepts. It provides the concept with the theoretical meaning. This type of definition is also called a theoretical definition. A nominal definition, or a rational definition. A constitutive definition attempts to state just what the concept means.

The operational definition provides the concept with empirical meaning by defining it in terms of observable data, such as the activities necessary to measure the concept or to manipulate it. This type of definition is also called an epistemic definition, a real definition, or rules of correspondence or interpretation. Operational definitions are measurement-oriented interpretations of constitutive definitions. Kerlinger (1986) identified two classes of these definitions. The measured operational definition states how a concept will be measured. The experimental operational definition spells out the details or operations required to manipulate the concept.

Operational definitions are necessary regardless of the type of research. This is true whether the operational definition identifies the paper and pencil questionnaire used in a survey or the domain of the researcher-informant experience of ethnography. Although operational definitions are needed for all types of research, they are a legacy of the experimental method. Discovery of theory by experimentation depends on actual operations with the variables involved. In fact, Bridgman (1972), the originator of operationism, viewed a concept as nothing more than a set of unique operations or procedures necessary to produce an observation.
Propositions

The third step in theory formalization is specification of the propositions as they are given in the research report. A proposition is a declarative statement about one or more concepts.

The Hypothesis.

Hypotheses are special types of propositions that represent conjectures about concepts stated in empirically testable form. They are expectations about the way things are in the world if theoretical speculations are correct. A hypothesis is derived from a proposition by linking one or more constitutively defined concepts with the empirical indicators identified in the operational definitions. Technically, a hypothesis is a prediction about one or more empirical indicators. More specifically, a hypothesis is a prediction about the scores obtained from the empirical indicator(s) (Dubin, 1978; Gibbs, 1972). The numerical scores form the empirical indicators are what are compared when statistical tests are conducted. Although most research reports state the hypothesis using only the names of the concepts examination of the report should determine what empirical indicators are included in the actual hypotheses. Like operational definitions and empirical indicators, hypotheses are, strictly speaking, not part of a theory.

Models

The first step in theory formalization is construction of a diagram of the theory. A diagram helps to determine how all the concepts, definitions, and propositions of the theory were brought together. It is the final aid to understanding exactly what the theory says and what it does not say. It also facilitates the identification of gaps and overlapping ideas in the theory (Burr, Hill, Nye, and Reiss, 1979; Hardy, 1974; Lin, 1976).
Theory Formalization

The four components of theory (concepts, definitions, propositions and models) presented a systematic view about the phenomenon (EDI). Table 2 presents a summary of EDI theoretical components using the four functions of theory components. That is useful for description, explanation, prediction, and/or control. The EDI theories developed from the four components expressed new ideas or new insight into the nature of the phenomenon of interest (EDI).

A theory, by virtue of its predictive potential, is the primary means of meeting the goals of EDI practice concerned with a clearly defined body of knowledge. That knowledge is a vital component in the human decision-making process involved in EDI usage and policy formation.

However, because scientific theories may permit control of certain phenomena through relations posited, it does not follow that those theories provide sufficient grounds for using that knowledge as a means of control. It is human judgments about the goals, obligations, and rights of those with whom and for whom EDI usage is planned that are the final bases for researchers and practitioners use of theory in practice situations.

Each of the four functions of theory-description, explanation, prediction, and/or control-represents a different phase of theory development. The ideal theory would do all these things well. However, there is rarely, if ever, such a thing as an ideal theory in any discipline-one which accomplished all four functions at the same time. At any point in time, the various theories in a discipline may be found at all stages of development. Some
Table 2
Summary of EDI Theory Components Evaluation

<table>
<thead>
<tr>
<th>Components</th>
<th>Evaluation Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concepts: Are words or collection of words expressing mental images of some phenomenon through categorization, interpretation and structure?</td>
<td>Relate to the basis concept of EDI. Concepts are easily identified. Concepts can be observed or measured.</td>
</tr>
<tr>
<td>Definitions: Are statements of intention to use the concepts in a particular way (meanings given to concepts)?</td>
<td>Provides concepts with theoretical meaning (constitutive definition). Provides concepts with empirical meaning (operational definition). Instruments used to measure concepts (empirical indicator).</td>
</tr>
<tr>
<td>Propositions: Are Declarative statements of expression of relationship about one or more concepts?</td>
<td>Non-relational proposition (one concept). Relational proposition (two or more concepts). Empirically testable form (hypothesis).</td>
</tr>
<tr>
<td>Models: Are diagrammatic structural design of general concepts and propositions of interest to a particular discipline?</td>
<td>Show logical relationship between concepts. Inventories of concepts and propositions. Conceptual maps (utilized relevant concepts).</td>
</tr>
<tr>
<td>Theory: Can describe, explain, predict, and control intended outcomes and goals from practice.</td>
<td>Description: The firm/trading partner situation is represented in such a way to give focus on the practice of EDI. Explanation: There is a logical relationship between events with trading partner and situation that influences the impact of EDI practice on the firm.</td>
</tr>
<tr>
<td>Predictions: Given certain approaches to EDI practice future projection can be made based on scientific reasoning.</td>
<td>Control: The theory can be used to produce a desired outcome.</td>
</tr>
</tbody>
</table>
theories are specifically designed as explanations, such as the theory of evolution, without any intention of predictability. Others are designed specifically to yield predictability but do not provide control. Indeed there are times when control might be impossible or unethical. For example, major earthquakes can be predicted but not yet controlled and, one hopes, never prescribed. Theory building is an imperfect world. Scientific thought grows through a self-correcting process. The submission of one’s ideas to the critique and analysis of one’s colleagues leads to a phenomenon of revision, validation, and extension of a given theory (Fawcott and Downs. 1985).

So far none of the six theories, examined is completed in terms of the four functions of theory (description, explanation, production, and control). Therefore it is imperative to propose a new comprehensive theory on EDI usage to examine its relationship to the hotel industry. The new propose theory is general system theory.

Systems Theory in a Hospitality Context

Systems theory revolves around the idea that organizations can be seen as a series of interdependent parts. Changes in one part of the system will necessarily have implications for other parts of the system. For example, a hotel as an organization will consist of a series of sub-systems, such as food and beverage, housekeeping, reception, maintenance and casino operations. Changes in one of those sub-systems resulting in additional customers will bring about changes in the food and beverage and housekeeping sub-system, as they will have to cater for the additional customers. Systems theory, therefore, allows managers to predict in advance what kinds of effects changes in one part of the system may have on the other parts.
Studying hotels as systems also allows managers to take account of the environment in which their hotel is located, as system theory models identify the need for regular feedback into the system from the environment. The models indicate that the system must be kept in a steady state; therefore feedback and monitoring will always be necessary. If feedback is not received, the system will not be able to accommodate changes and negative entropy will result. Systems, that do not take account of changes in the environment, are called closed systems and their long-term survival or success may be jeopardized by failing to adapt to the changing environment. For example, an organization that does not take account of changing customer tastes or the impact of economic recession, clearly takes the risk of losing its market share.

Studying organizations as systems also allows managers to take an overview of their organization or hotel in relation to problems within the subsystems, for example, the management of conflict between departments. Additionally, authors of systems models have developed sociotechnical systems, which draw attention to the relationship between work groups and the technical components of the work. This has been important in raising issues of job design and marching particular work groups to the specific technology.

Systems theory is designed to show the way in which theories allow the social scientist to abstract the issues from the area of study and to apply it to models that can assist in explanation. The main purpose of this is to allow for some degree of prediction to occur.

Using models or theories of behavior allows for generalize from one unit or system to another. Therefore, a theoretical framework allows explanation for classes of phenomena.
such as hotels. This theoretical framework may then show that the results obtained are not universal. Hotels at different market levels, or of different sizes, do not reveal the same patterns, which allows for refinement of theories. Without a theoretical framework to shape the collection of data, data can only be collect and analyze. that are relative to the particular sample that is study. For example, without a theoretical framework, we can observe staff pilfering at a particular hotel, at a particular point in time, but can go no further in generalizing about the phenomenon of occupational theft. However, if we started out with a theoretical framework concerned with the notion of group dynamics in occupational theft, we could use a theory to test the phenomenon in a wider range of hotels. thereby drawing conclusions about pilfering and generalizing to a wider context.

General System Theory

Bertalanffy (1968) became the primary articulator for the 'general systems theory' viewpoint. principally perhaps because he appreciated more than most the limitations of traditional science and saw the need to generate a revised science. He described general systems theory as the science concerned with complexly organized wholes.

Initially, Bertalanffy defined a 'system' simply as an organized, cohesive complex of elements standing in interaction. Subsequently greater emphasis came to be placed on 'interdependences' and 'environmental interactions'. A standard definition of system on the late 1960s, for example, stated that a system is 'a concept that refers both to a complex of interdependencies between parts, components and processes that involves discernible regularities of relationships, and to a similar type of interdependency between such a complex and its surrounding environments' (Bertalanffy, 1968).
To conceptualize an organization and its environment in holistic system terms, as a complex of interrelating, mutually interdependent parts, and as a field of interdependencies, is a fundamentally different world view form that of a set of antecedent factors that subsequently cause changes (Bertalanffy, 1971; Laszlo, 1975).

The Relevancy of General Systems Theory

As indicated above, general systems theory (GST) is the perspective from that we wish to examine Organization Development (OD) interventions. Thus, GST becomes the 'language' for discussing organizations and their component subunits and processes which are nominally the targets of change endeavors. A general theory of systems would be a useful tool providing, on the one hand, models that can be used in, and transferred to, different fields, and safeguarding, on the other hand, from vague analogies which often have marred the progress in these fields (Bertalanffy, 1968).

General systems theory comes about as consequences of noting the existence of general systems properties appearing in the pattern of similarities and functional isomorphisms found in many different fields, especially those fields studying organized complexity common in the biological, social and behavioral sciences; that is, fields whose phenomena are not easily explained by mechanical sciences; that is, fields whose phenomena are not easily explained by mechanical and probabilistic approaches (Buckley, 1967, p. 43).
A Systems View of Organizations

A strong argument has been made for viewing organizations as dynamic entities continually interacting with their environment, changing and adapting to develop congruence between people, process, structures, and external environments. This dynamic view helps explain why bureaucratic organizations, the dominant form of organization when the environment is stable, are under stress and new organizational forms are evolving. It also provides a historical and developmental perspective for any one organization and aids in diagnosing the current state and problems within that organization.

Healthy organizations sense change in the environment and make adaptations in the way they function to accommodate new environmental demands. They may also elect to interact with only parts of a larger environment based on assessment of their capacity to respond. Finally, they can try to influence their environments to be consistent with organizational arrangements and dominant managerial practices (Starbuck, 1976).

Systems Theory Applied to Organizations

Systems theory, the ideas that help explain the dynamic interrelationship of several parts of a larger whole as it interacts with its environment, has in the last several decades been applied to organizational theory (Kast and Rosenzweig, 1970; Katz and Kahn, 1978; Lawrence and Lorsch, 1967; Stogdill, 1959; Roethlisberger and Dickson, 1939). Even more recently systems theory has found its way into organization development where it has helped in organizational diagnosis and intervention strategies (French and Bell, 1978; Kotter, 1978; Beer, 1976; Huse, 1975; Beer and Huse, 1972). Applying systems theory to organizations leads to the following list of general characteristics.
(1) Organizations are composed of several components or parts that are in interaction with one another while at the same time part of an identifiable whole. These components may be subunits or they may be dimensions such as people, process, structure, and culture.

(2) Organizations, having more or less permeable boundaries, interact with an external environment from which they obtain energy/matter or information as inputs and to which they export a product or service as outputs. (By energy/matter is meant people, electricity, money, materials, etc.)

(3) Organizations are a network of people, structures, and technical operations that transform the raw materials, such as energy or people, into a product or service desired by users in the environment.

(4) Organizations have feedback mechanisms that allow its various parts or components to adjust to its other parts and components. Similarly there is information flow between the organization and its environment that allows it to adapt and influence. Market research departments are examples of external sensing functions, while various interdepartmental meetings are examples of internal feedback mechanisms.

(5) Entropy, or a running down of the system, will occur to the extent that energy is not continuously imported and converted into valued outputs that allow reinvestment and further development. For social systems, the most important maintenance source is human effort and motivation. Thus the motivation of people in the organization becomes just as important a source of energy as financial and other energy/matter resources.
General Systems Theory Current Development

The development of general system theory has provided a basis for the understanding and integration of scientific knowledge from a variety of specialized fields. Kast and Rosenzweig (1985, p. 103) define a system as "an organized, unitary whole composed of two or more interdependent parts, components, or subsystems and delineated by identifiable boundaries form its environment supra-systems."

When one applies the definition and key concepts of general systems theory to organizations, it is imperative also to define the structure and characteristics associated with that particular organization. The information obtained from this dissecting process provides a basic understanding of the organization in terms of its functional and operational capabilities.

The key general systems theory concepts that are common to all systems are as follows:

A system is more than the sum of its parts; it must be viewed as a whole.

A system has boundaries that separate it from its environment.

Systems have subsystems and are also part of a supra-system; they are hierarchical.

Systems can be further identified as open as closed. Open system organizations interact with their external environment, whereas closed system organizations exist within their own environment. The key concepts associated with open and closed systems are depicted in Table 3.

Organizations can be considered in terms of an open system model. The internal functioning of an organization must be congruent with the demands of organizational
Table 3  

**General System Theory Comparison of Open & Closed System**

<table>
<thead>
<tr>
<th>Open System</th>
<th>Closed System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receives inputs from its environment</td>
<td>Does not receive inputs from its environment</td>
</tr>
<tr>
<td>Does not experience entropy if the inputs from the environment are as great as the energy the systems use plus the energy and materials used in the operations of the system</td>
<td>Subject to entropy due to lack of inputs being received from their environment: this results in the failure of the entire system</td>
</tr>
<tr>
<td>Equifinality is a process used by open systems to achieve desired results; established expected outcomes may be accomplished in a variety of ways, using assorted inputs</td>
<td>The cause and effect relationship is the common process associated with closed systems: regimentation and specified sequencing result in the designed or expected outcomes</td>
</tr>
<tr>
<td>Exchanges information, energy, or material with its environment</td>
<td>Does not interact with its environment</td>
</tr>
<tr>
<td>Tends toward increased elaboration, differentiation, and a higher level of organization</td>
<td>Tends toward entropy and disorganization</td>
</tr>
<tr>
<td>Dynamic equilibrium is achieved when there is a balance or steady state; open systems have a greater potential to remain in a dynamic equilibrium through their ability to allow the inflow of materials, energy, and information</td>
<td>Dynamic equilibrium can be achieved in closed systems for a period of time until the lack of available resources, such as materials, energy, and information are depleted</td>
</tr>
<tr>
<td>The feedback of information required to maintain a steady state may come from inside or outside the system</td>
<td>The feedback of information required to maintain dynamic equilibrium may come only from inside the system</td>
</tr>
</tbody>
</table>

Adaptation from: Kast and Rosenzweig (1985)
tasks, technology, external environment, and the needs of its members if the organization is effective.

The view of an organization as an open system suggests a different and more challenging role for the management than their roles would be in a closed system. The open system interacts with its environment and move toward a steady state while maintaining capacity for workflow and energy transformation.

Management must deal with external uncertainties and ambiguities and be flexible to adapt to new and changing requirements. For example, the hotel organization receives input form its external environment in the form of personnel, financial and material resources, and information. These inputs facilitate the accomplishment of outcomes expected of hospitality organizations. In addition, employee participation is reinforced and rewarded for achieving organizational goals.

Katz and Kahn (1978) conceptualize the role of the executive or manager as one of a number of organizational subsystems. Such subsystems operate together to meet needs and accomplish necessary tasks. They identify maintenance structures that function to maintain stability and predictability in the organization. The purpose of such structures is to preserve a steady state of equilibrium. Such structures may result in a tendency toward organizational rigidity the preservation of the status quo in absolute terms, or they may necessitate mediation between task demands and human needs to keep the structures in operation. Such mechanisms for maintaining stability seek to formalize, or institutionalize, all aspects of organizational behavior.
The boundary structures of procurement of materials and personnel and product disposal involve transactional exchanges with the environment. These mechanisms concern acquiring control of sources of supply and creating an organizational image.

Adaptive structure concerns the survival of the organization. Both the maintenance and adaptive structures move in the direction of preserving constancy and predictability in the conditions of organizational life. Katz and Kahn (1978) emphasize that the adaptive function can focus either on attaining control over external forces, and maintaining predictability in the operations of the organization or on achieving internal modifications of organizational structures to meet the needs of a changing world.

The managerial subsystem cuts across all the operating structures of production, maintenance, environmental support, and adaptation. The managerial system is the controlling, or decision-making, aspect of the organization. The authors further state the "the complexity of organizational structures implies that the functions of managements are also complex. Three basic management functions can be distinguished: (1) the coordination of substructures, (2) the resolution of conflicts between hierarchical levels, and (3) the coordination of external requirements with organizational resources and needs" (Katz and Kahn, p.91).

The goals, resources, and outcomes as well as technical, adaptive, psychosocial, and managerial subsystems are all essential elements of the overall organizational structure within a general systems model framework. For example, because they are concerned with developing management principles and improving production efficiency, classical management theorists focused on the structural and managerial subsystems. The human relations and behavioral science approaches, on the other hand, emphasized the
psychosocial aspects, differences in individual behavior, and the influence of the work
group on the individual. The contemporary systems approach envisions the organization
interacting with all of its subsystems and the external environment.

System Model Using EDI Information Flow

Since EDI can be defined as an intraorganizational/interorganizational computer-to-
computer exchange of business documents and hotel organizational can be explain using
system theory, then an open systems model can be design to show information flow using
EDI between a hotel organization and its trading partners. What is the purpose of
designing a system model to articulate the structure and flow of information using EDI?
One answer is simply to create a conceptualization of various systems in a hotel
connected to its trading partner through EDI information flow. A second answer is that it
provides a tool to better explain the communication process associated with EDI usage.

The model developed for EDI information flow based on system theory is illustrated
in Figure 18. The rational that emerged from this model is the recognition that it provides
a basis for EDI usage in purchasing, accounting, finance and strategy (these usages were
explained in details in Chapter 3). The model specifies explicit linkages between various
systems.

In Figure 18 purchasing information was exchange through the use of EDI. Also
trading and delivery information between hotel and trading partners used EDI. Banking
is conducted through the use of EFT or FEDI. EFT is the electronic transfer of
information between banks that result in debits and credits of value to accounts. While
EDI and EFT are not the same they are very closely related using similar type
Adapted from: Kalakota and Whington (1996)
Figure 18 Open Systems Information Flow Using EDI
technology (Emmelhainz, 1993). FEDI comprise the electronic transmission of payments and remittance information between a payer, payee, and their respective banks.

The model specifies explicit linkages between various systems, partly because of the cause and effect relationships between them. This model can be use by managers or change agents as a tool in open system planning.

Open system in Figure 18 is the process by which managers systematically examine the relationship between their organization and its environment. Following a definition of the environment and their strategy in it, managers can specify the demands of the environments and its implications for the kind of human outputs, people, structure, culture, organizational process and behavior required. By comparing the actual state of the organization's system with the required state, a plan for organizational improvement can be developed.

Due to the interdependence of the many components and dimensions of systems, managers contemplating permanent improvements in organization will have to plan multiple changes in the systems. To identify the dimensions in each system component needing change, an assessment of each and its potential affect on risk taking and collaboration will have to be performed. The action plans for making changes in certain components and dimensions must be developed.

The process of diagnosis and open system planning using a model such as the one presented in Figure 18 can have a number of important affects on the dominant coalition undergoing such as experience.

(1) They become aware of the complexity and dynamics of systems and the multiplicity of changes to be created.
(2) They can gain an appreciation of the time and energy they will have to be invested to create needed changes. This will be particularly evident as they target dimensions for the organization for change and develop action plans to support change goals.

(3) They will be clearer on the outcomes to be achieved by an organizational improvement effort and the tradeoffs between alternative strategies. For example, it changes needed to increase collaboration and risk taking require more change and upheaval than is acceptable to them, they will be forced to confront the alternative of changing their strategy to compete in less dynamic parts of the market where collaboration and risk taking are not required. A system framework helps force informed choices about what the organization should be.

(4) They may become more aware of how their own predispositions have affected the social system. This awareness will be sharpened if they openly acknowledge that they are an important influence and accept data about the effects of their influence.

It is generally accepted that it can be several years before a decline in human outputs, such as motivation, satisfaction or innovation, is followed by a declined in profits or an increase in employee turnover (Likert, 1976). The larger, more complex, and financially or technically endowed the organization is, the longer this time lag is likely to be. For this reason some organizations make routine assessments of organizational health using some kind of a system model as a framework.

Assessing System Level Functioning

Inherent in a systems view of organizations is a contingent view of management. That is, the right organizational design, the qualities of the right person, or the right
management style depends on the desired outcomes for the system and the characteristic of the various interdependent parts of the system. This means, of course, that managers must decide (with influence from other stakeholders) what outcomes they want from the organization and only then, together with the assessment of the current situation, will the appropriate way to organize and manage emerge.

This contingent view of organizations makes it difficult to assess the effectiveness of a given managerial approach. Any number of fit combinations between the various components of the social system may be equally good depending on the outcomes desired. Leaving the question of the manager’s own values and inclinations aside for the moment, a systems approach means that the manager is put in the unhappy situation of having to make frequent assessments about how to manage. The fit or systems perspective takes away the easier route of looking to management principles as guides for whether other organization is being managed right. It makes earlier sound choices about organizational design and management style obsolete as organization strategy, people, or environment change.

The concept of fit allows the use of broader meta-criteria which can be useful in determining whether a system is functioning. These criteria are (1) efficiency, and (2) effectiveness. No specific organizational outcomes such as profitability or satisfaction are implied by these criteria. Rather, these are systems-level criteria which allow an assessment of the extent to which the organization has adapted to internal and external changes and the extent to which it has the capacity to adapt and cope with future internal and external changes.
Efficiency

This criterion may be defined as 'the extent of fit between and among the internal components of the social system'. The more congruity exists between these components, the more the organization will function smoothly with relatively little dissatisfaction on the part of members with the organization. That is, there is likely to be relatively little interpersonal or intergroup conflict between various constituencies, such as supervisors and subordinates or union and management. Furthermore, individuals are likely to view the organization as meeting their expectations and are likely to be motivated and committed to the organization. To the extent that motivation and commitment affect individual and organizational performance—that is, there are no overriding outside influences—these will also be high.

Thus in an efficient organization, relatively little energy would have to be spent in social maintenance activities to keep people happy and to keep them from leaving or unionizing. Quality of work life outcomes such as turnover, grievances, or absenteeism would be positive (low).

Effectiveness

Effectiveness may be defined as 'the extent of fit between the organization's environment and all the internal components of the system'. The more congruity exists between the internal social system components and the environment, the more the organization is likely to exchange favorably with its environment. That is, organizational performance indicators, such as customer or client satisfaction, profitability, market share or growth in volume, are likely to be positive (high). Furthermore, people in the
organization are likely to feel a greater sense of competence as they experience task accomplishment and success from their efforts.

Research by Miles and Snow (1978) indicates that the most rapid and effective organizational adjustments ones that result in the least losses in organizational effectiveness, were ones which were preceded by appropriate changes in structure and process. That is, it was not sufficient for an organization to change its strategy by developing a new product/marketing thrust and/or by developing new technology to produce the new product or service. Unless they translated this trust into a new conceptualization of organizational structures and management process and implemented these new structures and processes early, financial loses and ultimate failure in the new strategy were likely to result.

Theory Syntheses

Theory synthesis is a strategy aimed at constructing theory, an interrelated system of ideas, from empirical evidence. In this strategy a theorist pulls together available information about a phenomenon. Concepts and statements are organized into a network or whole, a synthesized theory.

Theory synthesis, like other synthesis strategies, builds on a base of empirical evidence. In theory synthesis, a theorist may combine information from various sources during theory building: field observation, available data banks, and published research findings. In utilizing field observations and statistical information in theory synthesis, it is helpful to first translate them into statement form. Because a theorist can use a variety of sources of data in theory synthesis, a method for each source will not be presented.
Rather, each source of data within an overall strategy for theory synthesis. A theorist might then utilize evidence from each of these sources in the construction of a particular model. In theory synthesis the source of data is less important than the salience of the evidence to the phenomenon represented by the model.

Like other synthesis strategies, a synthesized theory is limited in its generalizability or external validity by the extent and quality of evidence upon which it is based. Theoretical models drawn from a limited number of sources will generally be more restricted in focus and less generalizable than ones based on multiple and diverse sources. Synthesis strategies are more “grounded” in reality, however, than other strategies such as derivation, because they are in fact based on real data. Synthesized theories, like synthesized statements require testing or cross validating to reaffirm their empirical validity.

**Purpose and Uses of Theory Synthesis**

The general purpose of theory synthesis is to represent a phenomenon through an interrelated set of concepts and statements. Several more specific purposes for theory synthesis include (1) to represent the factors that precede or influence a particular event, such as factors that lead to resuming work roles after installing EDI (2) to represent effects that occur after some event, such as changes in EDI usage after receiving trading partner support or (3) to simply put discrete scientific information into a more theoretically organized form. Using theory synthesis for this third purpose involves organizing relational statements into a system and collapsing factors or variables that resemble each other into larger summary concepts. Conducting theory synthesis for this last purpose is less concerned with depicting relationships about a phenomenon than
focusing on improving the overall form and quality with which a theory is expressed. In contrast, the first purpose may be especially directed to predicting and perhaps controlling some EDI usage. The second is similar in its helpfulness in predicting and controlling effects that are desired or undesired consequences of EDI phenomenon. The varied purposes of theory synthesis are equally valid. The specific purpose for which a theorist engages in theory synthesis will depend on the interests of the theorist and the use envisioned for the synthesized theory.

Theory synthesis is applicable in a wide range of both scientific and practical situations. Theory synthesis can be used to produce a compact high-information-content graphic representation of research findings on a topic of interest. Literature reviews about multiple and complex relationships may be made less tedious and more informative through theory synthesis. Particularly where a graphic display of a synthesized theory is made, complex relations may be communicated more effectively than through traditional written reviews. This particular use of theory synthesis is relevant in the teaching of complex content about EDI adoption and diffusion, applying research to the design of EDI usage, and developing a theoretical framework for a research project.

Integration of EDI Theories

At this point in the evaluation of EDI theories, four major themes have evolved. Although none of them has clear-cut distinctions from the others, they present sufficient differences in their approaches to the major concepts and to the practice of EDI to warrant separate identifications. For example, Shannon (1948) and DeFleur (1970) emphasize communication that facilitates the trading partners understanding of their
operation recognizes the feedback aspects in relation to meeting firm (hotel) needs. They
are also quite concerned with the effects of the trading partner environment on the firm
(hotel). Thus, Shannon's and DeFleur's theory have an emphasis that was within the
framework of the interaction theme as well as the environmental and need themes. Yet in
reviewing some of the theories, such as database and cost/benefit theory, the need theme
is clearly appropriate and obvious. Innovation and diffusion, network and externalities
and interorganizational theories were viewed only within the interaction theme. The
placement of a particular theory within the framework of a particular theme has served
mostly for comparison.

Among the themes there were different major focuses (see Table 4). All themes focus
on the firm, mostly as an organization. The organization was universally described as
transacting business, experiencing changes, having needs, capable of interacting with the
environment and with other firms, and being relatively unique, although with common
growth and development characteristics. Both the need theories and interaction theories
were particularly oriented toward describing the role of the EDI in terms of these
characteristics. The environment's impact on the firm (hotel) was focused upon in the
environmental and systems theories. Their difference basically relates to either the
immediate physical environment or an open-systems environment that was all-inclusive
of firms (hotels) and the forces that affect them.

An Integrated Theoretical Model for EDI Practice in Hotel

There are certain inevitabilities in the development of an integrated model. It may not
adequately represent any one theory or group of theories because all their major concepts
### Table 4
Integrating Major Concepts with Theoretical Themes

<table>
<thead>
<tr>
<th>Major EDI Concepts</th>
<th>Environment Firms/Environment</th>
<th>Need Firms/EDI Usage</th>
<th>System Firms/Environment</th>
<th>Interaction Firms/Trading Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firms</td>
<td>Firms are affected by their sizes, affiliations, and social environment</td>
<td>Firms using or not using EDI depending on size, affiliation and business needs.</td>
<td>The firm is a unified whole within an open system, and has pattern, organization, and perceptions that influence the behavior system.</td>
<td>Firms are capable of engaging in an interactive process and experience conflict, developmental crisis, and have needs.</td>
</tr>
<tr>
<td>Environment</td>
<td>The environment is all things that are external to the firm and that influence the reparative process.</td>
<td>The environment affects firm development and the achievement of needs.</td>
<td>The environment affects firm, who are part of the environment.</td>
<td>The environment is based on the perception of the firm.</td>
</tr>
<tr>
<td>Adoption</td>
<td>Adoption is using computer hardware and software applicants to support operations, management, and decision making.</td>
<td>Adoption relates to sustaining continue processes, and maintaining integrating function, a state of adequacy, and self-direction in meeting firm needs.</td>
<td>Adoption is the ability to maintain integration, balance, and maximum potential through effective adaptation, goal setting, and reconstitution.</td>
<td>Adoption is a process of full growth and development and adaptation, and is the goal when poor performance or a perceived need occurs.</td>
</tr>
<tr>
<td>Diffusion</td>
<td>Diffusion is the process by which EDI applications are communicated through certain channels over time among firms.</td>
<td>Diffusion assists firms in meeting their needs and helping themselves when ever possible.</td>
<td>Diffusion is oriented toward the firm to respond to the variables within the environment in a positive manner.</td>
<td>Diffusion is an interactive process between firms and trading partners over a period of time to improve organizational effectiveness.</td>
</tr>
</tbody>
</table>
may not be included. The relationship between the concepts may or may not comprehensively reflect of any of the major themes. In essence, it is likely that system theory could support such a model in total.

There are three major concepts to the theoretical model in Figure 19: the models, the firm, and the trading partners. The firm (hotel) exclusively reflects the nurturance component of EDI usage. It involves commitment and is centered around adoption and diffusion. Trading partners are viewed as the external impact on EDI adoption and diffusion. The models utilize adoption and diffusion approaches to EDI practice. When these three concepts are integrated, infusion can occur in the context of widespread transfer of EDI technology to other system applications within the organization (See the model in Figure 19).

The model in Figure 19 identifies three interacting circles, which comprise the three main concepts of system theory. Each circle denotes an aspect of EDI process related to the firm (hotel), the trading partners and the underlying philosophical dynamics of adoption and diffusion. The circles shown in Figure 19, reflect an emphasis on the firms (hotels), and their trading partners, and change between them depending upon the progress of adoption and diffusion shown in "the models" of Figure 19. Figure 20 shows some possible modifications of the three interacting circles and gives a statement showing the emphasis of each. Each model must be reflective of the particular firm (hotel), the environment, and the goals of EDI adoption and diffusion. This frame of reference helps to clarify the focus or central component of EDI practice at any time. Each interaction of the firm (hotel) with its' trading partner may modify the particular
Figure 19 An Integrated Theoretical Model for EDI Practice
<table>
<thead>
<tr>
<th>Model Modifications</th>
<th>Major Emphasis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong></td>
<td>The main emphasis is on EDI usage within the firm. Here EDI provide supportive services as directed by top management. The model basically reflects the approach used in an intraorganizational environment.</td>
</tr>
<tr>
<td>The Firm (Hotel)</td>
<td>Trading Partners</td>
</tr>
<tr>
<td><strong>2.</strong></td>
<td>The relational aspect of adoption and diffusion is the primary focus. The model would be more reflective of the importance of conducting empirical research on EDI practice between the firm and its trading partners.</td>
</tr>
<tr>
<td>The Models</td>
<td>Trading Partners</td>
</tr>
<tr>
<td><strong>3.</strong></td>
<td>The one of the major role of the trading partner is to influence the firm to adopt EDI that will eventually lead to internal and external diffusion. This is true in situations where trading partners have significant impact regional and/or national.</td>
</tr>
<tr>
<td>Trading Partners</td>
<td>The Models</td>
</tr>
</tbody>
</table>

Figure 20 Theoretical Model Modifications & Major Emphasis for EDI Practice
emphasis. Thus, the EDI adoption and diffusion process is dynamic and constantly being modified to some degree.

The most significant impact that general system theory has on EDI process is the focus on the firm (hotel) as an open system organization. The theory supports the following propositions/assumptions in the practice of EDI technology.

1. In hotel organization a system is more that the sum of its parts: it must be viewed as a whole.

2. A hotel system has boundaries that separate it from its environment.

3. Hotel systems can be further identified as open or close. Open system organizations interact with their external environment, whereas close system organizations exist within their own environment.

4. The hotel organization can be considered in terms of an open system model. The internal functioning of a hotel organization must be congruent with the demands of the organizational tasks, technology, external environment, and the needs of its members if the organization is to be effective.

5. The adoptive structure concerns the survival of the hotel organization. Adoptive structures move in the direction of preserving constancy and predictability in the conditions of a hotel organization.
Chapter Summary

In this chapter, a step-by-step literature review precedes the theoretical research model, and the theory analysis and evaluation. As a result of the literature review on EDI adoption and diffusion, it was concluded that EDI usage as a technology and management innovations that could be adopted by hotel organizations as strategies to gain competitive advantage over their competitors.

According to the findings in the literature review EDI adoption and diffusion is multidimensional. Therefore, Six theories (Communication theory, database theory, innovation & diffusion theory, network & externalities theory, interorganizational theory and cost/benefit theory) are identified through empirical studies provided strong support for EDI. The theoretical model presented in Figure 5 provided strong support for EDI adoption and diffusion within all major industry.

Based on the fact that general system theory support hotel operations (Carmouche and Kelly, 1995), it is proposed that general system theory would be appropriate to support EDI usage within the hotel industry. The combined integrated theoretical model for EDI practice was illustrated in Figure 19.
CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

Introduction

The research design has two basic objectives: (1) to provide answers to research questions, and (2) to control the extraneous and error variances of the particular research problem. This is achieved through the use of an effective measurement instrument (questionnaire), sample planning to avoid sampling and non-sampling errors, and choosing the appropriate statistical analysis for testing the hypotheses.

Research design is used to answer the research questions as validly, objectively, accurately, and economically as possible. Research plans are deliberately and specifically conceived and executed to bring empirical evidence to bear on the research problem. The research problems are stated in the form of hypotheses. The hypotheses are empirically tested. The design is carefully worked out to yield dependable and valid answers to the research questions epitomized by the hypotheses. By adequately planning and executing the design helps greatly to permit reliance on observation and inferences.

The research design sets up the framework for study of the relations among the variables. The design tells what observations to make, how to make them, and how to analyze the quantitative representations of the observations. The design suggests the directions of observation making and analysis rather than precisely what to do. To
improve the adequacy of the research design the following steps were taken.

Questionnaires were mailed to 1,200 top-level managers at 400 hotels. The hotels were randomly selected from the American Hotel and Lodging Association's (AHLA) largest 1,000 hotels. The variables were measured on a seven-point scale. The statistical analyses used were Factor Analysis, Regression Analysis and Descriptive Statistic Analysis.

The type of research design used is descriptive research. Descriptive research is concerned with determining the frequency with which something occurs, the relationship between two variables or exploratory analysis. Two types of descriptive studies are considered: longitudinal and cross-sectional. Longitudinal studies rely on panel data. A panel is simply a fixed sample of individuals or some other entities from which repeated measurements are taken. Cross-sectional studies, or sample surveys, rely on a sample of elements from the population of interest that are measured at a single point in time. A great deal of emphasis is placed on the scientific generation of the sample so that the members are representative of the population of interest. A typical sample survey involves summarizing and generalizing the data collected. The analysis of sample survey results rests heavily on the cross-classification table, which is used to report the joint occurrence of the variables of interest. This study uses cross-sectional study or sample survey.

The intention of this chapter is to introduce the general principles of survey research design and methods of random sampling. Survey research can be seen as either descriptive or analytical in purpose (Churchill. 1995). Descriptive survey aims to make descriptive statements about a studied population. The intention of analytical surveys is to explore associations between the different variables under study. While it is useful to
distinguish these two main purposes, in practice, the survey carried out for this research is both descriptive and analytical.

The major feature of the survey is to obtain information from a sample of subjects who are selected from a study population and then, on the basis of this information, the whole study population is described. In other words, population parameters are estimated on the basis of sample statistics.

The term population refers to all those individuals that a researcher wishes to make statements about (Churchill, 1995). In this research, the population of interest is the AHLA largest 1,000 hotels, to determine the proportion of hotels that use at least one EDI application. This information is obtained from chief financial officers, management information systems managers and purchasing managers working for the hotel that is randomly selected. A sample refers to the group of subjects that a researcher selects form a defined population and these are the individuals about whom information will be collected (Kerlinger, 1986). This information can be summarized as ‘sample statistics’ (for example, the mean score of each variable measured). A population parameter refers to a measurable characteristic of a study population that is not known but is estimated on the basis of a sample statistic in descriptive surveys.

By their very nature, descriptive survey findings do not allow statements of ‘fact’ to be made about a population parameter. Indeed, any statement about a population based on sample findings can only be a probability statement, meaning that there is a chance that it could be wrong. The challenge is to reduce the chance of this final statement being wrong to an acceptable and calculable level. This can only be achieved by giving
attention to the design of survey and the principles that can be applied are outlined below (Churchill, 1995).

If information is collected from all individuals in a defined population, this is referred to as a population census. Although the idea of carrying out a census may hold some attractions, a brief consideration of the nature of censuses as compared to sample surveys show the latter to have definite advantages. First, it is very difficult to get information from everybody in a defined population; there are always some who either cannot be contacted or decline to help with an investigation. Even in the national census where people are compelled by law to complete and return a form, there are still those who refuse. As a consequence, the researcher is unable to make factual statements about the population. Second, a census can be very expensive to carry out and it can be shown that after a point any increase in the number of people from whom information is sought will not increase the accuracy of population estimates in proportion to the extra costs involved. In other words, the law of diminishing returns begins to take effect. Third, in some instances it might be entirely impractical to get complete information from a population.

The major objectives of this survey research are to achieve the highest possible degree of accuracy in the findings. Generally there are three main sources of inaccuracy, or error, in survey work (Alreck and Settle, 1995). There are sampling errors, non-response errors, and response errors. Each of these concepts is discussed later in this chapter. The avoidance of errors is central to the design of surveys and by giving attention to the procedures employed they can be controlled.
Objectives of the Questionnaire and Survey Design

**Purpose of the Survey**

The purpose of the survey is to identify EDI usage within the hotel operation so that the technology could be used to target specific functions that could benefit the hotel. These objectives as depicted in Figure 21 reflect the purpose of the survey and act as a guide to the development and choice of the survey.

The survey is directed towards chief financial officers, management information systems managers, and purchasing managers. It is designed to answer specific questions regarding EDI usage within the hotel industry. The information obtained can be used to assist top-level managers in the hotel organization to decide on whether to adopt EDI for interorganizational and/or intraorganizational use. However, the usefulness of the information collected is contingent upon the clarity of the objective that is stated.

**Assess the Available Resources**

Before conducting the survey, an assessment of the resources (money, time, and availability of experts) was made. More people usually need to be surveyed than originally estimated because of low return rates. Data gathering often requires more time than anticipated. Data analysis and report writing also may take much longer. All these conditions were evaluated and the necessary precautions were taken into account.

**Define the Population**

Based on the revised procedures of the survey, delineation of characteristics of the population under investigation was made by considering such variables as age, gender, socioeconomic status, occupation, and education. When delineating the population, the geographic boundaries to work within was decided based on the stated objectives.
Figure 21 Establishing Objections for the Questionnaire & Survey Design
Determine the Data Collection Techniques

There are four basic ways to collect survey information: (1) direct administration, (2) telephone, (3) interview, and (4) mail. It may be the case that the survey can be administered directly. Such a situation would be administering a survey to students in a classroom, or at a meeting of the group to which the results were to be generalized. This type of survey technique is inappropriate for collecting data on EDI usage regarding the largest AHLA 1,000 hotels.

Telephone surveys can obtain information quickly and are inexpensive to conduct. They are appropriate when simple and superficial information is needed and only a few questions have to be asked (Newman and McNeil, 1998). Questions on EDI usage required in-depth responses therefore a telephone survey would not be appropriate.

Interview surveys are conducted in person, with one respondent at a time. Such interviews require social skills and quick thinking by the interviewers. Procedures for interviewing can be divided into three broad categories: (1) structured, (2) partially structured, and (3) unstructured.

The major advantage of the interview over the other survey procedures is that the interviewer can obtain insight into why the respondents answered the way they did. Some disadvantages of using interviews are that they required an inordinate amount of time and expense. When using the interview approach, the interviewer must be well trained. This training is both time-consuming and expensive, but it is essential to have data that are reliable and valid. Based on the above disadvantages it would be inappropriate to use interview surveys.
Mail survey refers to the collection of data directly from the study subjects using a questionnaire. This study used mail survey to collect data on EDI usage because of the following advantages (Cormack, 2000):

1. Distribution in large numbers.
2. Cheaper than other methods of data collection.
3. Ease of administration, especially to a group or by mail.
4. Designed properly, the analysis can be easy.
5. Anonymity.
6. No training required.
7. Reduced interviewer bias.

The following are disadvantages associated with using mail a survey (2000):

1. Low response rate.
2. Inability/difficulty in completing questionnaires.
3. Forced choice answers not reflecting an individual’s experience, thus reducing the willingness to respond.
4. Introduction of bias by reading and/or answering questions out of order.
5. Impossible to clarify or rephrase.
6. Lack of personal contact between researcher and respondent.

These disadvantages mentioned are overcome by using the following procedures:

1) The use of follow-up letters to increase response.
2) Proper selection of the appropriate respondents.
3) Careful explanations as to the purpose and importance of the study and well constructed questionnaires contribute towards motivating respondent to cooperate.
4) Random errors associated with mail survey, generally even each other out and will not unduly affect the findings of the research involving groups of respondents because these types of mistakes behave in a random way (Cormack, 2000).

5) Systematic errors that could arise from problems in the way in which phenomena were measured were overcome by careful testing of questions used in the questionnaires and precise calibration of all measuring instruments used for the research.

Review the Pertinent Literature

In reviewing the literature, a well thought-out plan was used to save valuable time and produce a better survey. This plan was explained in chapter 2 to identify the most appropriate sources beforehand.

Develop the Survey

Circumstances dictate that this survey was custom-developed to answer the basic questions that relate to EDI adoption and usage. Before developing the survey the following questions were address:

1. What were the item format considerations?
2. What were the psychometric considerations?
3. What were the piloting considerations?
4. What were the necessary training considerations?

Item Format

There are four major ways that items could be presented to respondents. The item is open-ended, which means that the respondent is asked a general question and may respond in many ways. The opposite of an open-ended item is a dichotomous-choice item, as when the respondent must choose between two alternatives. If socially desirable
responses might occur, then the forced-choice item should be used. The fourth item format is the scaled-choice or close-ended format that allows more than two possible choices, usually on a Likert-type scale.

**Psychometric Considerations**

The three psychometric considerations (measurement considerations) are reliability, validity, and usability. Reliability means that the same response would be obtained on repeated attempts. Validity means that the survey item really does measure what you want it to measure. Reliability is a necessary condition for validity, but not a sufficient condition. An item can be very reliable, but not measure what you want it to measure. Can the survey be used for the purpose intended? Usability subsumes the ideas of reliability and validity, and facilitates them for the purpose the survey is intended.

**Piloting a Survey**

The purpose of piloting a survey is to increase the reliability, validity, and usability of the survey. There are three ways to collect pilot data. First, observe survey subjects responding to the survey. You could note items omitted, or pondered over for an inordinate amount of time. Respondents will often make notes in the margins possibly valuable information. Second, interview pilot respondents after they have taken the survey. Third, have the subjects respond to a list of questions where answers are required. Finally, if the instructions or items need to be changes, one should be prepared to pilot the revised survey. Responses to the revised survey should be similar to the original survey (Newman and McNeil, 1998).
Training of Interviewers

Phone surveys and interview surveys are labor intensive and therefore often rely on trained assistants. These assistants must be well trained in order for them to obtain data that is meaningful. Training issues span from whom you initially recruit, to procedures for training, competency standards and how you assess those standards. Since this is a mail survey training is not necessary.

Determine the Sampling Procedure

There was a definite advantage in using as large a sample as possible. The larger the sample, the more likely it represents the population. As the sample size increases, the sampling error of the statistical results decreases (Newman and McNeil, 1998).

Selecting the Sampling Technique

Sampling techniques can be divided into two broad categories: non-probabilistic and probabilistic. The major difference between the two is that probabilistic sampling uses some from of random sampling procedure.

Non-probabilistic sampling should not be used when it is possible to obtain a random (probabilistic) sample (Aaker, Kumar, and Day, 2001). However, it is usually unavoidable. Kerlinger (1986) stated, that some of the weaknesses of non-probabilistic sampling can be reduced by replicating the study on subsequent samples.

There are three kinds of non-probabilistic sampling: incidental, quota, and purposive. Incidental sampling generally refers to picking a sample that is convenient. It is the most frequently used sampling procedure, although the least accurate available.
Quota sampling requires prior information of the proportions of the various subgroups that make up the population of interest. The sample is then chosen to reflect those percentages. Purposive sampling chooses respondents based on some special purpose.

The major problem with non-probabilistic sampling is that there is no way of determining if the sample represents the population to which one wants to infer. The major advantages are that it is usually less expensive and easier to carry out (Kerlinger, 1986).

Probabilistic sampling is a procedure that requires a known probability of being chosen for each participant in the population. There are four basic procedures for accomplishing this. They are simple random sampling, systematic sampling, stratified random sampling, and cluster sampling.

**Simple random sampling** procedure draws a sample of a population so that each person has an equal chance of being selected. Samples chosen in a random fashion were considered unbiased and representative because no one person in the population has a greater chance of being selected than any other. If the sample is not drawn randomly, then some subsets of the population may be over-represented or under-represented, thus, resulting in a biased sample. Only random methods of selection allow one to assume that a sample is not biased. This is the major advantage over non-probabilistic sampling, a procedure that does not allow this assumption (Aaker, Kumar, and Day, 2001).

**Systematic sampling** draws only the first number at random. Then every other person is drawn according to some predetermined plan, such as every ninth person. For example, if the first one selected at random is the third person, then every ninth person after the third person becomes a member of the sample, until the required sample size is satisfied.
This method is generally easier than simple random sampling, especially when a large sample or list is used (Fraenkerl, 1996). In this study a systematic approach was used to select the sample of hotels that would receive questionnaires.

*Stratified sampling and quota sampling* are very similar but differ mainly in that in quota sampling persons are drawn using random procedures to fill the quotas for each of the defined groups. When one uses stratified sampling, the population was divided into subgroups based on specific variables such as race, sex, age, economic status, or geographic location. The percentage of each of these subgroups in the entire population was maintained in the sample (Kerlinger, 1986).

*Cluster sampling* defines the population as primary units of groups instead of individual people. These groups already exist, such as classrooms or regions of the state. This sampling procedure would be more appropriate when it is more convenient to select groups than individuals, such as selecting classrooms rather than individuals from many classrooms. Once the clusters are defined, the sample clusters would then be randomly selected. Often both cluster and stratified sampling techniques are combined to produce more representative, time saving, and economical means of obtaining a sample from the population, the major problem with the cluster procedure is that traditional statistical techniques can not be used (Kerlinger, 1986).

**Analyze the Results**

To be able to competently analyze and interpret the data of a survey, one must first have clearly defined the objectives on which the research is based. In other words, the researcher must know why the survey is conducted. The sample selection procedures are based on the objectives. The procedures are not chosen simply based on convenience.
since this makes the data uninterpretable. Non-respondents should be checked to detect if
the sample that responds to the survey is in any way different from those who do not
respond. This would be a crucial activity when inferring to the population from which the
sample is drawn. The research design and methods used to test the hypotheses in this
study are elaborated in this chapter. Included in Target Population and Survey Procedure
are the research domain, target population, and survey procedure issues. These are
followed by the construction of the Instrument and Measures that includes the
development of the research instrument and the operational definitions of the variables.
Following a description of the pilot study and its results, an analysis of measures used
with the obtained data is presented. This chapter concludes with a discussion of data
analysis techniques.

Target Population and Survey Procedure

The research questions in this study lend themselves to a cross-sectional mail survey
methodology. There are two main reasons for using a survey rather than other types of
research designs. First, the investigation of multiple variables in this study requires a
large sample size to obtain reliable and valid research results. A mail survey is a useful
research tool to reach a large number of subjects. Second, hotels that implement EDI are
scattered throughout the United States. Research designs limited to a specific
geographical area do not provide a sufficient sample size and can restrict the
generalizability of the study. A mail survey, then, has the greatest advantage of reaching
widely dispersed respondents in a relatively inexpensive way (Alreck & Settle, 1985).
This study examines the relationship between adoption variables and their effects on EDI usage, the target population is U.S. hotels that implement at least one EDI application. The subjects of the survey were chosen at the management level (chief financial officer, management information systems manager, and purchasing manager). It is believed that these high-ranking respondents can possess the four types of usage knowledge required for this study: (1) accounting, (2) financing (3) strategic planning and (4) purchasing.

The hotels and subjects are identified through a literature review and the rosters provided to this research through the American Hotel Motel Management Association. In this study, the target sample size is affected by the length of the questionnaire, and the necessary statistical power for the tests performed. These issues are discussed in the following paragraphs.

The procedures used in this mail survey are based on the Dillman (1978) Total Design Method. Surveys conducted by this method traditionally achieve a high response rate. According to Dillamn (1987), questionnaires, that are shorter than 12 pages, or about 125 items, do not have adverse effect on the response rate. The questionnaire used in this study consists of 61 questions and 4 pages. The numbers of questions and pages are within Dillman’s specifications. A larger number of questions might have decreased the response rate.

A researcher can commit two types of errors when testing a hypothesis: A Type I error when an alpha risk occurs and the true null statistical hypothesis is rejected, whereas the Type II error occurs when a beta risk is committed and the researcher fails to reject a false null hypotheses (Cohen, 1988; Cohen & Cohen, 1983; Cohen, S.A., 1979;
A synthesis of the literature indicates that researchers have concentrated their efforts more on controlling Type I errors than Type II errors and suggests that controlling Type II error should receive more attention (Cohen S.A., 1979. Mazen et al., 1987a). In this study all hypotheses will be tested at a five percent level of significance ($\alpha = .05$). The data collected from the self-administered survey instrument will be used to test the hypotheses.

Sample Size

Sample size requirements for quantitative studies are based on theoretical considerations as well as on the specific study purpose. There are three popular theoretical methods that can be used to determine sample size requirements in quantitative studies: the rule of thumb, power analysis, and absolute precision.

The rule of thumb approach can be used to estimate the required sample size. When using regression analysis the rule of thumb is the ratio of cases to independent variables. The simplest rules of thumb are $N$ greater than or equal to $50 + 8m$ (where $m$ is the number of IV’s) for testing the multiple correlation and $N$ greater than or equal to $104 + m$ for testing individual predictors. These rule of thumb assume a medium size relationship between IV’s and the DV’s, at $\alpha = .05$ and $\beta = .20$. In this study there are 19 predictor variables. Therefore, substituting this information into the above equations produces the following: $50 + 8(19) = 204$ to test regression; and $104 + 19 = 123$ cases for testing individual predictors. Since this study is interested in both the overall correlation...
and the individual IV’s, \( N \) is calculated both ways and the larger number of cases are selected (Tabachnick and Fidell, 2001).

Cohen (1988) sets three values of effect size for power analysis: small = 0.02, medium = 0.15 and large = 0.35. There is no available effect size from previous research predicting effect size and in this research it is not possible. Nevertheless, a power analysis is performed with values of the effect size 0.02 and 0.15 (Hintze, 1993) prior to conducting the survey. The reason for using small and medium effect sizes for planning the sample size is to be on the conservative side because Cohen and Cohen (1983) note that in behavioral sciences effect sizes as large as 0.25 were infrequent. When the effect size was equal to 0.02 and 0.05, to obtain a power of approximately 0.69, a sample size of 400 is needed. With the medium effect size, 0.15, a sample size of 200 provides power equal to 0.99 at \( \alpha = 0.05 \).

According to Churchill (1995) absolute precision is another approach that can be used to determine the sample size. For unknown population variance the following formula is used: 

\[
n = \frac{(z^2 \sigma^2)}{H^2}
\]

\( n \) = the required sample size,

\( z^2 \) = the square of the standardized significance level selected,

\( \sigma^2 \) = the unknown population variance; and,

\( H^2 \) = the desired absolute precision level (one-half).

This study will use a 95 percent confident interval. This implies that the standardized \( Z \) score equates to 1.96. The absolute precision level selected is 0.5. One-half of this desired level is 0.25. This study will gather data on a 7-point Likert scale. Therefore, if the mean responses are 4.0 and the precision level specified is 95 percent then the
estimated means will fall between 3.75 and 4.25. According Churchill (1995) an unknown population variance may be estimated to range between 2.5 to 4.0 using a 7-point Likert scale. To have a more uniform Likert-type measure the higher end of the range (4.0) is used. By substituting the above information into the equation the following result is obtained:

\[ n = \frac{(1.96)^2 (4.0)}{(0.25)^2} \]

\[ = \frac{3.8416 (4.0)}{0.0625} \]

\[ = \frac{15.3664}{0.0625} \]

\[ = 245.86 \]

The above result provides useful information regarding the required sample size necessary for this research.

Using the guidelines above a sample size of 250 respondents is selected to provide a relatively tight level of absolute precision around the mean Likert-scale rating. This sample size will avoid having too little statistical power for the test to be realistic, and avoid over-fitting of the data such that the result is artificially good and negatively impact generalizability. With prior studies having an average of 22 percent response rate it is decided to target 1200 subjects for mail questionnaires.

It is decided to target 1200 subjects and mail the questionnaires. There are several criteria in choosing target respondents. The first is to choose three respondents from the same company. The second is the position of the target respondent in the organization: it was preferred that respondents be a higher-level manager. The third is that the target respondents must be likely to have knowledge of implementation of EDI as well as knowledge of its usage.
First Pretesting of the Instrument

To gain a better understanding of how the respondents would interact with the survey instrument, a pretest was conducted. In selecting a pretest site it was decided that respondents should possess attributes similar to those of the sample frame for the overall study. Specifically, it was necessary to identify existing EDI users who could be surveyed via mail. To meet these requirements, 10-experienced EDI users from the faculty, technical staff, and graduate student body of a major western U.S. university were identified via a computer system accounting program. Based on the request to examine and responded to the survey, 5 faculty members, 2 students, and 3 managers completed the pilot surveys and give their comments. Modifications in the wording of questions, appearance of the survey, and general flow of the questionnaire were made in accordance with the respondents' suggestions. This included rewording some items, and separating items that were associated with the same construct, to prevent systematic marking of responses. Pilot respondents' time estimates of 21-28 minutes for survey completion seemed too long and the total number of items was changed from 113 to 61. The complete final version of the survey instrument is placed in the Appendix A and B.

Second Pretesting of the Instrument

Although it may be costly and time consuming, conducting a pilot study has several advantages (Flynn et al., 1990; Sproull, 1988). In conducting the second pretest test, the instrument was administered to a small sample size that is similar to the actual sample. A pilot study provides an opportunity to get feedback about the research method and the questionnaire before the actual testing.
Principal components analysis using varimax rotation was performed on the importance of rating the seven channel variables and four usage variables. The rotation produced seven channel and four usage components. Scree plots were used along with latent root criterion (Eigenvalue >1) to determine the number of components.

The reliability of the final scales was assessed through an analysis of internal consistency using Cronbach's alpha, which is viewed as "a good estimate of reliability in most situations" (Nunnally, 1978, p. 230). The overall Cronbach's alpha was .84. For the seven channel variables the Cronbach's alpha ranges from .75 to .86, while the four usage variables had Cronbach's alpha ranging from .77 to .89. Nunnally (1978) and Carmines and Zeller, (1979) suggested that a minimum criteria of .70 is acceptable for exploratory research.

The purpose of the pretest was to obtain information about appropriateness of the variables, measures and data collection methods. Furthermore, an investigation of the validity and reliability of the instrument becomes possible with the data collected in the pilot study (Sproull, 1988). Moreover, with the second testing there were no unclear concepts and questions that were identified. Therefore, the survey instrument was not changed (Flynn et al., 1990). The procedures used for conducting the survey are shown in Figure 22.
Identify the target population and select the sample using probability sampling technique

Identify the number of questionnaires that should be mailed out from the relevant sample size

Mail out the questionnaires to 1200 managers at 400 hotels with cover letter, informed consent and postage-paid envelope

Send the first follow-up letter one week after the initial mailing as a reminder

A second and third follow-up letters with questionnaires and postage-paid envelopes were mailed to nonrespondents three weeks and four weeks later respectively

Result: 23.92% response rate from the usable questionnaires returned

Handling the non-response problem by using a fourth follow-up letters five weeks later

Adapted from: Aaker, Kumar and Day (2001)

Figure 22 Procedures for Conducting the Survey
Validity Issues in Brief

There are several validity issues in conducting a survey research that require special attention. These issues include randomization of subjects, common method variance and non-response bias. Although common method variance and non-response bias will be further addressed in Chapter 4 relating to the results of this study, a brief discussion of these issues deserves some attention in this chapter in order to better elucidate the way this research is designed and the methods applied.

Randomization

Sampling design includes randomness so that bias cannot be introduced into the sample (Flynn et al. 1990; Scheaffer, Mendenhall, and Ott, 1990). For some research questions, however, sampling subjects at random may not make sense if a particular user group is under investigation (Flynn et al., 1990). In this study, the research questions target users of EDI applications. The random selection of U.S. hotels result in questionnaires being sent to both users and non-users of EDI applications.

Common Method Variance

Obtaining data from a single source on self-reports has been a concern in terms of validity and reliability of the research results (Avolio, Yammarino, and Bass, 1991; Mitchell, 1985; Podsakoff and Organ, 1986). Because the same source provides two or more measures, if there is any defect with that source, it can distort all measures in the same way and in the same direction. This well-known problem is called common method variance (Campbell and Fiske, 1959). Common method variance manifests itself as a bogus correlation between variables rather than a real relationship between variables.
Miller and Roth (1994) suggest that, in the case of using single respondents for practical purposes, greater care in the selection of informants can contribute to overcoming common method variance. Miller and Roth (1994) further argue that upper level informants tend to be more reliable sources than lower level counterparts and therefore, the probability of common method variance would be decreased.

Other researchers (Mitchell, 1985; Podsakoff and Organ, 1986) suggest using multiple methods and sources to overcome the common method variance problem. In recent years, researchers have secondary data sources (Young, 1989), which can be used in their studies. Secondary data sources, such as published financial reports, can be used to validate the data obtained by self-reports. Although obtaining secondary data for small and privately held companies may not be possible, a subset of responses with available secondary data can be used to validate the responses (Zahra and Das, 1993). In this study whenever available, secondary data sources are employed to check self-reported data.

Non-Response Bias

One of the disadvantages of a mail survey is low response rate (Alreck and Settle, 1985; Kerlinger, 1986). Alreck and Settle (1985) argue that although the reliability of data depends on the sample size obtained, a non-response bias can distort the reliability of the data, as in the case of non-random return of the questionnaires. This non-response to the survey may result in under-representation of some group and over-representation of other groups. Therefore, the researcher should investigate the conditions that may cause non-response bias (Alreck and Settle, 1985).

In this study, there are primarily three groups of non-respondents. One group may not respond because they are misidentified as EDI users. If they did not implement an
EDI application, they would not fill out the questionnaires. This group would introduce non-response bias to the study because this study is interested in the companies that do not implement at least one of the four EDI applications.

Another non-respondent group are the users of either one of the four application or all, but, they are not experiencing success with them. Because they are not improving their performance, they may not be willing to disclose any information.

A third, non-respondent group includes those who simply choose not to participate. If there is any systematic or non-random bias among that group, the descriptive statistics will reveal the bias (Ward et al., 1994; Zahra and Das, 1993). Therefore, in this study, to avoid reaching faulty conclusions, non-response bias is investigated and reported in Chapter 4.

The issues in the survey method are not limited to the topics discussed, but these validity issues are the most cited problems that a researcher may encounter in conducting survey research. In the next section, construction of the instrument and measures are discussed.

Construction of the Instrument and Measures

Figure 23 summarizes the steps followed to develop the instrument and measures used in this study based on Churchill’s (1979) work. As explained in the introduction of Chapter 2, the domains of constructs were identified. A comprehensive instrument for EDI usage was not found in an extensive review of the literature. The dissertations examined to assist with the construction of the survey instrument for this study were: McGowan, 1994; Vijayasarathy, 1994; and Poole, 1997. Although no particular item was
Indentify domain of Constructs

Develop and/or borrow items for each construct

Conduct pilot study

Refine the instrument

Collect data

Assess Reliability and Validity of the Instrument

Analyze data

Adapted from: Aaker, Kumar and Day (2001)

Figure 23 Specifications for the Development of Measures
directly taken from their works, their work inspired the construction of the survey
instrument. A new measurement for EDI usage was needed for this study to advance the
knowledge within the field of EDI usage. The EDI usage variables were based on the
literature review. A summary of items relating to the constructs were proposed in the
model and illustrated in Figure 24 and their sources were presented in Table 5.

This study used a Likert-type scale to detect moderating effects (McClelland and Judd,
1993; Russell and Bobko, 1992; Russell, Pinto, and Bobko. 1991), as discussed later. The
studies cited above demonstrated that when independent (McClelland and Judd, 1993)
and dependent variables (Russell and Bobko. 1992; Russell, Pinto, and Bobko. 1991)
were measured with a coarse scale, such as Likert scale, the ability of the moderating
regression to detect the moderating effects will decrease. Stone-Romero et al. (1994)
warned that with the existence of dichotomous moderator variables, detecting moderating
effects of moderating variables becomes difficult. Martin (1987) showed that the Pearson
product moment correlation changed with the use of different numbers of scaling points.
Martin’s study indicated that as the number of scaling points decreased, the amount of
information loss increased. Therefore, it is decided to use a continuous scale whenever
possible to increase the probability of reliable and valid results. The use of similar types
of continuous scales for research (Taylor, Cosier, & Ganster, 1992) has gained acceptance
in the social sciences. Table 6 summarizes variables, the type of variables, measurement
modes and their values. See Appendix B for the full text of the questionnaire.
Figure 24 Research Model for EDI Adoption
Table 5

Construction of Survey Instrument

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information on EDI applications</strong></td>
<td>1</td>
<td>Researcher Developed</td>
</tr>
<tr>
<td><strong>Information on EDI Adoption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Channel Variables:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>2-4</td>
<td>Davis (1989)</td>
</tr>
<tr>
<td>Usefulness</td>
<td>5-7</td>
<td>Davis (1989)</td>
</tr>
<tr>
<td>Accessible</td>
<td>8-12</td>
<td>Markus (1994)</td>
</tr>
<tr>
<td>Formalization</td>
<td>13-16</td>
<td>Kwon &amp; Zmud (1987)</td>
</tr>
<tr>
<td>Feedback</td>
<td>17-19</td>
<td>Zmud, Lind &amp; Young (1990)</td>
</tr>
<tr>
<td>Quality</td>
<td>20-22</td>
<td>Zmud, Lind &amp; Young (1990)</td>
</tr>
<tr>
<td>Distance</td>
<td>26</td>
<td>Steinfield (1990)</td>
</tr>
<tr>
<td>Timeliness</td>
<td>27</td>
<td>Orlikowski &amp; Yates (1990)</td>
</tr>
<tr>
<td>Configuration</td>
<td>28</td>
<td>Kahai &amp; Cooper (1990)</td>
</tr>
<tr>
<td><strong>Perceived Task Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>29</td>
<td>Katz &amp; Tushman (1979)</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>30</td>
<td>Steinfeld (1986)</td>
</tr>
<tr>
<td>Communication</td>
<td>31</td>
<td>Steinfeld (1986)</td>
</tr>
<tr>
<td>Analyzability</td>
<td>32</td>
<td>Rice (1992)</td>
</tr>
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<td>Predictability</td>
<td>33</td>
<td>Applegate (1991)</td>
</tr>
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<td>34</td>
<td>Thompson (1967)</td>
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<tr>
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<tr>
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</tr>
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<td>Accounting Usage</td>
<td>39-43</td>
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<td>Financing Usage</td>
<td>44-48</td>
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</tr>
<tr>
<td>Strategic Usage</td>
<td>49-53</td>
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</tr>
<tr>
<td><strong>Information about the hotels</strong></td>
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<tr>
<td>Factor Affecting Adoption</td>
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<tr>
<td>Affiliation</td>
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</tr>
<tr>
<td>Trading Status</td>
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</tr>
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<td>Hotel Size</td>
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</tr>
<tr>
<td>1. Profile Variables</td>
<td>Operationalization</td>
<td>Values</td>
</tr>
<tr>
<td>---------------------------</td>
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<td>-------------------------</td>
</tr>
<tr>
<td>Affiliation</td>
<td>Count of each affiliation</td>
<td>Number of affiliations</td>
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<td>Property Size</td>
<td>Annual Sales</td>
<td>Dollars</td>
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<td>Trading Status</td>
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<tr>
<td>Uncertainty</td>
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<td></td>
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<td></td>
<td></td>
<td>Strongly Agree = 7</td>
</tr>
<tr>
<td>Interdependence</td>
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<tr>
<td></td>
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<th>Values</th>
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</tr>
<tr>
<td></td>
<td></td>
<td>Strongly Agree = 7</td>
</tr>
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<td>Perceived Usefulness</td>
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</tr>
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<td></td>
<td></td>
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</tr>
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<td>Mean of 5 items</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Strongly Agree = 7</td>
</tr>
<tr>
<td>Perceived Quality</td>
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<tr>
<td></td>
<td></td>
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<tr>
<td>Economic Awareness</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Strongly Agree = 7</td>
</tr>
<tr>
<td>Independent Variables</td>
<td>Operationalization</td>
<td>Values</td>
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<tr>
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<td>-----------------------</td>
</tr>
<tr>
<td><strong>3. Channel Variables Cont.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overcome Distance</td>
<td>Single item rating</td>
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<tr>
<td></td>
<td></td>
<td>Strongly Agree = 7</td>
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<td></td>
<td></td>
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<td></td>
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<td><strong>4. Dependent Variables</strong></td>
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<td>Purchasing Usage</td>
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</tr>
<tr>
<td>Accounting Usage</td>
<td>Mean of 5 items</td>
<td>Never = 1; Always = 7</td>
</tr>
<tr>
<td>Finance Usage</td>
<td>Mean of 5 items</td>
<td>Never = 1; Always = 7</td>
</tr>
<tr>
<td>Strategic Usage</td>
<td>Mean of 5 items</td>
<td>Never = 1; Always = 7</td>
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</tbody>
</table>
Research Hypotheses

The research model for EDI usage is described in Figure 24. This model explicitly integrates demographic, channel, and task variables that could influence the decision leading to adoption of EDI. These variables represent the independent variables in the model. In Figure 24, the decision to adopt EDI will affect the usage contexts in the areas of purchasing, accounting, financing and strategic management. These four specific usages form the critical important dependent variables in the EDI research model.

Profile Variables as Predictor of EDI Usage.

The demographic variables relate to the statistical characteristics of the hotel population. The profile variables (property size, trading status, and ownership affiliation) are used to profile the hotel’s characteristics in relationship to EDI usage. Past studies on the effect of profile variables on the usage of e-mail in an interorganizational context predict a positive effect (Kettinger and Grove, 1997). Profile variables (affiliation, property size, trading status, EDI initiator, and management support) are projected to have positive association with interorganizational usage (Premkumer, Ramamurthy and Nilakanta, 1994; Orlikowski and Yates, 1994; Markus, 1987; and Steinfield, 1986). It is therefore expected that profile variables will have a positive influence on EDI usage. Therefore, the following is hypothesized.

H1: The size of the hotel will positively influence the use of EDI.
H2: The hotel trading status will positively influence the use of EDI.
H3: The type of ownership will positively influence the use of EDI.
Channel Variables As predictor of EDI Usage.

Research shows that communication channels are not equal in their capacity to process information (Tushman and Nader, 1978; Tushman, 1977). Individuals select a channel based on their perception of channel attributes such as usefulness, ease of use, social presence, feedback, accessibility, information quality, communication configuration, cost, and the ability to overcome distance and time barriers. For example, a hotel's perceptions of EDI's "usefulness" for its unique task requirements may determine usage. To assist in measurements of user attitudes, Davis (1989) developed a technology acceptance model in which perceived ease of use and perceived usefulness predict information technology usage. Studies employing these constructs (Davis, 1989; Davis, Bagozzi, and Warshaw, 1989) have found them to be strong indicators of technology usage. Given the strength of these measures in various contexts, it is anticipated that perceived ease of use and perceived usefulness will be positively related to interorganizational EDI use. Therefore, the following is hypothesized.

H4: Perceived ease of use will positively influence EDI usage.

H5: Perceived usefulness will positively impact EDI usage.

Perceived information richness or formal presence has been the subject of numerous empirical studies. Perceptions of richness are based on a medium's ability to provide feedback, offer numerous cues, be personalized, and rapidly synthesize complex information (Daft and Lengel, 1986). In the richness hierarchy, EDI has been ranked below the telephone medium, but above paper-based media (Trevino, Lengel, Bodensteiner, Gerloff, and Muir, 1990). According to Zmud, Lind, and Young (1990, p. 444), "a channel with high immediate feedback enables an individual to ask questions
and receive answers, thus enabling message meaning to be more quickly assessed and modified. In this regard, providing and obtaining feedback to and from an individual establishes the immediacy of a communication channel. A channel with high cue variety (physical presence, voice inflection, body gesture, words, graphic symbols) enables an individual to give and receive multiple cues with a wide range of meanings (Kiesler, Siegel, & McGuire, 1984; Steinfield, 1986). If a medium does not possess formal presence it may be perceived to be cold, impersonal, and inadequate for requisite business interaction. It is anticipated that perception of EDI business presence and feedback can result in the usage of EDI. Therefore it is hypothesized that:

H6: Perceived business presence of EDI will positively influence EDI usage.
H7: Perceived feedback will impact EDI adoption.

Access to computer-based communication systems has been shown to predict usage (Culnan & Markus, 1987; Kerr & Hiltz, 1982; Rice & Shook, 1988). Rice and Shook found positive relationships between access and all types of intraorganizational e-mail use. Receiver access is based on the concept that there must be a critical mass of users with physical access and a propensity to use a channel before an individual will seek it out as an alternative communication option (Zmud, et al., 1990; Markus, 1987). The extent that users perceive EDI to be available and dependable as a means to communicate will positively impact EDI usage. Hence, the following is hypothesized.

H8: Perceived access will positively influence EDI usage.

A related variable, information quality, has been suggested as influencing communication channel selection (Rice and Shook, 1988; Swanson, 1987; Zmud, et al., 1990). Perceived quality is based on the assumption that, all things being equal,
individuals will choose to use information of the highest quality. Here, quality is defined as relevance, accuracy, reliability and timeliness (Zmud, 1978). Given that a primary motivation of EDI use will be "getting access to information." It can be expect that perceived quality predicts greater EDI usage. Therefore it is hypothesized that:

H9: Perceived quality will positively influence EDI usage.

Past research indicated that individuals consider cost in channel selection (Montgomery and Benbasat, 1983), and it has been suggested that the economics of the media usage decision should be included as a perceived channel attribute in predicting EDI use (Rice and Shook, 1988). It is hypothesized that the extent to which EDI is viewed as an economical medium (perceived economy), it will receive greater use. Therefore it is hypothesized that:

H10: Perceived economic awareness will positively impact EDI usage.

Communication configuration represents the ability of the medium to provide access to multiple modes: one-to-many communication (Culnan and Markus, 1987; Kahai and Cooper, 1990). Emmelhainz (1993) argued that as EDI is perceived to support "distribution" or one-to-many communication relationships, its usage will increase. Emmelhainz found that the perceived ability to overcome barriers of physical distance was a strong predictor of task-related EDI use. Given the critical mass of users of EDI, it is expected that a higher perception of distribution support would result in higher use. Finally, researchers such as Markus (1987) and Orlikowski and Yates (1994) predicted that the perceived ability to overcome time barriers will influence usage. It is predicted that when organizations perceive EDI usage to overcome the barriers of time and place, then EDI usage will increase. Therefore, following hypotheses are derived:
H11: Perceived distance will positively impact EDI usage.

H12: Perceived timeliness will positively influence EDI usage.

H13: Perceived communication configuration will positively effect EDI usage.

**Task Variables as Predictor of EDI Usage.**

Research shows that properly matching the nature of work with the appropriate communication pattern will enhance effectiveness (Tushman, 1977; Tushman and Nader, 1987). An underlying premise of this research is that tasks vary in uncertainty. Correspondingly, information processing requirements increase with greater task complexity or the lack of routines to satisfy uncertain work situations (Thompson, 1967). Related studies have examined the relationship between task interdependence (Thompson, 1967; Van de Ven, Delbecq, and Koenig, 1976), task uncertainty (Tushman and Nader), task complexity (Katz and Tushman, 1979; Pelz and Andrews, 1966; Tushman, 1977), and the need for increased communication. It is found that matching task information processing needs to the richness of the media will lead to greater perceived effectiveness (Draft, Lengel, and Trevino, 1987) and greater media use (Rice, 1992). In the context of EDI, while the importance of task variables has been widely recognized (Applegate, 1991), few studies have operationalized them. One exception is Steinfied’s (1986) study, which developed measures of task interdependence. Other researchers have pointed to the need to study such variables as task analyzability and task predictability as they relate to computer-based communication (Applegate, 1991; Kahai & Cooper, 1990). This is especially important, given the considerable organizational design research dedicated to operationalizing these task dimensions (Van de Ven, Delbecq, and Koening, 1976; Withey, Draft, and Cooper, 1983). Supported by information processing theory and given
the potential moderating effects of social influences. It may be expected that as needs to communicate outside organization increase, EDI use will rise. It may also be anticipated that business uses will increase between interorganizational work partners as a result of growing interdependence. These dyadic relationships may, over time, lead to further work and business related electronic communication across organizations.

The following hypotheses developed from the above information:

H14: Task complexity will positively affect EDI usage.

H15: Task uncertainty will positively affect EDI usage.

H16: Task communication will positively affect EDI usage.

H17: Task analyzability will positively affect EDI usage.

H18: Task predictability will positively affect EDI usage.

H19: Task interdependence will positively affect EDI usage.

Table 7 outlines summary of important constructs and variables that should be examined in the context of EDI usage. Table 7 also depicts a summary of hypotheses that will be examined within the context of EDI usage, while Figure 24 provides a pictorial depiction of the overall research model.
<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Definitions</th>
<th>Hypothesized Relationship with EDI Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Profile Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Property Size</td>
<td>The number of hotel rooms available for occupancy.</td>
<td>H1: Positive</td>
</tr>
<tr>
<td>Trading Status</td>
<td>The hotel stocks are actively traded on the stock market.</td>
<td>H2: Positive</td>
</tr>
<tr>
<td>Affiliation</td>
<td>The type of hotel ownership and management control.</td>
<td>H3: Positive</td>
</tr>
<tr>
<td><strong>2. Task Variables</strong></td>
<td></td>
<td></td>
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<tr>
<td>Complexity</td>
<td>The degree to which a task is perceived as difficult to understand.</td>
<td>H4: Positive</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>The lack of predictability, structure and information in a task.</td>
<td>H5: Positive</td>
</tr>
<tr>
<td>Communication</td>
<td>The process in which information is shared for mutual understanding.</td>
<td>H6: Positive</td>
</tr>
<tr>
<td>Analyzability</td>
<td>The degree to which data can be categorized and summarized for a task.</td>
<td>H7: Positive</td>
</tr>
<tr>
<td>Predictability</td>
<td>The degree to which task performance always follow established rules.</td>
<td>H8: Positive</td>
</tr>
<tr>
<td>Interdependence</td>
<td>The degree to which tasks are linked together in an organization.</td>
<td>H9: Positive</td>
</tr>
<tr>
<td><strong>3. Channel Variables</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Ease of Use</td>
<td>The degree to which the target system is free of effort.</td>
<td>H10: Positive</td>
</tr>
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<td>Independent Variables</td>
<td>Definitions</td>
<td>Hypothesized Relationship with EDI Adoption</td>
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<td><strong>3. Channel Variables Cont.</strong></td>
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<td></td>
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<tr>
<td>Perceived Usefulness</td>
<td>The belief that a prospective system will increase performance.</td>
<td>H11: Positive</td>
</tr>
<tr>
<td>Perceived Accessible</td>
<td>The degree to which the prospective system is reachable.</td>
<td>H12: Positive</td>
</tr>
<tr>
<td>Formalization</td>
<td>The degree to which the prospective system follows rules and procedures.</td>
<td>H13: Positive</td>
</tr>
<tr>
<td>Perceived Feedback</td>
<td>The confirmation or correction of prior information.</td>
<td>H14: Positive</td>
</tr>
<tr>
<td>Perceived Quality</td>
<td>Quality is defined as relevance, reliability and accuracy.</td>
<td>H15: Positive</td>
</tr>
<tr>
<td>Economic Awareness</td>
<td>Prudent, careful and efficient use of resources.</td>
<td>H16: Positive</td>
</tr>
<tr>
<td>Overcome Distance</td>
<td>The degree or amount of separation between sending and receiving information.</td>
<td>H17: Positive</td>
</tr>
<tr>
<td>Perceived timeliness</td>
<td>Presenting relevant information before it loses its usefulness.</td>
<td>H18: Positive</td>
</tr>
<tr>
<td>Communication Configuration</td>
<td>Represents the ability of a medium to provide multiple access.</td>
<td>H19: Positive</td>
</tr>
</tbody>
</table>
Dependent Variables (Usage Type)

While the usage contexts of an interorganizational and intraorganizational EDI may differ, it might be argued that they share some research similarities. Like the intraorganization context, interorganization EDI will be used to conduct work and it can be hypothesized that purchasing use will form an important dependent variable. In addition, accounting usages that seek to either inform or search for information in one-to-many relationships is a second intraorganizational and interorganizational usage type. Given the growth in EDI interest (EDI and the Internet, and EDI and XML) it can be theorized that EDI communication across organizational boundaries has financing implications and is a dependent variable. Finally, strategic usage that is prominent in interorganizational communication. Figure 24 shows the relationship with the study's independent variables and the four dependent usage type variables (purchasing, accounting, financing, and strategy).

Purchasing Usage of EDI

The potential for dramatic cost savings and productivity improvements suggests that both buying and selling firms will benefit from increased use of EDI for corporate-related purchasing activities. Thus, suppliers with EDI purchasing capabilities, as well as those considering an implementation of such a system, need to devise ways to increase the usage of online purchasing among their customers (Hill, 1999; Weber, 1999). Developing effective strategies for increasing online business-to-business buying requires an understanding of the factors that contribute to buyers’ adoption of EDI for online
corporate related purchasing. Accordingly, one of the objectives of this research is to
investigate the impact of EDI adoption for corporate-related purchasing activities.

Online business-to-business purchasing is a relatively new phenomenon. Nevertheless,
existing theory on the diffusion of innovations provides an excellent foundation for
exploring the role that suppliers play in the adoption of EDI for corporate purchasing
activities. Diffusion theory explains "the flow of information, ideas, practices, products,
and services within and across cultures and subcultures, or markets and market segments"
(Gatignon and Robertson, 1985). Adoption, a component of the diffusion process, refers
to an evaluation of the results of a trial use of the innovation and a decision to continue
using the innovation in the future (Rogers, 1962). Certainly, extant research on
innovation adoption exists (Lancaster and Taylor, 1986). Within marketing, much of this
research has focused on consumer adoption of new products (Gatignon and Robertson,
1985; Midgley, 1987). Still diffusion theory is quite relevant to the adoption of a new

Under the umbrella of diffusion theory, an innovation has been defined as any idea,
practice, or product perceived as new by the individual or firm (Rogers, 1962; Zaltman,
Duncan, and Holbek, 1973). Innovations can generally be classified as continuous or
discontinuous. Continuous innovations are basically product extensions, such as software
product upgrades, and require little or no change in buyer behavior in order to use the
innovation. Alternatively, discontinuous innovations are perceived as completely new,
established by a major technological advance, and require significant changes in user
behavior (Anderson and Ortinau, 1988; Moore, 1999; Rogers, 1962). Online business-to-
business purchasing via EDI can be categorized as a discontinuous innovation in that it
offers technological advances in the buying process and requires a change in the way that organizational buyers search for information, communicate with suppliers, and place and track orders. Of course, changing buyer behavior is not always an easy task. A buyer who is resistant to change and content with the current order routine may resist EDI as an innovation that threatens to change the established routine (Ram, 1987). Indeed, habit has been identified as the single most powerful determinant in generating resistance to change (Sheth, 1981). Suppliers, therefore, face challenges in overcoming buyers’ resistance to change and in creating new buyer habits.

The critical role of suppliers in the adoption process seems evident. Unfortunately, within the traditional adoption and diffusion literature, few researchers have examined the role of suppliers (Gatignon and Robertson, 1989). Some studies, however, do provide support for the contention that suppliers will play a key role in the usage of EDI for purchasing by organizational buyers. In an empirical test of the effects of competition on the adoption of technological innovations by organizations, Gatignon and Robertson (1989) found that supply-side vertical coordination (e.g., providing educational seminars) and supplier incentives (e.g., discounts) were related positively to the adoption of a new technology. Similar results were obtained by Cool, Dierickx, and Szulanski (1997), they concluded that supply-related factors were more likely to accelerate the acceptance of an innovation than demand-related factors. In a study analyzing a new technology involving an additive that improved cattle feed efficiency, Wozniak (1987) found that education and information enhanced the ability to overcome resistance to change, thereby raising the probability of adoption. A study of international technology adoption conducted by Phillips, Calantone, and Lee (1994) found that attitude and behavioral intention to adopt
the new technology depend on the perceived benefits of the technology and the perceived ease of adoption. Finally, the results of case research by Huff and McNaughton (1991) suggest that ongoing training and support were critical to the successful implementation of an innovation.

Taken together, these findings offer several implications relevant to the present study. First, information, education and training, and supplier incentives have been shown to enhance innovation adoption (Gatignon and Robertson, 1989; Wozniak, 1987). It seems logical that the more guidance and support a supplier provides to purchasing professionals, the more likely these buyers will turn to EDI for purchasing activities (Robertson and Gatignon, 1986). Second, an understanding of the benefits associated with using the technology, including convenience of EDI as an information source, seems critical (Phillips, Calantone, and Lee, 1994). Buyers, who perceive EDI to be more effective and easier to use than the more traditional information sources, such as salespeople or telephone customer service representatives, are more likely to try it and prefer it. By providing training and guidance, suppliers can emphasize the convenience of EDI, thereby making such benefits clear to buyers (Emmelhainz, 1991).

In contrast to electronic mail, the EDI form of electronic purchasing is a two-way transmission of data, involving computer-to-computer exchanges of intercompany business documents and information. Three versions of EDI are in use today. The first one uses the supplier’s computer, the second uses the buying company’s computer, and the third uses both computers (Galliers and Baets, 1998).
Supplier’s Computer Provides the Information

This type of EDI technique involves using online, real-time systems for remote order entry and inventory status reporting. Typically, the supplier provides the buyer with a terminal or software specifically written for the interface, which the buyer can use with a personal computer.

With this arrangement, the buyer can view the supplier’s inventory system and, if the parts were available, simply place an order for the parts online. The supplier will then ship the parts immediately from inventory. Some of these systems allow the buyer to actually view the supplier’s future production schedules and allocate production not yet sold to match the buyer’s requirements. The order is confirmed online and displayed on the screen. If desired, a printer at the buyer’s site will then produce a confirming acknowledgement in duplicate, simultaneously printing the same order at the supplier’s location (Gilbert and Reichert, 1997).

The disadvantage of this type of a system is that if enough suppliers choose to have this kind of direct linkage, the buyer could end up needing an entire room filled with terminals in order to handle all the items from all the suppliers.

Buyer’s Computer Provides the Information

This arrangement is the reverse of the preceding one; the buyer provides the supplier with a terminal, so the supplier can look into the buyer’s scheduling system on a daily or weekly basis. In some cases, the supplier actually does the purchase-part planning for the buyer and if required to advise the buyer in advance of it cannot meet the buyer’s required delivery dates. Here’s how it works. The supplier looks at the individual planning reports for each item number it supplies. The supplier converts planned orders
to scheduled receipts on the planning report, which would be a confirmation of the supplier’s intention to deliver the parts on that day. If the date for the delivery is sooner or later than the need date the system alerts the buyer of the situation. The buyer then calls the supplier to determine why the delivery date is off (Gilbert, 2001).

When the supplier ships, the supplier enters the shipping information, along with the quantity and item numbers, into the computer terminal. This shipping information establishes an inbound schedule for the buyer’s receiving dock. When the shipment arrives at the dock, Receiving enters the receipt on the system and the computer compares the receipt information with what the supplier shipped. The negotiated purchase prices are already in the database, and if the receipt matches the shipment information, the buyer’s company pays for the item upon receipt without the need of an invoice. This eliminates the need for a requisition, purchase order, receiving report, or invoice. As a result, the buyer has more time to buy and the company has eliminated a mountain of paperwork that adds no value to its product (Gilbert, 2001).

**Buyer’s Computer and Supplier’s Computer Interact**

The third version of EDI currently in use, and one that represents excellent opportunities for further development in purchasing entails an interaction between the buyer’s computer and the supplier’s computer. Nissan’s automobile plant is a classic example of this type of scheduling arrangement. The automaker and 19 percent of its suppliers have Manufacture Resource Planning Systems (MRPS), (Thierauf, 1990).

When an automobile body enters the paint booth at the manufacturer’s facility, MRPS identifies the customer, the options, the color, and so on, and then schedules all downstream operations to assemble the proper options for that customer. At the same
time, it downloads the schedule into the suppliers' computers that are hardwired into the system. Thus, the automobile maker not only schedules its own manufacturing operations, but it effect, schedules its suppliers' operations as well.

The suppliers manufacture their respective purchase items and deliver them directly to the assembly line at the automobile plant. The parts are installed in the automobile three hours after they were scheduled in the supplier's computer by the buyer's computer.

Each of the suppliers hardwired into the system delivers multiple shipments of purchase parts per day. As a result, this plant averages less than one day for purchase parts (Thierauf, 1990).

Accounting Usage of EDI

As the use of EDI increases, it is expected to exert a noticeable influence on accounting activities. The use of electronic data interchange appears to improve vendor relationships and to increase purchasing productivity without changing the basic nature of business. A widespread foundation for the implementation of EDI now exists in a number of industries: therefore, the use of EDI is expected to grow significantly. Accounting, purchasing, and supplier management need to become familiar with EDI concepts and to explore potential applications in their own organizations. Overall, the use of electronic data interchange, has increased significantly during the last few years for the communication of sales, purchasing, and accounting information (Bragg, 1996).

Currently, a number of industries, such as automotive, grocery, and pharmaceutical, have made strong commitments to the use of electronic interchange in accounting and purchasing and have begun to use EDI for a significant percentage of transactions.
Studies by reputable consultants indicate that electronic exchange will emerge and grow into the dominant method of exchanging business data for industries in which regular transactions of a repetitive nature take place. Direct communications between the buyer and seller are likely to become the norm rather than the exception over the next decade. This, in turn, means that a company's accounting activities will be drastically affected by EDI (Schmitz, 1999).

Trading Partners' Relationships

Prior to EDI, a buyer-seller relationship was somewhat limited, and company boundaries were considered sacred territory. Both the buyer and the seller had their own computer systems and they went their separate way. At no time was there any discussion of linking trading partners. However, with EDI networking systems, this has changed. Buyers and sellers are linked together electronically, thereby enlarging relationships which never existed before. The basis for the enlarged trading partners' relationships is based on economic benefits to both buyers and sellers (Truman, 2000).

Databases for Enlarged Accounting Capabilities

Accountants are finding database software extremely useful for storing and manipulating the voluminous amounts of data integral to their work. Unfortunately, not all database applications are simple, and questions often arise concerning how to structure the data in a database logically for an EDI networking approach. Since database design is critical to the smooth functioning of the particular software package being used, guidelines for effectively designing a small to large computer database are noted below.

The first guideline in designing a database is to determine what to put in it. At this initial stage, the purpose of the database must be carefully considered. If the database
simply automates what is previously done manually, then the data requirements are obvious. But usually more would be demanded from an automated accounting database for an EDI network than from a manual filing system. As such it would be important to ascertain the output desire form the database. Designing hypothetical outputs represents an effective method of determining data input requirements (Thierauf, 1990).

The second guideline centers on developing data relationship. In technical jargon, a database must be "logically complete." What this means would be that a database must store and connect all relevant data both between and within the files. Although logical completeness would be an obvious requirement for any database, what would not be obvious is how to achieve it. To reach logical completeness, there should be a need to determine how data items relate to one another. Three global relationships exist: one-to-one, one-to-many, and many-to-many (Emmelhainz, 1993).

A one-to-one relationship exists between the client and the client's address, each client has one address and each address has one client. A one-to-many relationship exists between partners and clients, each partner has many clients but each client has only one partner. Many-to-many relationship exists between several buyers and suppliers sharing a value added network (Emmelhainz, 1993).

The third guideline relates to integrating the appropriate data relationship within the EDI network. Because most accounting databases would be operational and data relationships would be well defined, it may be necessary to restructure the database such that an effective electronic data interchange will exist between the buyer and the seller. Overall, database design considerations for an EDI network vary depending upon the
circumstances. There may be no need to change the database in some cases while the reverse would be true in other cases.

**Software Needs for Microcomputers and Computer Mainframes**

Typically, the accounting relational databases needed in an EDI network would be in real-time. Real-time means that data contained in the database can be instantly accessible to anyone with a computer terminal. Therefore, the accounting software for microcomputers and computer mainframes needs to have this real-time capability. But more importantly, the software needs to go beyond the fully integrated approach. Fully integrated accounting software allows users to assess their organization's economic performance by addressing the connections between business operations. Essentially, these packages go one step further than the older form of integration by utilizing an interface, an ad hoc link between discrete applications. The interface has come under fire because it can create redundant rather than truly integrated data when transactions passed from a source database in one application to a destination database in another. It can also be a burden on system resources. Like applications developed in-house, integrated packages use interfaces as conduits for data transfers. However, because most integrated applications work with database management systems, they can share data stored in master files, eliminating redundancies and using system resources more efficiently. Equally important, integrated systems provide standardized tools and facilities that make it easier to learn how to use the applications (Emmelhainz, 1993).

**EDI Approach to Accounting**

Once a company has made the decision to convert to an electronic data interchange approach, important changes must be undertaken. Clearly, getting such a system up and
running requires thorough planning, dedicated resources, and significant coordination both internally and externally with its trading partners. Generally, coordination involves more than just accounts receivables and payables. It also relates to cost accounting as well as financial statement preparation and analysis.

EDI today can be compared to the same stage of development as use of the telephone early in this century. Back then, several local phone companies provided incompatible often unconnected services. Businesses had a hard time using them efficiently as a result. But with telephone system standardization, the telephone soon became a necessity for business transactions. Now corporate America would grind to a halt if its telephones were taken away. The computer reaches the same level of importance in today's factories, sales offices, and purchasing departments. And EDI can help to move that process along by creating standardized forms of communication between all the different computer hardware, software, and business systems in use throughout American companies. That standardization, however, can also be the one drawback to setting up an EDI system. Managers resist the imposition of an outside format on what have become longstanding and useful procedures in their companies (Bragg, 1996).

Additionally, purchasing and accounting both have objected to the potential loss of paper trails for transactions – something that becomes particularly important during audits of order and payment errors. But as auditing standards for computer transactions become more sophisticated and computer programs learn to build in audit trails for transactions, some of these objections have fallen by the wayside. The enlarged trading benefits from an EDI approach with increased efficiency and improved communication, not to mention increased productivity for the trading partners.
Financing Usage of EDI

Finance Design Considerations for EDI

Although the linkage of buyers and sellers has a pronounced effect on the accounting function, it also has an impact on the finance function of a typical company. In light of this important fact, this section looks at some of those finance design considerations that influence EDI networks. Initially, the focus will be on integration of finance with strategic planning and control. This linkage of the highest-level function in a company to finance can be brought out by the utilization of financial networks subject matter.

Needless to say, there would be a great need for security in such a vast EDI network. Corporate management needs assurance that financial data sent throughout the network will be fully secure against attempts by outsiders to penetrate the network (Bragg, 1996).

Evaluation of EDI Packages

It is appropriate at this time to consider evaluation of the EDI packages that will be used essentially for finance and accounting operations. Because all EDI software packages are not alike, their strengths and weaknesses are not obvious. The factors to consider are presented here with the intention to help discern the specific requirements of users (Thierauf, 1990).

First, the software should possess financial intelligence. Financial intelligence requires that the software automatically "understand" the relationship between companies, the chart of accounts and the concept of sub-accounts, and the frequency of data. This financial intelligence, or relationship knowledge, would not be inherent in all EDI software because many rely on a substantial systems development effort to define and maintain the data relationships.
Second, the EDI package should be easy to install and maintain. Typically, EDI systems can be designed to be installed by MIS personnel with a financial orientation. Generally, a combination of design guidance from a vendor and careful consideration of alternatives by the financial staff provide the installation. A good question to ask would be: "How long has it taken to install the software in applications of similar size and scope?" This question can be best answered by talking to current users of the package, without the vendor present to find out what really happens in an installation. There should be little reliance on a vendor's presale promises or the newly acquired enthusiasm of recent and uninstalled purchasers.

Flexibility and easy maintenance should also be key concerns related to this second factor. The system will be only as effective as its ability to change with the addition of new customers and vendors. In addition, how difficult will it be to make changes to the company's chart of accounts, the organization, and financial reports? Will the MIS staff be capable of maintaining the system after installation? Ideally, the company should be independent of the vendor, but specialized knowledge must be available if needed.

Third, the software should meet minimum performance standards. For example, the company should make sure that the vendors understands its requirements and can give a carefully calculated estimate of time to perform EDI activities. Fourth, can data be loaded easily into the system? One of the less interesting, but very important aspects of getting good information out of a system should be how difficult it would be to get new information into a financial database when interfacing with customers and vendors outside the company. Downloads from general ledgers, submissions from outside...
locations, and transfers from other sources need to be fast and easy. The software vendor should demonstrate this process for large volumes of data.

Fifth, while ease of data loading and retrieval should be important, sensitive financial data should not be accessible to everyone within and outside the company. Security of final data should be tightly controlled by identification and password protection as well as security profile that limit user access on a task-by-task basis. After transmission by internal and external reporting sites, information should be locked in and, to preserve data integrity, modifications should be made only with the acknowledgment of the central headquarters. For auditing purposes, a detailed user log should track the usage of systems.

Finally, the company should be aware of the vendor claims stating "no training necessary." Software with any reasonable power or flexibility will require some investment of time from the MIS staff. The vendor should offer structured training classes for the MIS staff to become proficient in software installation and maintenance as well as training for end users, such as outside customers and vendors.

In summary, evaluation of an EDI package can save significant time, reduce errors, and increase the timeliness of the company's financial data. The choice may not be easy. However, if the decision is approached analytically and in the proper framework, the company will find the right EDI software to meet its operating needs.

**EDI Approach to Finance**

Much of the present financial decision making was performed by the company's treasurer, cash managers, and financial analysts who interact with traditional databases that contain the latest financial status and reflect trends in market dynamics. Productivity
of key individuals is of great concern to the company. EDI technology, if properly applied, can enhance the productivity and accuracy of these individuals in terms of everyday operations (Marcella and Chan, 1993).

**Cash Flow Analysis**

In an EDI environment, as soon as bills are paid electronically, the cash is gone immediately versus the past MIS approach which gives a company a few days before vendors deposit the checks. Although EDI’s widespread adoption is impeded by the loss of float, most companies, in reality, would experience faster cash inflows to compensate for faster outflows. In addition, both buyers and sellers can benefit from EDI and electronic funds transfer transactions by adjusting payment terms. The sellers’ methods of adjusting payment terms include: (1) offering the buyer a cash discount to compensate for reduced payment initiation timing and collection float; (2) lengthening the payment initiation time only; and (3) offering a discount to compensate for faster collection float. An important consideration in these negotiations is the differential between the cost of capital for the buyer and the seller (Bragg, 1996).

From this discussion, it can be seen that cash inflows and outflows can be handled electronically in a manner that is conducive to both parties. The net result is that the loss of float is not a great problem when trading partners are operating on a comparable basis. This is true not only for projecting daily cash flow, but also for projecting quarterly cash flow. The major difference is that a company’s cash is more representative of the actual cash flow since float is eliminated.

From another perspective, a company’s cash flow is more accurate when EDI is utilized under conditions of explosive growth in sales or a downdraft in sales caused by...
recession. The updraft or downdraft in cash flow is reflected faster, thereby giving the
cash manager more of a feel for what monies can or cannot be spent. Collections on
receivables can be speeded up such that the next three months are representative of the
actual cash flow. In effect, the company’s treasurer has a better feel about what funds can
be expected as well as expended. In addition, the individual has a better idea of the
amount of excess funds to be invested or the amount to be borrowed to meet current
operating needs. In either situation, the treasurer has better means of integrating strategic
short-range financial planning with control in an EDI environment versus an MIS
environment.

Capital Investment Decision

The cash manager reviews a company’s financial structure to determine the best
method of financing for the accepted capital project. This is particularly necessary for
large capital projects. The best financing method is sent to the vice president initiating the
project, the vice president of finance and accounting, and the executive vice president for
approval. If approved, the cash manager then obtains the funds. If rejected, reasons for
doing so are sent by the cash manager to the initiating department. One reason for
rejection is the current high interest rates. Another reason is that the company’s cost of
capital has been exceeded for this unusually high-cost capital project. The procedures for
financing a capital project, then, are the focal point of the activities undertaken by the
cash manager.

Because the cash manager is using financial structure data, it will be different in an EDI
environment versus an MIS operating mode. For one, the financial ratios are calculated
on a basis that is more reflective of the actual situation; that is, electronic cash collection
Financial Ratios

Although financial ratios are not an integral part of a typical EDI system, they do reflect the changes that have been incurred from using an EDI approach. With the elimination of float in an EDI system, the financial ratios are more representative of what their actual values are. Essentially, financial management has a better handle on "what makes the company tick" in terms of day-by-day operations. There are no hidden amounts or reserves since cash transactions are handled electronically. The net result then is that financial ratios are a true representation of what is occurring in a company's financial area using an EDI approach versus an MIS approach (Bragg, 1996).

In terms of a thorough analysis of overall performance and variances using financial ratios, there is a great need to employ graphics. Financial ratios can be compared on a month-by-month or other time period basis. The purpose of this analysis is to determine whether the company is improving its financial stature. Of equal importance is the fact that financial ratio analysis (using graphics) discloses whether financial management is really managing the company effectively over the short term to the long term. In addition,
a graphic analysis of important financial ratios within an EDI operating mode discloses whether this new approach to electronic information systems is really paying for itself.

Fundamentally, the foregoing analysis focuses on the internal operations of the company. However, meaningful analysis should be undertaken by taking the information gathered here and relating it to external environmental factors, such as the state of the economy and industry averages. In turn, this information can be related to corporate strategies. From this perspective, EDI can be helpful in integrating the internal factors with the external ones better since both are related on a more current basis with EDI than is possible with an MIS approach (Kalakota and Whinston, 1996).

Companies are realizing the potential of EDI transmission. But at the same time, they need to be aware that without proper security, some of these transmissions could expose privileged information. In a similar manner, its widespread adoption is impeded by such barriers as the loss of float. In reality, most companies experience fast cash inflows to compensate for faster outflows. In addition, trading partners can benefit from EDI and EFT transactions by adjusting payment terms. According to Brook, Droge and Germain (2000), EDI and financial performance are positively related.

Strategic Usage of EDI

Strategic planning provides a logical starting point for a company desiring to get involved in the implementation of EDI or expanding its EDI activities sometime in the near future. Once a strategy has been developed by top management for implementing EDI that ties in with the company's overall strategy, there is a need to break down the EDI strategy into specific programs and projects that will govern its installation and use.
on an everyday basis. Also, appropriate policies must be developed that tie the company’s EDI activities with outside trading partners. Overall, a strategy to implement EDI starts at the highest level with top management and the corporate planning staff. In turn, this highest level of management and staff relegates the task of implementation to middle management and their staffs. The task of maintaining daily operations is given to lower management and their operation personnel (Chatfield and Yetton, 2000).

Everyday EDI operations save money and time by enabling purchase orders, invoices, and bills of lading to be transmitted electronically. EDI eliminates the printing and handling of paper at one end and the input of data at the other.

**Strategy for EDI Implementation**

There are two basic strategies for implementing EDI. First, companies can develop independent EDI communications directly or point-to-point with their trading partners. Second, companies can communicate with their trading partners via a third-party network. In addition, there are different levels of EDI implementation. If a company wants to get started, it can begin by purchasing a personal computer-based system, which includes a PC, a modem, and software, and simply sends and receives documents; it is not necessary to own another in-house computer to undertake EDI processing. The savings is in the cost of postage and preparing the paper mail. The software takes care of formatting the data, so there is no need to have a specific knowledge of standards (Larson and Kulchitsky, 2000).

On the other hand, the real benefits of EDI are seen when the system is integrated with the organization’s payables, receivables, and other files. In this fully integrated scheme, when invoices are received, they automatically go into the payables files, and when
purchases orders are received, they automatically go to the shipping files. The cost of setting up this kind of system varies, depending on whether the companies will need more hardware and the level of development effort it requires. The amount of in-house programming depends on how tightly EDI is to be integrated into the current system (Truman, 2000).

Integration of Short-Range Strategic Planning with Everyday Operations

The best approach to implementing EDI short-range strategic plans is to develop appropriate EDI action plans. Generally, this task often baffles and irritates managers at all levels. Plans for action detailing and other kinds of reality testing for EDI are often nonexistent or rudimentary at best. Action detailing usually follows short-range strategic planning and takes the strategy as given. Detailed operational planning should be used as a further test of a strategy’s feasibility (Gilbert, 2001).

A good way to combine strategic and operational planning of EDI is to begin an advocacy process as soon as agreement on strategic thrusts has been reached by top management and its corporate planning staff. An EDI task force is set up for all functional areas involved, with strong representation from lower and middle managements. Each functional area can identify and analyze the options for reaching a particular EDI objective and then rough out the major action steps necessary to accomplish the option that it will present to the EDI task force (Maromonte, 1998).

The functional area manager’s job is to explain and defend what it considers the best way of bringing this EDI option to life. Each area must deal with a timeframe, risk analysis, allocation of responsibility, resource requirements, organization obstacles, and monitoring devices. In mapping out and testing EDI strategic options, managers begin to
think explicitly about assumptions, alternatives, contingencies, and what competitive reactions to expect. Failure to come to grips with these details can undermine the execution of the appropriate EDI strategy (Chatfield and Yetton, 2000).

When top management and its corporate planning staff are invited to try their hands at EDI action planning, they often find it an uncomfortable exercise. Because EDI is so technical they tend to offer as action steps what are really wishes or desired results, such as introducing new services that appeal to the customer or eliminating wasteful practices. Good action detailing, however, requires the participation of lower and middle management and operating personnel. Top management and its corporate planning staff know the direction; those below know the terrain. Not only is lower-level participation essential to the working of EDI it is also highly desirable. Through such participation, these managers generate the kind of understanding, ownership, commitment, and motivation necessary for successful implementation. The alternative is to try to push EDI strategic planning out into the organization and down through the ranks by exhortation and other forms of one-way communication, has only minimal effect. Companies trapped in half-thought-out EDI planning may lack the information and motivation necessary to good strategy execution. These companies may avoid the front-end costs of participation, discussion, and explicit detailing, but they pay the cost of not seeing their options, not reaching their goals, and spending days bogged down in implementation (Chatfield and Yetton, 2000).

After all the steps in developing EDI have been finalized by lower and middle management plus their appropriate personnel, there is need for top management to approve the action plans for implementation. After this is accomplished, the action plans
are integrated with a control system so that “the right hand knows what the left hand is
doing.” Short-range strategic planning cannot achieve its full potential until it is
integrated with other control systems, such as budgets and cost information systems
(Emmelhainz, 1993).

While managers who have adopted strategic planning see it as an indispensable tool,
they tend to treat it at first as just another addition to an array of control devices. Before
long, they may discover that one control is at odds with another. To overcome this
problem, reference can be made to the strategic planning system set forth under the
current MIS approach, that is, short-range strategies are linked to medium-and long-range
strategic plans. In turn, exceptions are brought to the appropriate management level for
items related or not related to EDI activities (Chatfield and Yetton, 2000).

Overall, the lack of integrating strategic plans and budgets can be an area of
dissonance for EDI implementation. Managers tend to view the annual planning and
budgeting sequence as logically connected but not integrated in fact. While the best
efforts for EDI strategic planning start from an external environmental analysis and then
work in the department’s ability to respond, budgeting usually proceeds by making
incremental adjustments to the previous year’s internal departmental budgets. This
practice allows the momentum of last year’s (possibly obsolete) business strategy and this
year’s functional strategies to determine the funding of this year’s total business plan.
The absence of strategic action planning often thwarts those who want to integrate plans
and budgets. Not until a company has formulated explicit action steps can it cast fixed
capital, working capital, operating expense, and revenue and head-count implications in
the form of strategy-based budgets that are related to EDI costs as well as cost savings (Scott, 2000).

**Better-Planned Workday**

Once short-range strategic plans are integrated with current budgets so that control can be exercised over EDI activities, the next step is to examine the effects of EDI on daily operations. A most important advantage of EDI is that it saves money. It is very expensive to hire people to perform the redundant input that telephone and letter communications require. In addition, matching invoices and remittances plus numerous other clerical functions can save companies considerable money. From a much broader perspective, the EDI system allows for a better-planned workday. More specifically, this refers to receiving invoices and purchase orders in real-time, thereby eliminating the peaks and valleys that result from companies sending documents daily or weekly. Companies can avoid the afternoon panic when the mailroom drops a large number of release orders. With EDI, it is no longer necessary to have employees working overtime to process orders for the next day. Instead, orders are received all day long, which results in a more even workload throughout the day (Truman, 2000).

**Reduced Order-Processing Errors**

Many users point to EDI benefits that are not related directly to postage and handling of paper documents. EDI cuts down on the inevitable errors that occur when data are entered and printed out numerous times. United Refrigerated, for example, is a public warehouse for the grocery industry. It receives more than 1,000 release orders a day to ship products to outlets throughout the country. Needless to say, that leaves a lot of room for error. When a mistake is made, the company pays freight both ways. Also, the
company has to restock the product and goodwill is lost. While the company does not have an exact figure on how often errors occur now that it uses EDI, the 850 release orders received electronically each day are processed practically error-free (Stevens, 1998).

When used for transmitting price lists and promotional announcements, EDI can also better organize the buying process. If a company has to depend on salespeople to deliver price lists and promotional announcements, it can never be sure of getting current information to customers. Some promotions are missed by customers because a sales person could not get them in on time. In addition, the ability to receive and act immediately on purchase orders and invoices provides a level of service not found in non-EDI systems.

**Better Control over Inventory**

Building upon the above benefits of a better-planned workday and reduced order processing errors, EDI allows a typical company to gain better control over inventory. Real-time transmission of purchase orders allows a company to lower its inventory since it will be able to replace stock more quickly. For example the K-Mart Corporation in Troy, Michigan, is handling 80 percent of its general merchandise orders through EDI, it is able to delay ordering most stock by three to four days. For such a large corporation, the cost savings in interest alone is substantial when the entire stock is multiplied by three to four days (Stevens, 1998).

Lowering inventory by several days is an impressive savings for retailers, but manufacturers plagued by tough foreign competition often have to do even better. Each of the big three U.S. automobile manufacturers has instituted some form of just-in-time
inventory, which requires, in some cases, only an hour’s supply. Today, a car manufacturer has to schedule assembly plants and docks hour by hour. It cannot do that on paper, since timing is too inexact. A plant never knows when the paper will arrive. Ford, for example, uses EDI to send purchase orders and receive information as to when parts will arrive both for production and non-production items (Baker, 1991).

While just-in-time inventory is considered the leading edge in plant organization, some experts feel that EDI’s capabilities have not yet been fully explored. That is, once the age of the paperless business transaction is reached, industries will be able to explore efficiencies and techniques of which just-in-time will be only one example. As an analogy, compare EDI to a superhighway system. By itself, it has little meaning. But it has made a lot of things possible. It is expected that in the future EDI will be depended upon as much as the highway system is depended upon today (Bragg, 1996).

**Linkage to Electronic Funds Transfer**

Aside from better control over inventory using EDI, experts predict that the most revolutionary change EDI will bring in the near future is expanded use of cash management. Some companies are already taking into account the more exact knowledge of when cash will arrive and the quicker and more accurate collection procedures afforded by EDI. Better cash management has resulted in organizations receiving discounts and better terms by making more timely payments. However, this major change in managing cash will be more dramatic with the increased used of electronic funds transfer, a type of EDI in which payments are electronically transferred from the purchaser’s to the vendor’s account. The largest electronic funds transfer project has been

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undertaken by General Motors and the bulk of its vendors (Kalakota and Whinston, 1996).

Fundamentally, electronic funds transfer is a natural progression for EDI. More specifically, a company can transfer information about the funds it is sending. But if the actual funds are sent through the mail, there must be some matching and input of data as well as some delay. Typically, once a company sends data electronically, there is a small additional effort required for it to send funds as well. Thus, banks will be thought of as third-party EDI vendors (Kalakota and Whinston, 1996).

An important part of implementing EDI is its inclusion in a company's present and future strategy. Typically, a short-range strategic planning approach to EDI tends to improve operational activities in a number of ways. These include a better-planned workday, reduced order-processing errors, better control over inventory, and a linkage to electronic funds transfer. Such an EDI approach not only saves money by cutting staff, but also time in processing everyday business activities.

Just-In-Time Usage of EDI

Many researchers have suggested that EDI can be a strategic weapon (Janssens and Cuyvers, 1991; Jelassi and Figon, 1994; Johnston and Vitale, 1988; and Mukhopadhyay, Kekre and Kalathur; 1995). In general, buyer-supplier relationship through the use of EDI can be improved by combining JIT concept to reduce cycle time, support quick response to changes in consumer demand, and enable initiators to compete in a timely manner. Brook, Droge and Germain (2000) found that EDI and inventory were positively related and that the relationship was contingent upon context and JIT. According to these
researchers stable demand for inventory stimulates the need to use JIT with firms of all sizes as EDI increasingly adopted.

This strategic use of EDI by adopters typically requires adopter cooperation in undertaking joint economic action with the initiator, such as new product design and just-in-time (JIT) delivery of components. To do this, the adopter frequently has to make significant changes to its internal processes. Strategic payoffs are unlikely when initiators and adopters use EDI simply to automate existing inter-firm information flows and decision processes (Benjamin, de Long, Morton. 1990; Clemons and Row. 1993; Johnston and Vitale, 1988). In practice, many initiators simply do this and avoid internal restructuring, leaving inefficient processes intact or ignoring overall interdependence across processes (Davenport and Short, 1990; Hammer, 1990; Willcocks and Lester, 1996). It follows that a firms’ unwillingness to reengineer its internal systems is a barrier to capturing the strategic benefit of EDI.

The sharing of JIT schedules with suppliers using EDI technology gives suppliers accurate and precise information on future material requirements. Integrated information systems using EDI facilitate this process, as information can effectively flow across organizational boundaries (Cash and Konsynski 1985; Kekre and Mukhopadhyay, 1992). Using integrated information systems, suppliers can promptly react to messages from their customers since the internal systems of suppliers can adjust to customers’ request dynamically. Many elements of JIT practices requiring coordination between organizations can be facilitated, as the higher degree of electronic coupling helps the synchronizing of material flows (Galliers and Baets, 1998).
According to Rogers (1977), a potential bias found in diffusion research was the belief that innovations were good and should be adopted by all, when in fact some individuals should not adopt them. Although the reference was made to individuals, for example consumers, it seems possible that it could be transferred to organizations. Perhaps not all firms would realize the cost savings and productivity improvements promised by business-to-business online purchasing. As noted by Hardaker and Graham (2000), organizations offering online capabilities required access to a wide range of external technological services to operate effectively, including high-speed digital switches, satellite downlinks, and comparable EDI. These high-technological demands and their associated costs may be cost-prohibitive for some organizations (Wenninger, 1999), particularly smaller businesses. Practitioners should ensure that the benefits to their organizations outweigh the costs associated with implementing and/or using such a system. Future research might focus on identifying the conditions under which an organization would be most likely to benefit from this innovation in purchasing. Table 8 presents a summary of the dependent variables.
<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Definition</th>
<th>Operationalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchasing Related Usage</td>
<td>Is the acquisition of goods/services from dependable suppliers, with the buyer assuming the responsibilities of receiving, storing, and eventually issuing the items to various departments.</td>
<td>Mean of 4 items</td>
</tr>
<tr>
<td>Accounting Related Usage</td>
<td>Is defined as the process of identifying, measuring, and communicating economic information to permit informed judgments and decisions by the users of the information (Hermanson and Edwards, 1992).</td>
<td>Mean of 5 items</td>
</tr>
<tr>
<td>Financing Related Usage</td>
<td>Involve transactions that causes changes to ownership equity in the form of investment or withdrawal of equity capital and operation returns of income (or losses).</td>
<td>Mean of 5 items</td>
</tr>
<tr>
<td>Strategic Related Usage</td>
<td>Is the critical procedures design to unite an organization and move it in the right direction by focusing on the primary task, core competency and positioning of the firm.</td>
<td>Mean of 5 items</td>
</tr>
</tbody>
</table>
Chapter Summary

In this chapter, the research design and methods employed to test the hypotheses are presented in Figure 24. A cross-sectional mail survey was used with the target population of hotels in the U.S. The measures of EDI usage are developed and/or borrowed from other studies. The instrument is pilot-tested once. The reliability and validity of the instrument will be tested using Cronbach's alpha and factor analysis. The results of the analysis will determine the reliability and validity of the instrument.
CHAPTER 4

RESULTS OF DATA ANALYSIS

Introduction

In this chapter, the results from implementing the research design and methods are presented. First the issue of descriptive statistics for the variables used in the model and assumptions of multivariate tests are discussed. Then prior to testing the model, analysis of response rates and possible non-response bias are investigated followed by reliability and validity analysis, profile of usage, and factors influencing usage decisions. Then a profile of the hotels is presented. Finally, the output from the multivariate analytical techniques used to analyze the data is presented and discussed.

Descriptive Statistics and Assumptions of Multivariate Test

In this section, descriptive statistics and assumption multivariate tests are presented. Descriptive statistics are analyzed for variables used in the research model. Assumptions of multivariate tests, involving normality, linearity, and homoscedasticity are tested. In addition the sample was examined for outliers.

Descriptive Statistics

Descriptive statistics analysis was done for the data collected. Minimum and maximum values were examined to ensure that all the data entered did not exceed the
maximum value of seven or fall below the minimum value of one that was on the measurement scale. The means were also examined for accuracy of the data entered into the data set. According to Tabachnick and Fidell (1996) missing value is one of the most pervasive problems in data analysis. The total usable questionnaires were 287. Missing values were recorded as 26 and determined to be random in the sample. The missing values were taken into account during the principal component analysis. In this section, descriptive statistics and assumptions of multivariate tests are presented. Descriptive statistics are supplied for the variables used in the research model. Assumptions of multivariate tests, involving normality, linearity and homoscedasticity are tested. In addition, the sample is tested for outliers.

Assumptions of Multivariate Tests

As a rule, the assumptions of multivariate analysis are tested twice. The assumptions are tested first for individual variables and second, for the multivariate model because two or more univariate normal variables are not necessarily multivariate normal. The assumptions of multivariate analysis include normality, linearity and homoscedasticity of the variables (Hair, et al., 1995).

Test of the Research Model

The research model is tested by employing multiple regression analysis. In order to perform separate analyses of sets with each dependent variable, a test of the model with all three of the dependent variables is required. Before testing the model an analysis of response rate, non-response bias, and reliability and validity are taken into account. The size of the hotel was an important factor used in determining its effect on EDI the usage.
in the hotel. Hotels were divided into two groups. Hotels with less than 500 rooms were classified as small, while those with 500 room or more were categorized as large hotels. Prior studies (Ahmad and Schroeder, 2001; Dresser, Yao and Palmer, 2001; Williams, Magee, and Suzuki, 1998; Williams, 1994; and Walton, 1994) suggested that size impact the usage of EDI adoption and usage.

Analysis of Response

Survey instruments (see Appendix A) were mailed out with cover letter and UNLV research protocol (see Appendix B) to 1250 managers with the title of chief financial officers/controllers, purchasing managers, and management information systems managers on September 24, 2001. A week later after the original mailing the first follow-up letter (see Appendix B) was mailed out. Three weeks after the original mailing a second follow-up letter was sent out (see Appendix B). A third follow-up letter (see Appendix B) was necessary to improve the response rate. A total of 366 responses were received. There were 79 incomplete responses that were discarded leaving a total of 287 usable responses. The response rate obtained was 22.96 percent.

Table 9 presents a profile of the hotels and the overall response by property size, EDI applications, hotel affiliations, and by respondent positions. The largest response (38 percent) came from property with 500-999 rooms. EFT was the most popular used EDI application (51 percent reported). Respondents by position indicate that chief financial officers/controller returned 54 percent of the usable questionnaires.
Table 9

Summary of Sample Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Frequences</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>By Property Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>under 500</td>
<td>81</td>
<td>28</td>
</tr>
<tr>
<td>500 – 999</td>
<td>110</td>
<td>38</td>
</tr>
<tr>
<td>1000 – 1499</td>
<td>34</td>
<td>12</td>
</tr>
<tr>
<td>1500 – 1999</td>
<td>27</td>
<td>10</td>
</tr>
<tr>
<td>2000 – 2499</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Over 2500</td>
<td>23</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>287</td>
<td>100</td>
</tr>
<tr>
<td><strong>By EDI-Application(s) Used</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using only EFT</td>
<td>148</td>
<td>52</td>
</tr>
<tr>
<td>Using combined EFT, TDI &amp; FEDI</td>
<td>83</td>
<td>29</td>
</tr>
<tr>
<td>Using combined EFT &amp; FEDI</td>
<td>37</td>
<td>13</td>
</tr>
<tr>
<td>Using combined EFT &amp; TDI</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Using only TDI</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Using VBA</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>287</td>
<td>100</td>
</tr>
<tr>
<td><strong>By Hotel Affiliations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chain</td>
<td>178</td>
<td>62</td>
</tr>
<tr>
<td>Independent</td>
<td>87</td>
<td>30</td>
</tr>
<tr>
<td>Management Co.</td>
<td>22</td>
<td>8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>287</td>
<td>100</td>
</tr>
<tr>
<td><strong>By Respondent Position</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFO</td>
<td>156</td>
<td>54</td>
</tr>
<tr>
<td>Purchasing Manager</td>
<td>57</td>
<td>20</td>
</tr>
<tr>
<td>MIS Manager</td>
<td>74</td>
<td>26</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>287</td>
<td>100</td>
</tr>
</tbody>
</table>

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Non-response Bias

As mentioned in Chapter 3, non-response can be a serious problem because those that respond are likely to differ substantially from those who did not respond on key questions. The best way to protect against this bias is to improve the response rate. Improvements in the response rate were achieved through the use of multiple follow-ups. Another method used was to send out 100 certified follow-ups from a sample of the non-respondents. A sample of this letter is in Appendix B. A total of 24 were completed and returned. Analysis reveals that there were no significant differences in respondents and non-respondents on the key questions of interest on the questionnaire.

Reliability and Validity analysis

Care was taken to establish content validity for each measure through the extensive literature review process and the adaptation of validated measures. In order to validate the latent dimensions represented by the items, common factor analysis with varimax rotation was used for all multi-item constructs. These analyses were conducted within the domains of usages, task, and channel attributes in order to test for discriminant and convergent validity (Hair, Anderson, Tatham, & Black, 1987). Scree plots were used along with the latent root criterion (Eigenvalue > 1) to determine the number of factors. Because some of the scales were based on prior work, conservative rules were established before items were dropped. Specifically, an item was dropped when (1) it did not meet the threshold loading of 0.30 (over the 0.15 recommended for sample sized greater than 300) on any factor and the item had low communality, or (2) it showed significant
variance across two or more factors (Hair, et al.). The results of the factor analysis (with high loading emphasized) are presented in Tables 25 and 26.

Of the 19 usage items, only access to bank balance did not load on predefined constructs. Figure 25 indicates that the four major uses of EDI were consolidated into three categories. Accounting usage was absorbed into purchasing and financing usages. Invoice statement and payment remittance advice load on to purchasing, while accounts receivables, accounts payables, and financial statement preparation load on to financing. The results of factor analysis on channel variables (see Figure 26) were not as clean as the usage variables. Five factors rather than the seven conceptualized emerged from the analysis. Items from "usefulness" and "ease of use" loaded together forming a new factor usage. The strong loadings and explained variance provide evidence of construct validity for usage measures. that was renamed "readiness" (Factor 1). The merger of these groups suggests that perceived usefulness of EDI is highly related to its perceived ease of use. This has been suggested in the literature (Montgomery & Benbasat, 1983; Rice & Shook, 1988). "Business presence" and "feedback loaded on to each to form a new factor. The new factor was therefore retained under the name "business presence feedback" (Factor 2), referring to the perception of being able to send and receive quality information. The final outcome of this analysis yielded five multi-item channel variables: readiness, business presence feedback accessibility, quality, and economic awareness. Table 10 provides the final set of constructs and the relevant items used for the analysis. It also provides summary statistics and reliabilities for each construct. Almost all variables demonstrated strong internal consistency, with Cronbach's alpha ranging from 0.76 to 0.92.
Rotated Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request for Quote</td>
<td>0.817</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchase Order (PO)</td>
<td>0.827</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO acknowledgement</td>
<td>0.854</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receiving verification</td>
<td>0.866</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invoice Statement</td>
<td>0.814</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Payment Remittance Advice</td>
<td>0.771</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts Receivables</td>
<td>0.536</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts Payables</td>
<td>0.633</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial Statement Preparations</td>
<td>0.648</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Management</td>
<td>0.756</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capital Investment Decisions</td>
<td>0.821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Flow Analysis</td>
<td>0.796</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Transaction Management</td>
<td>0.523</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Access to Bank Balance</td>
<td>0.705</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Term Procurement Contract</td>
<td>0.801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce the Number of Suppliers</td>
<td>0.729</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Just-in-Time Shipment</td>
<td>0.781</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Better Control Over Inventory</td>
<td>0.781</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linkage to Electronic Funds</td>
<td>0.583</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Final Factor Name:
Factor 1: Purchasing Usage
Factor 2: Financing Usage
Factor 3: Strategic Usage

Figure 25 Result of Factor Analysis – Three Factor Solution

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Rotated Component Matrix

<table>
<thead>
<tr>
<th>Component</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to use</td>
<td>0.789</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy to learn</td>
<td>0.872</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible to operate</td>
<td>0.727</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Useful</td>
<td>0.668</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effective</td>
<td>0.651</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Productive</td>
<td>0.562</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Convenience</td>
<td></td>
<td></td>
<td></td>
<td>0.620</td>
<td></td>
</tr>
<tr>
<td>Dependable</td>
<td></td>
<td></td>
<td></td>
<td>0.724</td>
<td></td>
</tr>
<tr>
<td>Accessible with trading partners</td>
<td></td>
<td></td>
<td></td>
<td>0.688</td>
<td></td>
</tr>
<tr>
<td>Accessible using existing computer system</td>
<td></td>
<td></td>
<td></td>
<td>0.743</td>
<td></td>
</tr>
<tr>
<td>Accessible via the Internet</td>
<td></td>
<td></td>
<td></td>
<td>0.635</td>
<td></td>
</tr>
<tr>
<td>Structured data</td>
<td></td>
<td></td>
<td></td>
<td>0.591</td>
<td></td>
</tr>
<tr>
<td>Coordinate information</td>
<td></td>
<td></td>
<td></td>
<td>0.723</td>
<td></td>
</tr>
<tr>
<td>Impersonal communication</td>
<td></td>
<td></td>
<td></td>
<td>0.751</td>
<td></td>
</tr>
<tr>
<td>Keep information confidential</td>
<td></td>
<td></td>
<td></td>
<td>0.733</td>
<td></td>
</tr>
<tr>
<td>Customizable response</td>
<td></td>
<td></td>
<td></td>
<td>0.598</td>
<td></td>
</tr>
<tr>
<td>Sponaneous reply</td>
<td></td>
<td></td>
<td></td>
<td>0.573</td>
<td></td>
</tr>
<tr>
<td>Automatic exchange of information</td>
<td></td>
<td></td>
<td></td>
<td>0.523</td>
<td></td>
</tr>
<tr>
<td>Clear communication</td>
<td></td>
<td></td>
<td></td>
<td>0.798</td>
<td></td>
</tr>
<tr>
<td>Reliable information</td>
<td></td>
<td></td>
<td></td>
<td>0.788</td>
<td></td>
</tr>
<tr>
<td>Accurate information</td>
<td></td>
<td></td>
<td></td>
<td>0.669</td>
<td></td>
</tr>
<tr>
<td>Reduce time in processing documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.729</td>
</tr>
<tr>
<td>Reduce inventory cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.815</td>
</tr>
<tr>
<td>Reduce transaction cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.805</td>
</tr>
</tbody>
</table>

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

Final Factor Names:
- Factor 1: Readiness Usage
- Factor 2: Business Presence Feedback
- Factor 3: Accessibility
- Factor 4: Quality
- Factor 5: Economic Awareness

Figure 26 Result of Factor Analysis – Five Factor Solution
Table 10

Descriptive Statistics and Reliabilities of Variables (n=287)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Means</th>
<th>Std. Dev.</th>
<th>Cron. Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usage Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Purchasing Use</td>
<td>6.1128</td>
<td>0.8566</td>
<td>0.92</td>
</tr>
<tr>
<td>Financing Use</td>
<td>4.1976</td>
<td>0.7984</td>
<td>0.8</td>
</tr>
<tr>
<td>Strategic Use</td>
<td>5.8008</td>
<td>0.8096</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Profile Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Property Size</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Trading Status</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Channel Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Readiness</td>
<td>6.4369</td>
<td>0.6831</td>
<td>0.84</td>
</tr>
<tr>
<td>Accessibility</td>
<td>6.4029</td>
<td>0.6614</td>
<td>0.8</td>
</tr>
<tr>
<td>Business Presence/Feedback</td>
<td>6.4289</td>
<td>0.6992</td>
<td>0.78</td>
</tr>
<tr>
<td>Quality</td>
<td>6.4546</td>
<td>0.6171</td>
<td>0.78</td>
</tr>
<tr>
<td>Economic Awareness</td>
<td>6.4237</td>
<td>0.6535</td>
<td>0.76</td>
</tr>
<tr>
<td>Physical Location</td>
<td>6.3601</td>
<td>0.598</td>
<td>N/A</td>
</tr>
<tr>
<td>Timing of Communication</td>
<td>6.4266</td>
<td>0.6379</td>
<td>N/A</td>
</tr>
<tr>
<td>Configuration</td>
<td>6.5035</td>
<td>0.6255</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Task Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>5.6154</td>
<td>0.6481</td>
<td>N/A</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>5.6608</td>
<td>0.6437</td>
<td>N/A</td>
</tr>
<tr>
<td>Communicate</td>
<td>5.6829</td>
<td>0.6849</td>
<td>N/A</td>
</tr>
<tr>
<td>Analyzability</td>
<td>5.8223</td>
<td>0.6636</td>
<td>N/A</td>
</tr>
<tr>
<td>Predictability</td>
<td>5.7937</td>
<td>0.6511</td>
<td>N/A</td>
</tr>
<tr>
<td>Interdependence</td>
<td>5.9895</td>
<td>0.7502</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: No Cronbach Alpha value was reported for single-item scale.
Profile of Usage

To address the first part of the research question, Table 11 illustrates how EDI is being used in terms of type and extent of use for the 18 items remaining after validity analysis. The factor analysis strongly indicates that there are indeed three classes of usage for EDI. Item means range from a high of 6.31 for “receiving reports” to a low of 4.31 for “cash flow analysis.” It is interesting to note that the top ten items describing EDI use are divided between purchasing (6), and strategic (4) uses. The result indicated that the means of the three usage factors differ significantly, with purchasing use showing highest frequency of usage, followed by strategic use, and then financing use.

In examining usage within each category, it is interesting to observe that the more frequent uses tend to be those that appear to “fit” the richness and capabilities of the medium. For instance, frequent purchase uses tend to be for purchaser order and use of EDI as an alternative to the phone or mailing. Long-term procurement contract, reducing the number of suppliers, and linking to electronic funds reflect the higher scores on strategic use. This usage pattern is most likely a direct consequence of the one-to-many information flow relationships possible over such network. In this way, interorganizational users may capitalize on the accumulated job and strategic knowledge of the thousands of fellow users tied to the EDI network. In contrast, uses that require financial assistance and information tend to be on the lower end of the scale.

Factors Influencing Usage Decisions

To examine the hypothesized relationships between the variables and the types of usage, multiple regression analysis was used. Each set of constructs within the categories
<table>
<thead>
<tr>
<th>Type of Usage</th>
<th>Mean</th>
<th>Stand. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Purchasing Usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Request for Quote (RFQ)</td>
<td>6.2822</td>
<td>0.7435</td>
</tr>
<tr>
<td>Purchase Order (PO)</td>
<td>6.2308</td>
<td>0.765</td>
</tr>
<tr>
<td>Purchaser Order Acknowledgement</td>
<td>6.2509</td>
<td>0.8063</td>
</tr>
<tr>
<td>Receiving Report</td>
<td>6.3147</td>
<td>0.8412</td>
</tr>
<tr>
<td>Invoice Statement</td>
<td>5.8322</td>
<td>0.9587</td>
</tr>
<tr>
<td>Payment Remittance Advice</td>
<td>5.7657</td>
<td>1.0248</td>
</tr>
<tr>
<td><strong>Financing Usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accounts Receivables</td>
<td>4.0559</td>
<td>0.8189</td>
</tr>
<tr>
<td>Accounts Payables</td>
<td>3.8706</td>
<td>0.7498</td>
</tr>
<tr>
<td>Cash Management</td>
<td>4.3846</td>
<td>0.8072</td>
</tr>
<tr>
<td>Capital Investment Decisions</td>
<td>4.3345</td>
<td>0.757</td>
</tr>
<tr>
<td>Cash Flow Analysis</td>
<td>4.3112</td>
<td>0.7887</td>
</tr>
<tr>
<td>Cash Transaction Management</td>
<td>4.5645</td>
<td>0.9397</td>
</tr>
<tr>
<td>Financial Statement Preparations</td>
<td>3.8362</td>
<td>0.7273</td>
</tr>
<tr>
<td><strong>Strategic Usage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long-term Procurement Contracts</td>
<td>5.6829</td>
<td>0.8154</td>
</tr>
<tr>
<td>Reduce the Number of Suppliers</td>
<td>5.528</td>
<td>0.7887</td>
</tr>
<tr>
<td>Just-in-Time Shipment</td>
<td>5.4321</td>
<td>0.9092</td>
</tr>
<tr>
<td>Reduce the Number of Inventory Items</td>
<td>5.784</td>
<td>0.9248</td>
</tr>
<tr>
<td>Linkage to Electronic Funds</td>
<td>6.5734</td>
<td>0.6097</td>
</tr>
</tbody>
</table>

Scale: Never 1 2 3 4 5 6 7 Always

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of profile variables, channel variables, and tasks variables, was regressed separately with each type of usage, that is, purchasing, financing, and strategic. After analyses of all possible regression permutations, each possible domain of independent variable and each dependent variable were identified as being the best, based upon highest explained variance.

Before proceeding with each regression, checks of equal variance and normality were conducted using the Kolmogorov D statistics and a normal probability plot of the residuals (Neter, Wasserman, & Kutner, 1985). As might be expected with a large sample size, the results suggest that the error terms are approximately normally distributed in the probability plots and K-D statistics are all significant at .05 levels. Multicollinearity was also examined before proceeding with interpretation of multivariate results. An intervariable correlation matrix indicated that most independent variables within each category showed low correlations. However, to compute the effects of multicollinearity, a test of the variance inflation factor (VIF) and collinearity diagnostics was conducted (Neter, et al., 1985). The VIFs showed no threat of multicollinearity, with values ranging from 1.209 to 1.411, and consistently low condition numbers (not exceeding 2.05). Recommended VIF values are below 10 and condition numbers below 33 (Myers, 1986).

Regressions for Purchase Use.

Table 12 illustrates the results of three regressions with purchase use as the dependent variable. From the profile variables, only property size and trading status showed significance. This means that on average purchasing usage of EDI was significantly less for hotels comprised of less than 500 rooms compared to those with 500 rooms or greater.
Table 12
Summary of Regression Analysis for Purchasing Use (n=287)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>0.03</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>Property Size</td>
<td>1.18</td>
<td>0.15</td>
<td>0.44*</td>
</tr>
<tr>
<td>Trading Status</td>
<td>0.75</td>
<td>0.21</td>
<td>0.21*</td>
</tr>
<tr>
<td>Channel Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rediness</td>
<td>-0.01</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Accessible</td>
<td>-0.10</td>
<td>0.07</td>
<td>-0.10</td>
</tr>
<tr>
<td>Business Presence</td>
<td>0</td>
<td>0.06</td>
<td>0</td>
</tr>
<tr>
<td>Quality</td>
<td>0.06</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Economic</td>
<td>-0.02</td>
<td>0.07</td>
<td>-0.08</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.10</td>
<td>0.12</td>
<td>-0.06</td>
</tr>
<tr>
<td>Timeliness</td>
<td>0.11</td>
<td>0.12</td>
<td>-0.07</td>
</tr>
<tr>
<td>Configuration</td>
<td>-0.18</td>
<td>0.12</td>
<td>-0.12</td>
</tr>
<tr>
<td>Task Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>0.05</td>
<td>0.11</td>
<td>0.03</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>0.32</td>
<td>0.10</td>
<td>0.21*</td>
</tr>
<tr>
<td>Analyzability</td>
<td>0.03</td>
<td>0.10</td>
<td>0.02</td>
</tr>
<tr>
<td>Communication</td>
<td>0</td>
<td>0.11</td>
<td>0</td>
</tr>
<tr>
<td>Predictability</td>
<td>-0.14</td>
<td>0.11</td>
<td>-0.09</td>
</tr>
<tr>
<td>Interdependence</td>
<td>-0.36</td>
<td>0.09</td>
<td>-0.27*</td>
</tr>
</tbody>
</table>

Note: $R^2=.12$ for property size; $R^2=.03$ for trading status; and $R^2=.09$ for task variables. *p<.05.
(t = - 7.995, p = 0005). Also on average purchasing usage of EDI was determine to be significantly more for hotels that were publicly traded than those that were not (t = 3.606, p = .0005).

The relationship between task variables and purchase usage showed interesting results. Organizational researchers have shown that as the task environment gets more uncertain, communication will increase to obtain information to reduce the uncertainty. Some of this is evidenced here. However, task analyzability and predictability, which in the past have shown a tendency to promote task communication, did not predict purchase use of EDI. This suggests that regardless of how routine a task is, there are aspects of the task for which EDI will be valuable. Task interdependence can be seen to facilitate distribution of information, giving feedback, and coordinating projects. This is especially true when a significant portion of the task requires external interaction. Therefore, tasks that are interdependent involve time with outside parties and have uncertainty results in greater interorganizational task-related use of EDI.

The weakest regression relationship with purchasing use can be found within the channel variables. It is possible that the sophistication of EDI users in the sample might have reduced the importance of these variables. In sum, purchase use is lower among those who perceive the medium to be one that is not useful and economical, facilitates timing, and has a configuration that enables a variety of communication flows.

Regressions for Financing Use

Table 13 illustrates the results of three regressions for financing use of EDI. Among the profile variables, only hypotheses relating to property size is supported. The financing
Table 13

Summary of Regression Analysis for Financing Use (n=287)

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profile Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>-0.15</td>
<td>0.12</td>
<td>-0.07</td>
</tr>
<tr>
<td>Property Size</td>
<td>-0.35</td>
<td>0.16</td>
<td>0.13*</td>
</tr>
<tr>
<td>Trading Status</td>
<td>-0.13</td>
<td>0.21</td>
<td>-0.04*</td>
</tr>
<tr>
<td><strong>Channel Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rediness</td>
<td>0.01</td>
<td>0.06</td>
<td>0.10</td>
</tr>
<tr>
<td>Accessible</td>
<td>0.15</td>
<td>0.06</td>
<td>0.15*</td>
</tr>
<tr>
<td>Business Presence</td>
<td>0.09</td>
<td>0.06</td>
<td>0.09</td>
</tr>
<tr>
<td>Quality</td>
<td>0.04</td>
<td>0.06</td>
<td>0.04</td>
</tr>
<tr>
<td>Economic</td>
<td>0.03</td>
<td>0.07</td>
<td>0.02</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.01</td>
<td>0.12</td>
<td>-0.01</td>
</tr>
<tr>
<td>Timeliness</td>
<td>-0.03</td>
<td>0.12</td>
<td>-0.02</td>
</tr>
<tr>
<td>Configuration</td>
<td>0.07</td>
<td>0.12</td>
<td>-0.04</td>
</tr>
<tr>
<td><strong>Task Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>-0.18</td>
<td>0.11</td>
<td>-0.12</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>0.08</td>
<td>0.12</td>
<td>0.05</td>
</tr>
<tr>
<td>Analyzability</td>
<td>0.01</td>
<td>0.10</td>
<td>0.01</td>
</tr>
<tr>
<td>Communication</td>
<td>0.19</td>
<td>0.12</td>
<td>0.13</td>
</tr>
<tr>
<td>Predictability</td>
<td>-0.03</td>
<td>0.12</td>
<td>-0.02</td>
</tr>
<tr>
<td>Interdependence</td>
<td>-0.02</td>
<td>0.10</td>
<td>-0.01</td>
</tr>
</tbody>
</table>

*Note: R²=.12 for property size; R²=.05 for channel variables.*

*p<.05.
usage of EDI was determined to be significantly less for hotels with less than 500 rooms compared to those with 500 rooms or greater (t = -2.156, p = 0005. Therefore, the sizes of the hotel have influence on financing usage.

Among the channel variables, there was no relationship with financing use (as hypothesized). Similar situation was observed with task variables. This suggests that those who are involved in routine structured tasks do not value EDI capabilities.

Regressions for Strategic Use

The strategic capabilities of EDI primarily relate to its ability to request information from multiple sources or private settings. Table 14 shows the regression results for this usage category. Here the profile variables show no relationship with EDI strategic use.

Strategic uses involve obtaining information from external and internal sources; the significant positive relationship with task uncertainty (as hypothesized) is easy to interpret. Also, in past research, task interdependence has been shown to be a predictor of the amount of information accessed (Ito & Peterson, 1986) and hence would encourage strategic use of EDI. Therefore, greater task interdependence may result in information gathering in which strategic users of EDI extract information from their environment to satisfy uncertainty needs of both intra-and interorganizationally based projects. The results for channel variables indicate that three variables, accessible, business presence feedback and quality are significant at a p<.05 level; this reflects that EDI technology is capable of providing quality business information that is readily accessible.

This study was exploratory in nature. Therefore a alpha level of .05 was used. According to Cronbach and Meehel (1967) and Nunnally (1967) exploratory study using
### Table 14

**Summary of Regression Analysis for Strategic Use (n=287)**

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>B</th>
<th>SE B</th>
<th>Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Profile Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>0.028</td>
<td>0.12</td>
<td>0.01</td>
</tr>
<tr>
<td>Property Size (Rooms)</td>
<td>0.21</td>
<td>0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>Trading Status</td>
<td>-0.33</td>
<td>0.21</td>
<td>-0.09</td>
</tr>
<tr>
<td><strong>Channel Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rediness</td>
<td>0.02</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Accessible</td>
<td>0.17</td>
<td>0.06</td>
<td>0.18*</td>
</tr>
<tr>
<td>Business Presence</td>
<td>0.22</td>
<td>0.06</td>
<td>0.23*</td>
</tr>
<tr>
<td>Quality</td>
<td>0.14</td>
<td>0.06</td>
<td>0.14*</td>
</tr>
<tr>
<td>Economic</td>
<td>0.07</td>
<td>0.07</td>
<td>0.06</td>
</tr>
<tr>
<td>Distance</td>
<td>-0.08</td>
<td>0.12</td>
<td>-0.05</td>
</tr>
<tr>
<td>Timeliness</td>
<td>-0.11</td>
<td>0.11</td>
<td>-0.07</td>
</tr>
<tr>
<td>Configuration</td>
<td>0.19</td>
<td>0.11</td>
<td>0.12</td>
</tr>
<tr>
<td><strong>Task Variables</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>0.08</td>
<td>0.11</td>
<td>0.05</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>0.26</td>
<td>0.10</td>
<td>0.17*</td>
</tr>
<tr>
<td>Analyzability</td>
<td>0.05</td>
<td>0.10</td>
<td>0.03</td>
</tr>
<tr>
<td>Communication</td>
<td>-0.18</td>
<td>0.11</td>
<td>-0.12*</td>
</tr>
<tr>
<td>Predictability</td>
<td>0.04</td>
<td>0.11</td>
<td>0.02</td>
</tr>
<tr>
<td>Interdependence</td>
<td>0.3</td>
<td>0.09</td>
<td>0.22*</td>
</tr>
</tbody>
</table>

Note: R²=.13 for all channel variables; R²=.12 for task variables.

*p<.05.
an alpha of .05 is acceptable because this will result in constructs showing a high reliability coefficients. Also Hair, Anderson, Tatham, and Black (1998): and Hinkle Wiersma and Jurs (1998) suggested that alpha levels of .01 and .05 are good conservative guideline that can be used to measure the level of significance in any research. This study used an alpha level of .05. This is consistent with prior exploratory study on EDI adoption and usage in other industries by: Droge and Germain (2001); Williams, Magee, and Suziki (1998); and Williams (1994). However, Lievens and Moenaert (2000) recommend in their exploratory study the use of alpha level significance of .10, because they had limited sample size and this would minimize Type II errors. This study had adequate sample size, but because it was exploratory the constructs were tested at alpha .10. There was no significant difference in the compare with the alpha level of .05. Therefore, all the results were reported at the alpha level of .05.

Chapter Summary

The data analysis results were presented in this chapter. The descriptive statistics and multivariate assumptions test were discussed. Then analysis of the research model in relationship to the multivariate assumptions reveals no significant violations.

Regression analysis was run for each of three usage factors (purchasing, financing and strategic). The analysis supports the following hypothesis: a) EDI purchasing and financing usage is positively associated with property size, b) trading status in positively associated with purchasing use, c) business presence/feedback and quality is positively associated with strategic use, d) uncertainty is positively associated with purchasing and strategic use, e) analyzability is positively associated with strategic use, and f)
interdependence is positively associated with purchasing and strategic use. In the next chapter a summary of table of hypotheses is presented and the interpretation of the results are addressed.
CHAPTER 5

SUMMARY & CONCLUSION

Introduction

This chapter presents summaries and discussions of findings of the research and reviews the implications that evolve from the findings. In the first section of this chapter a summary of the study and discussion of specific results of hypotheses tested in the previous chapter are presented. Next are some general implications that may be derived from the study. Finally the limitations of the study are presented, followed by suggestions for future research and conclusions.

This dissertation presents a theoretical framework for evaluating hotel EDI business applications. From the theoretical framework a research model that links EDI adoption with its usages in the areas of purchasing, accounting, financing, and strategic areas was developed. The model suggests that hotels could adopt EDI and used it for four basic business functions (purchasing, accounting, financing, and strategic usages). The model suggests that profile variables, channel variables, and task variables all have direct impact on EDI adoption, which in turn affects the type of usage that a hotel will undertake.

The hypotheses that were developed and tested in this study are based on data collected from hotel controllers, purchasing managers, and management information systems managers. These hypotheses were tested using multiple regression analysis. The
study was also examined for reliability, and validity considerations that are generally applicable to a survey type research.

Discussion of Results

The primary goal of this study was to address a basic research question. Are there any significant descriptive variables that might explain why some hotels used EDI? What are some of the areas where hotels might employ the use of EDI? A rich repertoire of variables grounded in past work was used to hypothesize relationships between the different categories of usage. A summary of empirical results is presented in Table 15.

The study provides insight into the growing use of EDI. It establishes the three classes of usage as purchasing, financing, and strategic. All significant relationships in Table 15 are in the hypothesized direction.

Three overall multiple regressions were also run using variables from all predictor groups as independent variables onto each of purchasing, financing, and strategic use as dependent variables. In almost all cases the same variables entered the model from each group. The top four predictors of purchasing use are property size, trading status, uncertainty, and interdependence, respectively. The only variance in financing use is explained by property size. Strategic use is strongly related to uncertainty, analyzability and interdependence. The discussions below focus on the three empirically-derived usage types.
Table 15

Summary of Hypothesized Relationships between the Established Three Categories of Usage. All Significant Relationships are in the Hypothesized Direction.

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Purchasing Usage</th>
<th>Financing Usage</th>
<th>Strategic Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profile Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affiliation</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Property Size (Rooms)</td>
<td>*</td>
<td>*</td>
<td>n/s</td>
</tr>
<tr>
<td>Trading Status</td>
<td>*</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Channel Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rediness</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Accessible</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Business Presence</td>
<td>n/s</td>
<td>n/s</td>
<td>*</td>
</tr>
<tr>
<td>Quality</td>
<td>n/s</td>
<td>n/s</td>
<td>*</td>
</tr>
<tr>
<td>Economic</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Distance</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Timeliness</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Configuration</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Task Variables</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complexity</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Uncertainty</td>
<td>*</td>
<td>n/s</td>
<td>*</td>
</tr>
<tr>
<td>Analyzability</td>
<td>n/s</td>
<td>n/s</td>
<td>*</td>
</tr>
<tr>
<td>Communication</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Predictability</td>
<td>n/s</td>
<td>n/s</td>
<td>n/s</td>
</tr>
<tr>
<td>Interdependence</td>
<td>*</td>
<td>n/s</td>
<td>*</td>
</tr>
</tbody>
</table>

Note: n/s is not significant; and * is significant.
*p<.05.
Strategic Use

Strategic usage reflects an environmental scanning function in which users make information requests to a community of EDI users. Many of these requests are directed at trading partners and banks that are known to the hotel. The use of EDI in a strategic way was significantly greater than the other two usage categories. This application of EDI represents a unique usage type that may not be conveniently duplicated through alternative media such as the telephone or the Internet.

It was found that business presence feedback, accessibility, and quality also predicted strategic use. In this way, formal and important links were being made between people from different organizations that may not have otherwise shared information. In the intraorganizational context, Feldman (1987) termed these spontaneous and structured network connections as new organizational “weak ties.” The finding that EDI is being used to provide supplemental information to assist in problem solving supports Huber’s (1990) proposition that computer-assisted communication technologies lead to a larger number and variety of people being used as information sources in decision making.

Task uncertainty was found to be related to strategic use. This is consistent with past research on information scanning behaviors (Draft & Lengel, 1986). Fahey and King (1977) stated that individuals faced with uncertainty often use a passive search strategy based on the chance of encountering the right people and appropriate information. Interorganizational networks now allow people with common interest from different organizations to find each other at a relatively low cost to either party. The finding that task interdependence is related to strategic use might explain the behavior of boundary-
spanning members of interdependent work groups who gather and share information to satisfy organizational needs.

**Purchasing-Related Use.**

Purchasing usage of EDI reflects communication dedicated toward accomplishing group work such as disseminating information, obtaining feedback, problem solving, and coordination. These interorganizational "networking" mechanisms involving lateral communication typically center on teams, task forces, and formal interactions. Similar to the findings of Eveland and Bikson (1987) on intraorganizational email use, users seem to interact around projects on which they work together and such group tasks tend to break down barriers to communication.

The focus of EDI use seems to be on getting the job done in the most cost-effective manner, using EDI's capabilities to better manage the timing of communication between hotels and their trading partners. In this vein, cost effectiveness (the extent that EDI is perceived to be an effective cost/benefit decision) was not a significant predictor of purchasing use. Also timing (the perceived ability to better manage one's time by overcoming temporal barriers) and configuration (the perceived ability to support many communication relationships) were both insignificant predictors of purchase use.

As was the case with strategic use, environmental uncertainty and task interdependence were significant predictors of purchase use. This result suggests the breadth of lateral interorganizational project information distribution and coordination.

Task predictability and analyzability did not predict purchase use of EDI. One explanation of this finding may be that EDI is of value to all workers regardless of the
level of task predictability and analyzability. For example, purchasing manager and controller may use EDI extensively for sending routine administrative memos or requests to suppliers, while MIS manager may use it equally extensively to conduct intricate program analysis. An additional explanation may be found in Social Influence Theory (Fulk & Boyd, 1991; Fulk, Schmitz, & Steinfield, 1990). This theory would suggest that the highly educated and technically oriented sample perceives channel attributes (such as richness of the media) based on business norms as opposed to rational construction. In this way business influence within these environments pushes for interorganizational computer-mediated communication regardless of task types.

Financing-Related Use.

EDI can be used as a business mechanism to participate in interesting financial decision making by hotels, VP finance/controller and financial analyst. It can be used with traditional databases that contain the latest financial status and reflect trends in market dynamics. Cash inflows and outflows can be handled in an electronic manner that is conducive to hotel operations, trading partners and banks.

All the channel and task variables relating to finance were not significant. This could be interpreted to mean that hotels were not using EDI for cash flow analysis, capital investment decision and financial ratios or that hotels were not realizing the full potential of using EDI in a financing manner.

This study did not examine the relationship between varying management levels or types of decision-making and purchase use of EDI. Because there is prior evidence that the information requirements of managers tend to differ depending on level of
management and decision-making activity, it follows that their usage and perceptions of EDI would be similarly affected. The use of EDI by varying levels of managers and under differing management decision-making contexts is an important topic for future research.

Finally, this study did not explore the frequency of use of EDI compared to other communication options available to the respondents. A significant research inquiry could be made concerning the media selection decision to use EDI. The relationship between the use of other interorganizational media (e.g., fax, telephone, video conferencing, face-to-face) and the independent variables in this study can be investigated by controlling the media type available for interorganizational communication. Of particular interest would be an exploration of the newer Internet developments such as hypertext-based World Wide Web pages, which offer alternate forms of communication and extensible machine language (XML).

Internal and External Validity

This study was non-experimental in nature, and no active manipulation of the variables was involved. This aspect opens the problems of internal and external validity.

Internal Validity

This study was subject to several concerns of internal validity. These included testing, history, maturation, mortality, instrumentation, and selection.

Testing

Rating scales are reactive measures because they may change the event that the researcher may attempt to measure. They may focus the attention on the events being
observed. As the attention is uncontrolled, it may serve as a rival hypothesis or explanation for any significant difference.

**History**

The historic rate of growth in the use of EDI within the hotel industry is unknown at this time. Therefore it is not possible to determine if the use of EDI is growing because of changes in the hotel organizations or whether the organizations are changing because of the growth of EDI. This study did not test for causation.

**Maturation**

Hotels surveyed in this study have used EDI for different periods. This opened the research to the threat of maturation as firms may have different levels of experience.

**Mortality**

Similarly, this research did not control for mortality. Only hotels currently using EDI were surveyed. Hotels, that have spent the required time, money, and effort to use EDI and then decided to give it up, may have decidedly different views of the value of EDI. This threat may be minimal, however, because most of the hotels used EDI at the instigation of their trading partners.

**Instrumentation**

Instrumentation, a normal threat to surveys, was minimized through the use of pilot testing. Further, the respondents answered identical queries for EDI and non-EDI use. Any respondent’s misunderstanding of a question should be offset by the same degree for both the EDI and Non-EDI sections. Thus, instrumentation should not be a major threat to this report.

**Selection**

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Not all hotels surveyed currently used EDI. It is not known if the target population matched the universal population. However, the selection of the largest 1000 hotels to determine their usage of EDI is consistent with prior studies that investigate EDI usages in other industries.

**External Validity**

External validity issues can be described as population and ecological issues. These are discussed in the following sections.

**Population**

Population validity is the extent to which the research sample can be generalized to the target population (Neale and Liebert, 1986). The threats to population validity are cost-restricted sampling, and self-selection and volunteer bias. In this study, the large size of the target sample diminishes the threats of cost-restricted sampling. Twelve hundred and fifty surveys were mailed across the U.S.

Self-selection and volunteer bias are relevant threats to population validity in this study. There may be built in bias based on the roster lists used. The managers of the largest hotels may be more knowledgeable about EDI usage because they have more resources and opportunities to be exposed to EDI concepts. This exposure may be accomplished through membership in professional organizations and attending professional conferences at the company’s expense. In summary, this research will not be generalizing its finding beyond the sample investigated in this study. In other words, no effort is made to generalize the findings to the whole population, thereby negating population validity as a threat.
Ecology

The concern with ecological validity is to what extent the findings can be generalized from one context to another, such as place and time (Neale and Liebert, 1986). The threats to ecological validity suggested by Neale and Liebert (1986) are: regional differences, interaction of treatment by setting, temporal effects, interference effects, unique contexts, and experimenter effects.

This study was a one-time data collection and because of the context of the study, the threats of interaction of treatment by setting, interference effects, unique contexts and experimental effects to ecological validity are not relevant. The threats of temporal effects can occur from economic circumstances in the year selected for the data gathering. Because perceived usage was measured relative to other hotels in the industry, temporal effects are not considered a potential threat to ecological validity.

Support for the Research

Although this dissertation contained some limitations, it also had some strong points that were explained throughout the dissertation in describing how the study was planned and conducted. Strong support for this dissertation comes from the theory, and methodology are discussed here for emphasis.

Theory

In general, good methodology starts with good theory. In Chapter 2, the theoretical framework for the study was outlined. This study evaluated six different theories that support the adoption and usage of EDI. Analysis of theories selected was summarized in
Table 1. The purpose for using these theories was to improve external validity of the study.

The purpose of the study was clearly identified. The purpose led to specific research questions and the resulting statistical hypotheses and techniques. The independent variables were derived from profile, channel, and task concepts, while the dependent variables came from the usage of EDI in the areas of purchasing, accounting, financing, and strategy.

Methodology

The methodology was explained in Chapter 3. All constructs were defined in Chapter 1 and operationalized in Chapter 3. The resulting variables were linked to specific questions of the instrument.

Kerlinger (1986) discussed ways to increase the control of variables, including choosing independent variables as homogenous as possible and matching subjects. Leenders and Fearon (1993) differentiated industrial distribution firms from the consumer market. Only industrial distribution firms were used in this study increasing the homogeneity of the independent variable. This study matched subjects with themselves. Indeed, as Kerlinger (1986, p. 289) stated “How much better on all possible variables than by matching a subject with himself?”

The rating instrument used was developed and summarized in Table 7. A scale from 1-7 was used to provide adequate dispersion. The resulting instrument was pilot tested with two groups. One group was academics and professionals, and the second group included managers similar to the population. Reliability coefficients for each variable were calculated.
Podsakoff and Organ (1986) discussed methods to minimize the self-reporting of data, including escalating the unit of analysis and reordering the scale. This study asked key individuals to rate their hotel's adoption and usage of EDI. The unit of analysis was escalated from the individual hotels to three managers from each hotel resulting in 1250 mailed out questionnaires and 287 usable responses. A response rate of 23.92 was obtained. This was greater than the usual 20-22 percent.

Limitations of the Research

The study is a modest effort understanding the consequences of EDI use in the hotel industry. It does have a number of shortcomings that are discussed in this section. The research model and the directionality of effects are derived from the literature. However, the revisions that were required, clearly point to the need for further testing and refinement of the model using different data sets. Moreover, the $R^2$ values for some of the variables in the model are quite low. This is an indication that the model is far from being fully specified. There obviously are other variables that have to be incorporated and evaluated to better understand the adoption of EDI and its possible consequences on interorganizational usage.

The results suggest that EDI use is still very much in the embryonic stage in most hotels. While the majority of the respondents appear to have adopted EDI to process purchase order transactions, the technology's potential for facilitating other interorganizational transactions is yet to be exploited. With further diffusion of EDI applications in the future, stronger support could possibly be found for some of the hypothesized relations in the research model.
This study examines the usage of EDI with profile, channel, and task variables. The results of EDI usage variables were low, suggesting that EDI was not intensively used at the time of the data collection. The results suggested an embryonic state of EDI adoption, and possibly a highly fluid situation with respect to EDI usage impacts. While there were significant findings in the areas of strategic usage of EDI, it may be that performance outcomes are fully realized only after EDI adoption creates greater levels of integration. Also, this study uses a cross-sectional design that leaves open the possibility for lagged effects between adoption and usage of EDI.

Other limitations associated with this study are the possibility that omitted variable biases could have influenced the results. Also the questionnaire did not specifically asked the respondents on the hard copy to state their position when they fill out the questionnaire.

Finally, the sample for the study was confined to large hotels in the U.S. that may or may not be using EDI. The use of EDI is not limited to the hotels. Its use is prevalent in many other industries including transportation, chemical, automotive and health-care. Further, EDI is an international phenomenon and is used extensively in Western European and Far Eastern countries. As a global technology, EDI not only spans multiple organizations but also multiple countries. The dynamics involved in EDI use across national boundaries poses interesting questions and could be the focus of future studies.
Future Studies

This study focused on the use of EDI between hotels and their trading partners. Future research can be expanded in several ways. First approach would be to compare hotels that are not yet using EDI to others in the industry that are using EDI. This alternate approach, used by Chatfield and Yetton (2001) and most other studies in the past, contrasts with this research, which compared firms who used EDI with two classes of trading partners.

Secondly, it can be hypothesized than hotels with extensive breadth of EDI use will have closer relationships with their trading partners than hotels minimally implementing EDI with their trading partners.

Thirdly, future inquiry could be the issue of integration and how using EDI for internal business processes assists in the creation of value-added services to hotels customers. Fourthly, an investigation of the effect of the Internet on the diffusion of EDI technology among small, medium, and large hotels could be done.

Fifth, future research could be done in the areas of telecommunications services used with EDI. Researchers could investigate those services from telecommunications technology perspective in conjunction with information systems supports and examination of the extent to which the Internet and XML could affect the usage of EDI.

Finally researchers could also explore on a longitudinal basis the impact of EDI on internal work practices and structure. for example, research questions such as how EDI has changed the purchasing and financial process, and whether the EDI investment was directly or indirectly associated with the benefits from these modifications.
Conclusion

Global competition placed extreme pressure on all companies including hotel to find more innovative ways for conducting business. In the area of managing interorganizational relations, EDI is promoted as a major breakthrough for achieving significant improvements in efficiency and effectiveness. Many researchers have predicted that EDI will eventually replace the traditional paper base system. Researchers and practitioner are constantly reminding companies of the consequences of not adopting EDI technology. They insisted that EDI is not just a technology, it also have administrative capabilities.

EDI can bring significant amount of benefits to an organization. There are competitive advantage and strategic benefits associated with EDI use that have been substantiated by some well-publicized studies conducted among larger and small companies. This study is a step toward assessing one of the popular benefits attributed to EDI use, namely in the areas of purchasing, financing, and strategic.

This dissertation provides a theory-driven model to explain the connection between EDI adoption and use. Empirical data about EDI adoption and use were collected from hotels. The data analysis provided partial support for the model and suggested possible modifications. It is hoped that the inclusion of relevant literature from the various disciplines such as finance, accounting, management information systems, economics, and marketing, and the empirical findings are a contribution to the growing knowledge on the use of EDI and its consequences.

EDI is one of the many ways hotels may exchange information. This study shows that EDI can be use by hotels for purchasing, financing and strategic purposes. For hotels
to improve their internal usages of EDI two conditions must be accomplish. First, hotels must improve the information flow between their trading partners. Second, the information flow must be sufficient to stimulate intraorganizational usages.

It is anticipated that the role of EDI in hotels will continue to grow in the future. Presently EDI in hotels are more confine to purchasing (purchase or purchase order processing), and strategic use (long-term procurement contracts and linkages to electronic funds). In the future, EDI could become an important tool for hotels to use in conducting business in both an interorganizational and intraorganizational way.
APPENDIX A

SURVEY INSTRUMENT HARD COPY
A Study of Electronic Data Interchange (EDI) Adoption and Diffusion in the Hotel Industry

The purpose of this study is to investigate some of the issues of adoption and diffusion of Electronic Data interchange (EDI) in the hotel industry. Your cooperation is vital. Please answer all the questions as best you can. Your answers are completely confidential. Thank you for your help.

EDI can be used for internal and external communication of information within and between organizations through the use of computers for business transaction such as purchase orders, invoices, payments, and wire transfer of cash in a pre-established, structured format.

There are four major groups of EDI applications that can be used in a hotel operation.

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<td>Banks processed Hotel's trade data</td>
</tr>
</tbody>
</table>

1. Please indicate which if any, of the following EDI application(s) currently use:

☐ TDI  ☐ FEDI  ☐ EFT  ☐ VAB  ☐ NONE

If you check NONE please go to the last page and answer Sections 5 and 6, then kindly mail in the survey.

If your hotel is currently using EDI application(s) please continue to answer ALL the remaining questions through SECTION 5.

Section 1: Communication Channel Attributes Related to EDI Adoption

The following are communication channel characteristics that may or may not impact your decision to use EDI. Please indicate the effect of each on EDI usage.
<table>
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<tr>
<th>Ease of Use of EDI</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Easy to use</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>2. Easy to learn</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>3. Flexible to operate</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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</tbody>
</table>

<table>
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<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Useful</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>5. Effective</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>6. Productive</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
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<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Convenient</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>8. Dependable</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>9. Accessible with trading partners</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>10. Accessible using existing computer system</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>11. Accessible via the Internet</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Presence of EDI</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Structured data</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>13. Coordinate information</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>14. Impersonal communication</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>15. Keep information confidential</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback from EDI</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Customizable response</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>17. Spontaneous reply</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>18. Automatic exchange of information</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quality of EDI usage</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>19. Clear communication</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>20. Reliable information</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>21. Accurate information</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Economic Awareness of EDI usage</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. Reduce time in processing documents</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>23. Reduce inventory cost</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>24. Reduce transaction cost</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dispersed Physical Locations</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>25. Effective way to communicate</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Timing of Communication</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>26. Provides continuous communication</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Many-to-Many Communication</th>
<th>No Effect</th>
<th>Strong Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>27. Allows trading with many firms</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

**Section 2: Perceived Task Variables Related to EDI Adoption**

Please indicate the extent to which the following factors affect your monthly work time.
1. **Complexity**: how often you have to redesign, and modify existing procedures.  
   1 2 3 4 5 6 7
2. **Task uncertainty**: how often the information needed for your job changes.  
   1 2 3 4 5 6 7
3. **Outside communication**: how often you conduct hotel business with other firms.  
   1 2 3 4 5 6 7
4. **Analyzability**: how often you rely on established procedures to do your major task.  
   1 2 3 4 5 6 7
5. **Predictability**: how often your tasks vary from day to day.  
   1 2 3 4 5 6 7
6. **Independence**: how often your job requires input from someone else’s work.  
   1 2 3 4 5 6 7

**Section 3: Perceived Extent of EDI Usage Factors**

The following is a listing of possible uses of EDI. Please indicate the extent to which you use EDI by checking the appropriate number.

**a. Please indicate your purchasing usage**

1. Request for Quote  
   1 2 3 4 5 6 7
2. Purchase Order (PO)  
   1 2 3 4 5 6 7
3. PO acknowledgement  
   1 2 3 4 5 6 7
4. Receiving verification  
   1 2 3 4 5 6 7

**b. Please indicate your accounting usage**

5. Invoice Statement  
   1 2 3 4 5 6 7
6. Payment Remittance Advice  
   1 2 3 4 5 6 7
7. Accounts Receivables  
   1 2 3 4 5 6 7
8. Accounts Payables  
   1 2 3 4 5 6 7
9. Financial Statement Preparations  
   1 2 3 4 5 6 7

**c. Please indicate your financing usage**

10. Cash Management  
    1 2 3 4 5 6 7
11. Capital Investment Decisions  
    1 2 3 4 5 6 7
12. Cash Flow Analysis  
    1 2 3 4 5 6 7
13. Cash Transaction Management  
    1 2 3 4 5 6 7
14. Access to Bank Balances  
    1 2 3 4 5 6 7

**d. Please indicate your strategic usage**

15. Long-Term Procurement Contract  
    1 2 3 4 5 6 7
16. Reduce the Number of Suppliers  
    1 2 3 4 5 6 7
17. Just-in-Time Shipment  
    1 2 3 4 5 6 7
18. Better Control Over Inventory  
    1 2 3 4 5 6 7
19. Linkage to Electronic Funds  
    1 2 3 4 5 6 7

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Section 4: Other Information Affecting EDI Usage
1. EDI was initiated by: □ Your hotel □ Vendors □ Other __________
2. Please indicate the individual in the hotel who championed EDI development.
   □ President □ GM □ CFO □ Analyst
   □ MIS Director □ Purchasing Director □ Other ___________________
3. Please check the DURATION of time (years) since your hotel first adopted EDI
   □ □ Under 1 □ 1-2 □ 3-4 □ 5-6 □ 7-8 □ 9-10 □ Over 10

Section 5: Information About Your Hotel
1. Please indicate your hotel ownership affiliation.
   □ Chain □ Independent □ Management Company
   □ Other
2. Are you publicly traded □ Yes □ No
3. Are you a branch/division of a large company □ Yes □ No
4. Please indicate if your hotel has a casino operation. □ Yes □ No
5. Please indicate if your hotel has full service restaurant(s). □ Yes □ No
6. Please check the number of rooms in your hotel
   a. □ Under 500
   b. □ 500-999
   c. □ 1000-1499
   d. □ 1500-1999
   e. □ 2000-2499
   f. □ Over 2500

Section 6: For Non-user of EDI Please Answer the Following Questions
1. Please indicate if your hotel Received information Electronically
   On one system and re-key them into another system. □ Yes □ No
2. Please indicate if your hotel would consider using EDI. □ Yes □ No
3. Is your hotel currently using Global Exchange Services (GXS)? □ Yes □ No
4. Please indicate if your hotel is planning to use (GXS) □ Yes □ No
5. Is your hotel currently using the Internet to conduct business? □ Yes □ No
6. Please check if your hotel is planning to use the Internet for business □ Yes □ No

Thank you for taking the time to complete this survey. Your input is extremely important and greatly appreciated.
APPENDIX B

SURVEY INSTRUMENT PLACED ON WORLD WIDE WEB
The purpose of this study is to investigate some of the issues of adoption and diffusion of Electronic Data interchange (EDI) in the hotel industry. Your cooperation is vital. Please answer all the questions as best you can. Your answers are completely confidential. Thank you for your help.

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1. Please indicate which if any, of the following EDI application(s) currently use:
   - TDI
   - FEDI
   - EFT
   - VAB
   - NONE

http://www.unlv.edu/faculty/ramdeen/EDIsurvey
If you check NONE please go to the last page and answer Sections 5, 6 and 7; then kindly submit the survey.
If your hotel is currently using EDI application(s) please continue to answer ALL the remaining questions through SECTION 6.

Section 1: Communication Channel Attributes Related to EDI Adoption
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</tr>
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<td>18. Automatic exchange of information</td>
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http://www.unlv.edu/faculty/ramdeen/EDIsurvey
Quality of EDI usage
19. Clear communication
20. Reliable information
21. Accurate information

Economic Awareness of EDI usage
22. Reduce time in processing documents
23. Reduce inventory cost
24. Reduce transaction cost

Dispersed Physical Locations
25. Effective way to communicate

Timing of Communication
26. Provides continuous communication

Many-to-Many Communication
27. Allows trading with many firms

Section 2: Perceived Task Variables Related to EDI Adoption
Please indicate the extent to which the following factors affect your monthly work time.

1. Complexity: how often you have to redesign, and modify existing procedures
2. Task uncertainty: how often the information needed for your job changes
3. Outside communication: how often you conduct hotel business with other firms
4. Analyzability: how often you rely on established procedures to do your major task

http://www.unlv.edu/faculty/ramdeen/EDI survey

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Section 3: Perceived Extent of EDI Usage Factors
The following is a listing of possible uses of EDI. Please indicate the extent to which you use EDI by checking the appropriate number.

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<td><strong>a. Please indicate your purchasing usage</strong></td>
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<td>1. Request for Quote</td>
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<td>2. Purchase Order (PO)</td>
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<td>3. PO acknowledgement</td>
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<td>4. Receiving verification</td>
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<td><strong>b. Please indicate your accounting usage</strong></td>
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<td>5. Invoice Statement</td>
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<td>6. Payment Remittance Advice</td>
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<td>7. Accounts Receivables</td>
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<td>8. Accounts Payables</td>
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<td>9. Financial Statement Preparations</td>
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<td><strong>c. Please indicate your financing usage</strong></td>
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<td>10. Cash Management</td>
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<td>11. Capital Investment Decisions</td>
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<td>12. Cash Flow Analysis</td>
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<td>13. Cash Transaction Management</td>
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<td>14. Access to Bank Balances</td>
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<td><strong>d. Please indicate your strategic usage</strong></td>
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<td>15. Long-Term Procurement Contract</td>
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<td>16. Reduce the Number of Suppliers</td>
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<td>17. Just-in-Time Shipment</td>
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<td>18. Better Control Over Inventory</td>
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<td>19. Linkage to Electronic Funds</td>
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Section 4: Other Information Affecting EDI Usage

http://www.unlv.edu/faculty/ramdeen/EDI_survey
1. EDI was initiated by:  
   - Your hotel  
   - Vendors  
   - Other

2. Please indicate the individual in the hotel who championed EDI development.  
   - President  
   - GM  
   - CFO  
   - Analyst  
   - MIS Director  
   - Purchasing Director  
   - Other

3. Please check the DURATION of time (years) since your hotel first adopted EDI  
   - Under 1  
   - 1-2  
   - 3-4  
   - 5-6  
   - 7-8  
   - 9-10  
   - Over 10

Section 5: Information About Your Hotel
1. Please indicate your hotel ownership affiliation.  
   - Chain  
   - Independent  
   - Management Company  
   - Other

2. Are you publicly traded  
   - Yes  
   - No

3. Are you a branch/division of a large company  
   - Yes  
   - No

4. Please indicate if your hotel has a casino operation  
   - Yes  
   - No

5. Please indicate if your hotel has full service restaurant(s)  
   - Yes  
   - No

6. Please check the number of rooms in your hotel  
   a. Under 500  
   b. 500-999  
   c. 1000-1499  
   d. 1500-1999  
   e. 2000-2499  
   f. Over 2500

Section 6: Information Regarding Your Position

Please indicate your position in hotel:  
   - CFO/Controller  
   - MIS Director  
   - Purchasing Director  
   - Other

Section 7: For Non-user of EDI Please Answer the Following Questions

http://www.unlv.edu/faculty/ramdeen/EDIsurvey

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1. Please indicate if your hotel Received information Electronically on one system and re-key them into another system. 
   C Yes  C No

2. Please indicate if your hotel would consider using EDI. 
   C Yes  C No

3. Is your hotel currently using Global Exchange Services (GXS)? 
   C Yes  C No

4. Please indicate if your hotel is planning to use (GXS) 
   C Yes  C No

5. Is your hotel currently using the Internet to conduct business? 
   C Yes  C No

6. Please check if your hotel is planning to use the Internet for business 
   C Yes  C No

Thank you for taking the time to complete this survey. Your input is extremely important and greatly appreciated.

http://www.unlv.edu/faculty/ramdeen/EDISurvey
APPENDIX C

FORMS OF COVER LETTER AND UNLV RESEARCH PROTOCOL
Dear Sir or Madam:

I am a faculty member in the Hotel College at the University of Nevada Las Vegas (UNLV). I am conducting a survey on the usage of Electronic Data Interchange (EDI) in the hotel industry.

The purpose of this survey is to gain a better understanding of the extent to which EDI is being used in the hotel industry. The results from this investigation could lead to the improvement of EDI utilization in the areas of accounting, purchasing, finance, and strategic management.

Please complete the attached questionnaire and mail it back to me in the self addressed post paid enclosed envelope, or you may go to my Web Site and fill out the questionnaire at: http://www.unlv.edu/faculty/ramdeen/EDIsurvey.htm

All the information you provide here will be held in strict confidence. When the results of this study are published, it will be impossible to identify specific individual or firms. so please respond by answering all the questions.

Should you have any questions, please call me at: (702) 895-4908 or e-mail me at cramdeen@ccmail.nevada.edu. If you would like to receive a summary of the results of this study, please enclose one of your business card along with your completed questionnaire in the self-addressed post-paid envelope.

Your time is valuable, however, the success of this study is highly dependent on your participation. Your prompt response will be greatly appreciated.

Thank you for your time and cooperation.

Sincerely,

Collin Ramdeen
Lecturer UNLV
First Follow-up Sent 1 Week After Original Mailing

Dear Sir or Madam:

Last week a questionnaire seeking your opinion on the usage of Electronic Data Interchange (EDI) was mailed to you. Your hotel was randomly selected from the American Hotel and Lodging Association (AHILA) largest 1000 hotels to participate in this study.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, please do so today. This questionnaire was sent to only a small, but representative, sample of AHILA largest 1000 hotels. It is extremely important that your completed questionnaire be included in the study if the results are to accurately represent the usage of EDI among the largest AHILA hotels.

If you did not receive the questionnaire, or it got misplaced, please go to my Web Site: http://www.edu/faculty/ramdeen/EDIsurvey.htm and fill out the questionnaire online and submit it. You can contact me by calling (702) 895-4908 or e-mail me at: cramdeen@ccmail.nevada.edu

Thank you for your assistance.

Sincerely,

Collin Ramdeen
Lecturer UNLV
Second Follow-up letter Sent 3 Weeks After original mailing

Dear Sir or Madam:

About three weeks ago I sent you a questionnaire regarding the usage of Electronic Data Interchange (EDI) at your hotel. As of today I have not yet received your completed questionnaire.

This study was undertaken because EDI usage could provide both technological and administrative assistance to your hotel in the areas of accounting, purchasing, finance, and strategic management currently and in the future.

I am writing to you again because of the significance each questionnaire has to the usefulness of this study. Your hotel was selected through a scientific sampling process in which every hotel in the American Hotel and Lodging Association (AHLA) largest 1000 hotels had an equal chance of being selected. This means that only one out of every 3 hotels in this listing is being asked to complete this questionnaire. In order for the results of this study to be truly representative of the opinions of the AHLA largest 1000 hotels it is essential that a representative from each hotel selected in the sample return the questionnaire.

In the event that your questionnaire has been misplaced, a replacement is enclosed. You also have the option of going to my Web Site at: http://www.unlv.edu/faculty/ramdeen/EDIsurvey.htm to fill out the questionnaire. If you have any questions you can call me at (702) 895-4908 or email me at: cramdeenn@ccmail.nevada.edu

Your cooperation is greatly appreciated.

Sincerely,

Collin Ramdeen
Lecturer UNLV
Third follow-up

Dear Sir or Madam:

I am writing to you about my study regarding the usage of Electronic Data Interchange (EDI). I have not yet received your competed questionnaire.

The large number of questionnaires returned is very encouraging. However, to accurately describe the adoption and usage of EDI in the hotel industry depends upon you and the others who have not yet responded. This is because prior research suggests that those of you who have not yet sent in your questionnaire may hold quite a different opinion regarding the adoption and usage of EDI.

This is the first national study of this type that has ever been done with respect to the hotel industry. Therefore, the results are of particular importance to you and other professionals in the hotel industry. The usefulness of these results depends on how accurately I am able to describe the adoption and usage of EDI.

It is for these reasons that I send you this follow-up letter by certified mail to insure delivery. In case my previous correspondence did not reach you, a replacement questionnaire is enclosed. You also have the option of filling out the questionnaire by going to my Web Site at: http://www.unlv/faculty/ramdeen/EDIsurvey.htm Could you please complete and return the questionnaire urgently.

I will be happy to send you a copy of the results if you would enclose your business card along with your completed questionnaire and mail it back in the self addressed post paid envelope. If you have any question please contact me by telephone at (702) 895-4908 or e-mail me at: cramdeen@ccmail.nevada.edu Once again your participation in this study is extremely important.

Your contribution to the success of this study will be greatly appreciated.

Sincerely,

Collin Ramdeen
Lecturer UNLV
Fourth follow-up for non-respondents

Dear Sir or Madam:

I am writing to you about my study regarding the usage of Electronic Data Interchange (EDI). I have not yet received your competed questionnaire.

The large number of questionnaires returned is very encouraging. However, to accurately describe the adoption and usage of EDI in the hotel industry depends upon you and the others who have not yet responded. This is because prior research suggests that those of you who have not yet sent in your questionnaire may hold quite a different opinion regarding the adoption and usage of EDI.

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It is for these reasons that I send you this follow-up letter by certified mail to insure delivery. In case my previous correspondence did not reach you, a replacement questionnaire is enclosed. You also have the option of filling out the questionnaire by going to my Web Site at: http://www.unlv/faculty/ramdeen/EDIsurvey.htm
Could you please complete and return the questionnaire urgently?

I will be happy to send you a copy of the results if you would enclose your business card along with your completed questionnaire and mail it back in the self addressed post paid envelope. If you have any questions please contact me by telephone at (702) 895-4908 or e-mail me at: cramdeen@ccmail.nevada.edu Once again your participation in this study is extremely important.

Your contribution to the success of this study will be greatly appreciated.

Sincerely,

Collin Ramdeen
Lecturer UNLV
Informed Consent for Respondents

My name is Collin Ramdeen. I am a lecturer at the University of Nevada, Las Vegas in the College of Hotel Administration. I am working on my dissertation under the direction of Professor Andy Feinstein in the College of Hotel Administration.

I am requesting your participation in a research project regarding Electronic Data Interchange (EDI) Adoption and Diffusion in the Hotel Industry. The purpose of the research is to investigate some variables that could impact the adoption and usage of EDI in the hotel industry. A four-page questionnaire will be used as the primary instrument for obtaining information from you regarding EDI. The expected length of time for filling out the questionnaire is approximately ten minutes.

Your participation will involve filling out a four-page questionnaire and then e-mail or mail it back using the self-addressed post paid envelope. The risks from this research are minimal.

Benefits from this research that may apply to you will be to provide broad guidance on significant descriptive variables that might explain why a hotel used EDI, and some of the areas that hotel might employ the use of EDI. By participating, you will also be adding to the general body of knowledge on this subject.

You will not be receiving compensation for your time spent filling out the questionnaire. Your participation is completely voluntary and your anonymity will be protected through the use of confidential coding of the information. All records will be retained for at least three years after completion of the study in a locked filing cabinet at UNLV.

For questions concerning this research study, you may contact me or my faculty advisor, Dr. Andy Feinstein, (702) 895-4908 and (702) 895-1795 respectively. If you have any questions regarding the rights of research subjects, please contact the UNLV Office for Protection of Research Subjects at (702) 895-2794.

Your participation is completely voluntary. You may elect not to fill out the questionnaire if for any reason you feel uncomfortable.

Thank you for your kind assistance.

Sincerely,

Collin Ramdeen
Lecturer UNLV
REFERENCES


Bairstow, J. (1987). EDI may force e-mail standards. PC Week, 3.


VITA
Graduate College
University of Nevada. Las Vegas

Collin D. Ramdeen

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Las Vegas, Nevada 89119

Degrees:
Bachelor of Science, Accounting, 1988
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Master of Science, Accounting, 1994
University of Miami

Special Honors and Awards:
Board of Regents University and Community College System of Nevada. Outstanding Student Award for 1998-1999.

Roosevelt Fitzgerald Outstanding Student Award for Outstanding Scholarship, Leadership and Service, 1999.

The University of Nevada Las Vegas Alliance of Professionals of African Heritage, Certificate for Outstanding Academic Achievement, 1999.

Membership in the ETA SIGMA DELTA International Hospitality Management Honor Society in 1999.


Publications:


Dissertation Title: An Empirical Investigation of the Adoption and Usage of Electronic Data Interchange in the Hotel Industry

Dissertation Examination Committee:
Chairperson, Dr. Andy Feinstein, Ph. D.
Committee Member, Dr. John T. Bowen, Ph. D.
Committee Member, Dr. Tony Lucas, Ph. D.
Graduate Faculty Representative, Dr. Michael J. Sullivan, Ph. D.