A STUDY OF INTERORGANIZATIONAL EDI ADOPTION

DISSERTATION

Presented in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy in the Graduate
School of the Ohio State University

By

Lisa Rochelle Williams, B.S.B., M.B.A., M.A.

* * * * *

The Ohio State University

1992

Dissertation Committee:

Dr. Bernard La Londe
Dr. W. Wayne Talarzyk
Dr. Martha Cooper
Dr. James Masters

Approved by:

Advisor
Graduate Program in
Business Administration
Copyright by
Lisa Rochelle Williams
1992
To my mother, Mary Moore.
ACKNOWLEDGEMENTS

First I want to acknowledge God for guiding me through the successful completion of my doctoral program and for surrounding me with supportive people. I am especially thinking of my dissertation chair, my committee, the College of Business staff, friends and family.

Professor Bernard J. La Londe, my dissertation chair, has offered both challenges and advice during my tenure as a doctoral student. His assistance has both facilitated the timely completion of the dissertation and enabled me to establish the beginnings of a research stream.

Professor Talarzyk’s assistance in the development and structure of the dissertation’s data analysis will never be forgotten. The time and energy he invested in this endeavor will always be appreciated. Professor Martha Cooper has been both a role model and a source of inspiration. Her constant willingness to discuss research theories and methodologies has helped to provide me with a wealth of research ideas.

Professor James Masters has been extremely helpful in data analysis and overall development of the dissertation. His tireless efforts, patience and advice have greatly contributed to the successful completion of the dissertation.

The College of Business Administration staff has been extremely helpful. I first want to thank and acknowledge Judith Reese for her recruitment
efforts and guidance through the graduate school maze of requirements.

I am also indebted to the staffs in marketing and logistics. Cindy Coykendale, Sally Eikleberry, and Barb Wooten have provided tremendous amounts of help and assistance to me. I also want to thank Jennifer Belcar and Amy Thoma for their help with Harvard Graphics.

No one has ever had more sincere and loyal friends than I. Phillip Lewis has been both a colleague and a true friend. His never-ending support, patience and humorous stories have lifted my spirits on many days.

I also want to thank Debbie Warfield for the hour-long motivational conversations and Sheila Bell for her data entry and typing efforts. I am also indebted to Eric Walton for being both a dear friend and providing me with positive thoughts.

Last, but by no means least, I want to thank and recognize the tireless support of my family. My mother, to whom this dissertation is dedicated, has been my friend, my advisor, my confidant and my biggest supporter. All that I am and all that I become I owe to my mother, Mary Moore.

I am not sure there are words that can express my indebtedness to my sister, Tamra. She has always been there for me with a kind word and a smile. Her willingness to drive hours to come to my rescue will never be forgotten.

I also want to thank the hundreds of business executives that took the time to either talk with me or complete questionnaires. Without their help and support this process would not have been possible.
VITA

February 11, 1964.............. Born - Toledo, Ohio

1985............................. B.S.B. in Management Science, Wright State University, Dayton, Ohio

1984-1987.......................... Market Analyst, Dayton, Power & Light, Dayton, Ohio

1987................................. Market Analyst, General Motors Dayton, Ohio

1987................................. M.B.A., Wright State University, Dayton, Ohio

1987-1988............................ Assistant Professor, Central State University, Wilberforce, Ohio

1988-1989............................. University Fellow, Ohio State University, Columbus, Ohio

1989-1991............................. Graduate Teaching Assistant, The Ohio State University, Columbus, Ohio

1992................................. M.A., The Ohio State University, College of Business, Columbus, Ohio
PUBLICATIONS


"Trends, Benefits and Challenges of Strategic Partnerships" American Marketing Association 1990 Winter Educators' Conference (With Martha Cooper, Lisa Ellram, Rosemary Kalapurakal)

FIELDS OF STUDY

Major Field: Business Administration

Studies in Logistics

Professors Bernard La Londe, Martha Cooper and James Masters

Minor Field: Marketing

Professors Robert Burnkrant and Peter Dickson


Table Of Contents

ACKNOWLEDGEMENTS. .............. iii

VITA. ........................... v

LIST OF TABLES. ................. x

LIST OF FIGURES ................. xiv

CHAPTER ........................ PAGE

I. OVERVIEW OF THE RESEARCH. .... 1

  Background ........................ 1
  Statement of The Research Problem. . 5
  Research Questions ................ 10
  Scope of the Research .............. 11
  Research Methodology .............. 12
  Respondent Sampling ................ 15
  Data Analysis ...................... 16
  Limitations of the Research ........ 17
  Contributions of the Research ...... 20
  Contribution to Theory ............. 20
  Contribution to Practice ........... 21
  Organization Of The Research ...... 24

II. LITERATURE REVIEW .............. 25

  Introduction ........................ 25
  Definitions of EDI .................. 26
  State of the Art EDI ............... 30
  Studying EDI From The Channel
    Perspective ........................ 35
  Distribution Channel Separation. ... 39
  Marketing Channel .................. 39

vii
Tests of Non-Response Bias ........ 138
Univariate Statistics of Variables 143
Cronbach Alpha .................... 143
Factor Analysis .................... 146
Regression Models ................ 163
Summary Of Hypotheses Testing ... 169
Differentiating EDI Usage .......... 172
Additional Findings ............... 173
Summary .......................... 193

V. SUMMARY AND IMPLICATIONS
FOR FUTURE RESEARCH ............ 194

Introduction ....................... 194
Summary of The Research .......... 195
Research Methodology .......... 198
Conclusions of Hypotheses Testing 202
Contributions To Theory and Practice 215
Implications For Future Research 218
Summary ......................... 220

APPENDICES

A. Interview Protocol ............ 221
B. Questionnaires ............... 226
C. Condensed Questionnaire ...... 250
D. Univariate Statistics .......... 253
E. Differentiating High and Low EDI
Users ............................ 300

BIBLIOGRAPHY ..................... 303
# LIST OF TABLES

<table>
<thead>
<tr>
<th>TABLE</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Major Sources of Constructs</td>
<td>62</td>
</tr>
<tr>
<td>2.</td>
<td>Internal Dimension Constructs and Operationalizations</td>
<td>95</td>
</tr>
<tr>
<td>3.</td>
<td>External Dimension Constructs and Operationalizations</td>
<td>93</td>
</tr>
<tr>
<td>4.</td>
<td>Interorganizational Dimension Construct and Operationalizations</td>
<td>94</td>
</tr>
<tr>
<td>5.</td>
<td>Questionnaire Items Addressing Organizational Size</td>
<td>102</td>
</tr>
<tr>
<td>6.</td>
<td>Questionnaire Items Addressing Organizational Structure</td>
<td>103</td>
</tr>
<tr>
<td>7.</td>
<td>Questionnaire Items Addressing Demand Uncertainty</td>
<td>104</td>
</tr>
<tr>
<td>8.</td>
<td>Questionnaire Items Addressing Industry Competitiveness</td>
<td>105</td>
</tr>
<tr>
<td>9.</td>
<td>Questionnaire Items Addressing Customer Channel Power</td>
<td>107</td>
</tr>
<tr>
<td>10.</td>
<td>Questionnaire Items Addressing Carrier Channel Power</td>
<td>108</td>
</tr>
<tr>
<td>11.</td>
<td>Questionnaire Items Addressing Shipper Channel Power</td>
<td>109</td>
</tr>
<tr>
<td>12.</td>
<td>Questionnaire Pretests</td>
<td>115</td>
</tr>
<tr>
<td>13.</td>
<td>Overview Of The Five Interviews</td>
<td>128</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>-----</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>14</td>
<td>Variables Influencing EDI Adoption As Identified Through Personal Interviews</td>
<td>130</td>
</tr>
<tr>
<td>15</td>
<td>Comparison of Respondent and Non-Respondent Groups</td>
<td>142</td>
</tr>
<tr>
<td>16</td>
<td>Reliability as Measured By Cronbach Alpha</td>
<td>145</td>
</tr>
<tr>
<td>17</td>
<td>Supplier Factor Analysis</td>
<td>148</td>
</tr>
<tr>
<td>18</td>
<td>Customer Factor Analysis</td>
<td>153</td>
</tr>
<tr>
<td>19</td>
<td>Shipper Factor Analysis</td>
<td>157</td>
</tr>
<tr>
<td>20</td>
<td>Carrier Factor Analysis</td>
<td>160</td>
</tr>
<tr>
<td>21</td>
<td>Summary of Research Hypotheses Testing</td>
<td>171</td>
</tr>
<tr>
<td>22</td>
<td>General Information About Customer EDI Adoption</td>
<td>175</td>
</tr>
<tr>
<td>23</td>
<td>General Information About Carrier EDI Adoption</td>
<td>176</td>
</tr>
<tr>
<td>24</td>
<td>General Information About Shipper/Supplier Adoption</td>
<td>177</td>
</tr>
<tr>
<td>25</td>
<td>Transmissions When Fully On-Line With EDI</td>
<td>179</td>
</tr>
<tr>
<td>26</td>
<td>Measures of Strategic Partnerships</td>
<td>185</td>
</tr>
<tr>
<td>27</td>
<td>Reasons Given For EDI Adoption</td>
<td>189</td>
</tr>
<tr>
<td>28</td>
<td>Practical Implications of EDI Adoption</td>
<td>192</td>
</tr>
<tr>
<td>29</td>
<td>Market Share Possession</td>
<td>254</td>
</tr>
</tbody>
</table>
30. Competitors Production Line . . . . . . . 254
31. Number of Employees . . . . . . . . . . 254
32. Firm’s Profitability. . . . . . . . . . . . . 255
33. Firm’s Sales Revenue. . . . . . . . . . . . 255
34. Senior Management Interference with Decision Making . . . . . . . . . . . . . . . . . . 255
35. Perceptions About Divisions Within firm . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 256
36. Centralized Decision Making . . . . . . . 256
37. Sales Volume. . . . . . . . . . . . . . . . . . 256
38. Decision Flow . . . . . . . . . . . . . . . . . 256
39. Changing Customer Base. . . . . . . . . . . . 257
40. Major Competitors . . . . . . . . . . . . . 257
41. Control Over Department’s Annual Budgets. . . . . . . . . . . . . . . . . . . . . . . . . . 258
42. Changes to Keep Up With Competitors . . 258
43. Industry Characterization of the Market . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 258
44. Industry Characterization of Competitors. . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 258
45. Length of Production Cycle . . . . . . . . . 258
46. EDI Champion. . . . . . . . . . . . . . . . . . 258
47. How Would You Describe The Market For Your Firm’s Products. . . . . . . . . . . . . . . . 260
48. Large Trading Partner’s Influence Over Credit Policy. . . . . . . . . . . . . . . . 261
49. Small Trading Partner’s Influence Over Credit Policy. . . . . . . . . . . . . . . . 261
50. Large Trading Partner’s Influence Over Inventory Procedure. . . . . . . . . . . . 261
51. Small Trading Partner’s Influence Over Inventory Procedure. . . . . . . . . . . . 261
52. Large Trading Partner’s Influence Over Customer Service Policy. . . . . . . . . . 262
53. Small Trading Partner’s Influence Over Customer Service Policy. . . . . . . . . . 262
54. Large Trading Partner’s Influence Over Service/Product Line Offering. . . . . . 262
55. Shipper’s Influence Over Carrier’s Rates . . . . . . . . . . . . . . . . . . . . . . . . . . . 263
56. Small Trading Partner’s Influence Over Service/Product Line Offering. . . . . . 263
57. Percentage of Interorganizational EDI Adoption. . . . . . . . . . . . . . . . . . . . . . 263
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>FIGURE</th>
<th>DESCRIPTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Framework of Interorganizational EDI Adoption</td>
<td>8</td>
</tr>
<tr>
<td>2.</td>
<td>Distribution Channel Separation</td>
<td>40</td>
</tr>
<tr>
<td>3.</td>
<td>Marketing And Logistical Channels</td>
<td>42</td>
</tr>
<tr>
<td>4.</td>
<td>Histogram of Percentage of EDI Adoption</td>
<td>144</td>
</tr>
<tr>
<td>5.</td>
<td>Histogram of Responses From Key Questions</td>
<td>264</td>
</tr>
</tbody>
</table>
CHAPTER I

OVERVIEW OF THE RESEARCH

Background

The Importance Of EDI In Channels

The effective coordination and maintenance of interorganizational exchange relationships in channels are of extreme importance to business practitioners (Frazier and Sheth 1985). The environment in which businesses operate has become extremely competitive. As a means of competing, organizations are becoming strategically focused. Exchanges of products, services, and information are occurring on a long-term basis instead of the short-term transactional type relationship of the past.

1
The current research investigated the adoption of Electronic Data Interchange (EDI) because it is often the glue that ties long term relationships together (Bowersox 1983). EDI is a communications technology that offers a variety of benefits to channels. By enabling fast and effective communications, it provides the means for efficient channel coordination (Stern and El-Ansary 1988). EDI allows managers to transmit information from one channel member’s computer system directly to another channel member’s computer system (Dearing 1990). Compared to traditional methods, such as mail and telephone, EDI provides a faster, more accurate, less costly method of communications. In addition, to encouraging the formation of long term relationships the benefits provided by EDI can manifest themselves in improved operating efficiencies and reduced transaction costs.
EDI is attracting widespread interest by both domestic and international businesses. As Margaret Emmelhainz notes in her 1990 book *Electronic Data Interchange: A Total Management Guide*:

"Electronic Data Interchange (EDI) is fast becoming the standard way of exchanging business documents, not only in this country but also in the rest of the world. EDI provides a faster, more accurate, less costly method of communications ... However, EDI is doing more than just changing how businesses communicate; it is changing the way businesses operate."

Similarly, Phyllis Sokol states in her 1989 book *EDI: The Competitive Edge*, that,

"By every indicator, EDI, ....is taking the business community by storm. ... Already, in some industries EDI has gained such widespread usage that it is becoming a prerequisite for doing business."

Paul Kimberley (1991) asserts that:

"EDI is the first universally visible catalyst for permanent change in the way intercompany and interpersonal business will develop. It [EDI] marks the beginning of a profound evolutionary change in business practices."
Based on the above descriptions, it is apparent that EDI is not only improving business operations but it is revolutionizing the way businesses communicate with one another. However, despite EDI's role in improving interorganizational communications there is no known empirical research directed towards understanding interorganizational EDI adoption within distribution channels. Because EDI adoption between the different channel types has not been investigated, prior research has not incorporated the effect unique differences in channel transactions and communication flows have on interorganizational adoption.

Two types of channels identified by Bowersox, Closs and Helfrich (1986) and Bowersox (1978) were investigated in the present study. The marketing channel, which focuses on negotiating long term relationships between buyers and sellers, was represented by sampling customers and suppliers in the channel. The logistical channel, which coordinates and manages the actual flow of products, was represented by
sampling the shippers and carriers in the channel. Additional rationale and support for studying interorganizational EDI from the channel perspective are found in Chapter II.

Statement of The Research Problem

EDI offers adopting channels several benefits. By enabling fast and effective communications, it provides the means for efficient channel coordination. EDI has also been cited as a means for reducing personnel, inventory levels and transaction costs (Kimberley 1990). According to a survey by Coopers and Lybrand (1989), EDI adoption resulted in an average cost savings of $1 million per year. However, despite its advantages, channels are not adopting EDI at projected rates.

In a survey by Robeson (1983) respondents predicted that EDI would be widespread well before 1995. Other researchers have projected the number of
EDI users to grow upwards towards 400,000 (Baker 1991). However, according to 1991 estimates EDI users only approximate 12,000 (Dreyer 1991). The present research investigated the characteristics of EDI adopting channels in an effort to provide insight into the variables that influence adoption.

The current research explored four separate but related issues about EDI adoption within the two channel types. The first issue explored EDI adoption within marketing channels. The purpose here was to develop a general understanding of the characteristics of marketing channels that adopt EDI.

The second issue explored the characteristics of EDI adopting logistical channels. It is expected that EDI will grow in logistical channels as carriers and shippers continue to transmit purchase orders and bills of lading electronically (La Londe, Masters, Maltz and Williams 1991). The goal here was to develop a broad understanding of the variables that characterize EDI adopting logistical channels.
The general purpose of the third issue was to test the ability of theoretical constructs to explain EDI adoption within both channel types. The constructs investigated in this study fell into one of three dimensions, internal, external or interorganizational (See Figure 1).

The internal dimension included organizational variables that prior research found significant in explaining technology adoption (Rogers 1986; 1989). The specific internal variables tested in the present study were organizational size and organizational structure.

The external/industry dimension included environmental variables that researchers (Robertson and Gatignon 1986) found significantly explained technology adoption. Channels do not operate in isolation, instead factors outside their control often influence the adoption decision. The specific external variables tested in the present research were industry competitiveness
Figure 1

Framework Of EDI Adoption Within Channels
and demand uncertainty.

The interorganizational dimension included channel power, which was defined as the influence one channel member has over the other. Therefore, channel power was tested for its ability to explain the variance in interorganizational EDI adoption.

The fourth issue augmented the results from hypotheses testing. It provided additional information about EDI adopting channels. In particular, other findings about the EDI adoption process, nature of EDI relationships, the reasons for adoption and practical implications of EDI adoption were presented.
Research Questions

The Framework of Interorganizational EDI Adoption provided input in addressing the following research questions:

1. What are the distinguishing characteristics of EDI-adopting marketing channels?

2. What are the distinguishing characteristics of EDI-adopting logistical channels?

3. Which internal, external and/or interorganizational variables influence EDI adoption among channel types?

INTERNAL

a. Does large organizational size characterize EDI-adopting channels?
b. Does centralized organizational structure characterize EDI-adopting channels?

EXTERNAL

a. Does high industry competitiveness characterize EDI-adopting channels?
b. Does high demand uncertainty characterize EDI-adopting channels?

INTERORGANIZATIONAL

a. Does unilateral channel power characterize EDI-adopting channels?
Scope of the Research

This research focused on the adoption of EDI across multiple industries. While it is commonly known that EDI is used in governmental agencies as well as private industries, this study was limited to several private industries. There is no representation of government agencies in this study.

Although EDI technology is used in international markets, this research only sampled EDI-adopting channels within the United States. Thus, the results may not be generalizable to international markets. In examining EDI, this research centered on transmissions at the interorganizational level only. While admittedly EDI can and often does begin as intraorganizational, this study was limited to investigating interorganizational EDI adoption.

The research limited the theoretical constructs explored to three dimensions and five variables. The variables were selected because researchers (Rogers 1962; 1983 and Robertson and Gatignon 1986;1989) found
them to explain technology adoption at the organizational level. The present study tests their ability to explain interorganizational technology adoption by extending the unit of analysis from the single organization to the channel.

The three basic classifications of variables to be investigated were internal, external and interorganizational (See Figure 1). The internal dimension included organizational size and organizational structure. The external dimension included two variables, industry competitiveness and demand uncertainty. The interorganizational dimension included the variable channel power.

**Research Methodology**

The research was conducted in two phases. The first phase of the research utilized both telephone and personal interviews. The interviews were conducted to gain an understanding of the decision making process not provided by the literature. In order to understand
the interorganizational EDI decision making process interviews were conducted with a purposive sample. Five interviews were conducted with organizations representing suppliers and customers in the marketing channel and shippers and carriers in the logistical channels. In addition consultants and EDI third party providers were interviewed to gain an independent and unbiased perspective of EDI adoption in both channel types. The interviews both confirmed the variables suggested in the literature and provided additional variables that were thought to influence to EDI adoption. Both sets of variables were included in phase two of the methodology.

In the second phase data was collected via a mail questionnaire. Selected sections of the Customer and Supplier Questionnaires were designed so that supplier responses could be directly compared with customer responses. Likewise sections of the Shipper and Carrier Questionnaires were constructed so that shipper and carrier responses could be directly compared.
The questionnaire consisted of a series of interval scales. Seven point semantic differential style scales with bipolar descriptors and 7 point Likert scales anchored with "strongly disagree" and "strongly agree" were used to gather data.

Each construct of interest—organizational size, organizational structure, industry competitiveness, demand uncertainty and channel power—was represented by variables. Each variable had multiple operational definitions that were used to test reliability and validity. Internal consistency, determined by Cronbach alpha, assessed reliability by the amount of inter-item correlations between the variable measures (Mueller 1986). Convergent and discriminant validity was determined through factor analysis. Exploratory factor analysis was used to determine if variables measuring the same construct would converge on one factor and discriminant from other factors measuring different constructs. Scale items with convergent and discriminant validity consisted of questionnaire items
that correlated more highly among themselves, convergent validity, than they correlated with other factors, discriminant validity (Rummel 1970).

**Respondent Sampling**

A purposive sample of five organizations was interviewed in phase I. Interviews were conducted with shipper, carrier, customer and supplier organizations. Consultants and third party EDI providers were also interviewed for their perspectives on interorganizational EDI adoption.

The customer, shipper and supplier sample for phase II represented a convenience and judgment sample taken from the membership list of the Council of Logistics Management (CLM). The carrier sample was obtained from both the CLM membership roster and the 1992 Second Annual Mason Symposium attendee list. After duplication of firms was eliminated by subjectively selecting the most appropriate title for the respondent, and after firms not classified as shippers,
carriers, suppliers or customers were deleted, the questionnaires were mailed to the remaining members.

Two tests for non-response bias were conducted. The first test compared early responses to late responses on a key EDI adoption question. The second test, however, included contacting non-respondents. The test then compared responses from the non-respondents to those from questionnaire respondents on eight key questions.

Data Analysis

Several data analyses techniques were performed on the data. First, univariate statistics, specifically frequency counts and mean analysis, was performed on variables in the study. The data was then analyzed using Cronbach’s alpha to assess internal consistency and reliability. Items with reasonable Cronbach alphas were an indication that the items were consistent and reliable in measuring the research variables. Third, the reliable measures were further analyzed using
principal component factor analysis to determine the
number of factors present in the data. To interpret
the factors, test for validity and calculate composite
factor scores, factor analysis with varimax rotation
was performed. Variables that demonstrated reasonable
reliability and validity were used to develop
regression models. The regression models were used to
test the research hypotheses. In addition, cross
tabulations on high versus low users of EDI was
performed to determine which variables, if any,
differentiate users of EDI from low users of EDI.

Limitations of the Research

The intent of the research was to focus on the
adoption of a technological innovation between channel
organizations. However, the study was limited to the
adoption of electronic data interchange within
marketing and logistical channels. Thus, the findings
from this study may not be generalizable to adoption of
other technologies.
Industries represented by the Council of Logistics Management (CLM) membership roster and attendees of the 1992 Second Annual Mason Symposium were included in the sample. Thus, industries not represented or underrepresented by the CLM membership and Mason Symposium attendees had little or no representation in this study.

Organizations represented in the sample may not be totally representative of the general population. Firms belonging to CLM and participating in the Mason Symposium may be more proactive in recognizing the importance of logistics and organizational interrelatedness. Therefore, they may be more aware of the advantage of interorganizational EDI adoption than other firms. Thus these firms may be more receptive to EDI and more proactive in EDI adoption.

Another possible limitation of the study concerns nonresponse bias. If the beliefs and perceptions of those who did not respond to the questionnaire are statistically different from those who did respond,
then the findings of the research are limited to the respondent group only and the results cannot be generalized to the target population. Thus, threat of nonresponse bias may limit the generalizability of the study.

The research centered on the adoption of EDI between only two organizations in each channel type. Since channels can be comprised of multiple members, the study is limited because it did not explicitly consider the adoption of EDI linkages between three or more channel members. The marketing channel was defined as the supplier-customer link. The logistical channel was defined as the shipper-carrier link in the channel. The present research is limited because it did not recognize large numbers of intermediaries that may represent both channel types.

In order to properly research the phenomenon of EDI adoption within two channels both personal and telephone interviews were conducted. The study was limited to five organizations. Limiting the number of
case organizations to such a small number permitted
detailed analysis of each organization but limited the
applicability of findings to similar types of
organizations.

**Contributions of the Research**

The present research provides contributions to
both theory and business practice. The contributions
to theory will be presented first, followed by the
discussion of the study's contributions to practice.

**Contribution to Theory**

The study contributes to theory by investigating
the impact channel type has on interorganizational EDI
adoption. Bowersox (1978), Bowersox, Closs and
Helfrich (1986) define the distribution channel in
terms of two separate channels. The present research
contributes to understanding channel behavior by
determining how channel type affects adoption behavior.
The testing of convergent and discriminate validity
through factor analysis can provide insights into the factor structure of the constructs. Construct dimensionality, as evidenced by factor structures, can provide the foundation for understanding the constructs thought to influence EDI adoption.

The study also contributes to theory by extending the study of innovation adoption beyond single organizations. By using the channel as the focal unit of analysis the study extends prior research by testing the ability of theoretical variables to explain interorganizational adoption.

**Contribution to Practice**

The research also has managerial implications. Managers considering EDI adoption can benefit from knowing the adoption rates at which competitors are implementing EDI. This environmental information can prove beneficial to corporations during competitive strategy planning. Those firms possessing information about the competition can adjust their market strategy,
product offering or counter-attack by adopting EDI. In today's fiercely competitive environment information about the competition can be vital to marketplace success.

Managers can also benefit from knowing the expected adoption trends, cost considerations and implications of adoption. The research provides information about the expected growth trends in EDI adoption and information on how channels are actually using EDI. Perhaps more important, given today's economic conditions, is which channel member pays for third party transactions. Other competitive information provided by the research include rationale for channel adoption and the expected number and percentage of EDI partnerships. This research thereby provides valuable market intelligence information that managers can incorporate into strategic planning about EDI implementation.

The information from the research also enables managers to perform self analysis. Managers provided
The characteristics of EDI adopting channels can determine if their channel has the characteristics that make them likely adopters of the technology. In addition, the same information can allow managers to evaluate channel members with whom they should adopt EDI.

There are also implications for EDI providers. By determining the predictive power of variables in the model, EDI vendors may be able to assess which organizations are likely to adopt EDI. With this information, their managers will be able to improve sales force efficiency by allocating the sales force to those organizations worthy of the time and investment.
Organization Of The Research

Chapter I introduced the research topic and provided an outline of the research effort. Chapter II contains a review of the relevant literature. Chapter III discusses the research design and methodology. The results of the research, and the analyses, are shown in Chapter IV. A summary of the research, conclusions and recommendations for future research are included in Chapter V.
CHAPTER II

LITERATURE REVIEW

Introduction

Chapter II presents a review of the literature and provides the foundation for the research hypotheses. The chapter is divided into five sections. The first section will review the various definitions of electronic data interchange (EDI) found in the literature. The second section will review the state of the art in Electronic Data Interchange. Third, the chapter will discuss the rationale for studying EDI from the channel perspective. The fourth section provides the theoretical foundations for the study by systematically reviewing seminal research from Rogers.
(1962; 1983), Robertson and Gatignon (1986; 1989),
This section also shows how the current study augments
the body of research on information technology
adoption. The fifth section presents and explains the
variables that provide the foundation for the research
hypotheses and the framework of interorganizational EDI
adoption.

Section I: Definitions of EDI

Communications and the transfer of documentation
between organizations can be conducted in a number of
different ways. One method is that of Electronic Data
Interchange (EDI).

EDI has been defined in the literature in numerous
ways. Laughlin (1989) defines EDI as "a method of
computer-to-computer data transmission intended to
improve the speed and accuracy of transactions among
trading partners" (p. 20). According to Reich (1985),
EDI is "a way for a computer in one company to
communicate directly with a computer in another company to perform business transactions and to access data" (p. 72). Emmelhainz (1990) states that EDI is "the interorganizational exchange of business documentation in structured, machine-processable form" (p. 4). She further notes that:

"Electronic Data Interchange (EDI) is fast becoming the standard way of exchanging business documents, not only in this country but also in the rest of the world. EDI provides faster, more accurate, less costly method of communications ... However, EDI is doing more than just changing how businesses communicate; it is changing the way businesses operate. "

Akerman (1985) similarly defined EDI as "the direct computer-to-computer exchange of standard business forms" (p. 1). Oskroba (1990) defined EDI as "The computer-to-computer transmission of business data in a standard format" (p. 20). Stern and Reve (1988) defined EDI as electronic transmissions in certain prescribed formats either requested from or given to another company.
According to Sokol (1989):

"EDI is the intercompany computer to computer communication of standard business transactions in a standard format that permits the receiver to perform the intended transaction."

While the above definitions suggest that EDI involves electronic communication in standard format, they do not clearly distinguish EDI from electronic mail. Electronic mail involves the transmission of numerous types of data, however electronic mail does not have to always involve the computer. As evidenced by the above definitions, EDI always involves one computer communicating with another computer without human intervention.

Stern and Kaufman (1985) further emphasize the difference between EDI and electronic mail. By noting that EDI is the transmission of information in the form of "machine readable data" and pointing out the distinction between the communication of text (i.e., electronic mail) and the communication of machine
readable data (i.e., EDI). Stern and Kaufman suggest that the difference between the transmission of text and machine readable data reflects the ability of the receiver of the data to understand and use the message transmitted. In cases where the receiver is a person the message does not need to meet very specific formatting requirements. However, if the receiver is a computer, then the message must meet specific format requirements in order to be processed. Thus, according to Stern and Kaufman, the transmission of information in machine readable form and specified formats is "the core of EDI" (1985, p. 2).

**EDI Definition Used In This Study**

For the purpose of this research EDI will be defined as: "... the interorganizational exchange of business documentation in a structured, machine-processable form" (Emmelhainz 1990 p. 4). This
definition was chosen because it describes the interorganizational nature of EDI and the structured nature of the transmitted data. The definition also limits the type of data transmitted to business data.

Section II: State of the Art EDI

According to Electronic Data Interchange Association (EDIA), the focus of EDI adoption has shifted away from implementing systems for improving single company networks to convincing trading partners, channel members, to use the system (Bell 1990). This is a notable shift in EDI usage. For years, EDI has been used for internal operations. However, the benefits of interorganizational EDI are being recognized. The Butler Cox Foundation (1990) states "technologies such as EDI are now enabling companies to extend their computer system to their trading partners, thereby helping to reduce safety stocks and improve quality in manufacturing industries, or to reduce response time in service industries."
The state-of-the-art advances in EDI will do more than simply send standard electronic messages between trading partners; it will continue to be a catalyst for reengineering the business process. EDI will enable firms to gain a strategic competitive advantage through time compression management (TCM). TCM helps firms gain a competitive advantage by reducing order cycle and lead times. EDI is well adapted to the TCM program because both EDI and TCM seek to reduce paperwork costs, inventory levels, and lead times. Current and future users of EDI will achieve TCM by integrating interorganizational EDI with bar coding, CAD/CAM, and JIT.

One of the most sought after EDI enhancements is the ability to translate bar codes to and from EDI (Baker 1991). The retailing industry has done such a good job in integrating EDI with order technologies that its use has been given a name, quick response. Quick response in the retailing industry is the integration of EDI and the Universal Product Code (UPC)
(Emmelhainz 1990). Through the integration of EDI and UPC, channel members can collect information at the point of sale, spot changes immediately, and maintain an up-to-date inventory at minimal cost (Baker 1991).

A state-of-the-art version of an EDI/UPC system will allow the supplier to establish multiple levels of access control, thereby allowing the supplier to maintain a single catalog without having to publish separate versions for different customers. At the same time, the customers will have the quick access they require. In cases where the supplier uses a third-party service, the supplier should be able to send the catalog to the service provider in a standard data format, along with a profile listing the types of access controls to be maintained. Once the basic catalog has been placed on-line, the supplier will be able to update it as necessary using standard EDI transmissions.

The customer that wants access to this catalog can set up a profile that identifies the company and the
way in which it wants to receive the information. Once
the customer has established itself on-line, it can
browse through the supplier's catalog and place orders
via EDI. In a state-of-the-art integrated system, the
customer would be recorded in the retailer's inventory
system. That system then could trigger automatic EDI
orders, matching the sales trends revealed by the
checkout data.

EDI excels at transferring standard business
paperwork and state-of-the-art options will also enable
electronic transmissions of graphics. Without graphics
transmissions, channel members wanting to exchange
engineering drawings, for example, had to rely on
conventional services, such as the postal service,
while everything else was transmitted via EDI.

Some EDI vendors have been adding graphics
capacity to the packages of software and services.
Vendors then translate the standard file formats
produced by Computer Aided Design/Computer Aided
Manufacturing (CAD/CAM) products and other computer graphics sources and convert them for transmission to the channel partner, or third-party EDI mailbox. Many of these systems also handle text and binary files, screen images, and other graphic formats.

Further down the manufacturing process, the integration of EDI and JIT can reduce inventory and improve production efficiency. One of the major reasons behind implementing EDI in the automotive industry was to improve the operations of JIT systems. Since JIT requires frequent and rapid delivery of supplies, a method of rapid and accurate communication was needed. EDI provides this communication ability. According to Emmelhainz (1990), numerous JIT users have stated that JIT is very difficult to do without EDI. Without EDI, quick response channel members cannot operate on the short notice JIT requires. Channel members cannot get instant, precisely scheduled delivery if they rely on paper correspondence sent through the mail. EDI is, therefore, the communication
medium for JIT (Baker 1991). If a supplier must furnish windshields to a customer’s production schedule, the supplier must be aware of the schedule. Moreover, the supplier’s production schedule must become part of the manufacturer’s production schedule. Using EDI, manufacturers can send their orders electronically just as the production plans are being completed. The supplier can then use the information to integrate its schedule into the manufacturer’s production schedule.

More and more businesses are enjoying these benefits. According to a company, EDI Spread the Word, nearly 12,000 U.S. corporations use EDI. This number is expected to triple by the mid 1990’s. A study by another company, Input, found that over 50% of the Fortune 1000 firms are now involved in EDI. Another 24% are reviewing strategic business plans to incorporate EDI.
Section III: Studying EDI From The Channel Perspective

Section III presents the rationale behind studying EDI from a channel perspective. The section is divided into three parts. Part one discusses the channel as the unit of analysis. The second part presents the reason why studying EDI from the channel perspective is significant. The last part discusses the rationale for studying EDI from within both channel types.

The Channel As Unit Of Analysis

Previous research regarding EDI has focused on its implementation within single departments or organizations (e.g., Emmelhainz 1986, La Londe and Emmelhainz 1985, Emmelhainz 1987), its use with other technologies (e.g., Stamper 1990, Knill 1990), and competitive advantages of EDI adoption (e.g., Sokol 1989, Kimberley 1990, Benjamin, de Long, Scott Morton 1990). While there has been literature on the interorganizational use of EDI, between shipper and carriers (e.g., Laughlin 1989, La Londe, Masters, Maltz
and Williams 1991), customers and suppliers (e.g., Lawrence 1990) and warehousers, shippers and carriers (e.g., La Londe and Cooper 1988) very few, if any, researchers have used the marketing and logistical channel as the unit of analysis.

Eventually, the study of interorganizational EDI transactions in distribution channels should probably take the form of analyzing networks instead of two organizations in a channel. Network analysis would more completely capture the interactions and complexity of the entire supply chain; however, first one needs to understand the basic transactions or exchange between pairs of social actors by applying a dyadic model (Ellram and Cooper 1991). Indeed, as Aldrich and Whetten (1981) acknowledge, "The starting point for all studies of aggregates of organizations is a relation or transaction between two organizations" (p. 385).
Significance of Studying EDI From
The Channel Perspective

The point here is not that past research has not studied the marketing and logistical channel as the focal unit, but that by not studying the channel the interorganizational nature of EDI has been neglected. By its very definition, EDI is interorganizational, it is the transmission of data from one channel member’s computer system to another channel member’s computer system. By studying single departments or individual organizational adoption, the impact of EDI on interfirm relations, channel coordination and channel management has been neglected. As no research has examined interorganizational EDI or adoption differences within the different channel types, the current research contributes to the understanding of channel relations and EDI adoption process.
Distribution Channel Separation

According to Bowersox, Closs and Helfrich (1986) the distribution channel can be separated into two distinct types of channels (See Figure 2). In an earlier work, Bowersox (1978) states that "to achieve a satisfactory marketing process, a flow of transaction-creating efforts and a flow of logistical efforts must exist and be coordinated." Bowersox (1978) suggests that the distribution channel be thought of as consisting of two components: the transaction, or marketing channel, and the logistical channel.

As defined by Bowersox et al. (1986), marketing and logistical channels are characterized by different goals, transactions flows and, most important for this study, communications.

Marketing Channel

The goal of the transaction channel is to focus on the relationships between buyers and sellers in the channel of distribution. It is therefore often termed
Figure 2
Distribution Channel Separation
the marketing channel. The purpose of the transaction or marketing channel is to negotiate, contract and administer trading on a continuing basis. The communications in the transaction or marketing channel center around providing possession utility. Buyers and sellers in this channel type transmit documentation such as prices, terms of sale and product features that are designed to encourage ownership and product possession. For the purpose of the current research, the terms "marketing channel" and "transaction channel" were used interchangeably, and were represented by the supplier-customer link in the channel (See Figure 3).

Kotler (1984) describes the marketing channel as the flow of information between a collection of buyers to and from a collection of sellers. Kotler further states that these flows connect buyers and sellers together.

Schewe and Smith (1983) provide additional support for the marketing channel distinction. The authors state that information transmitted between buyers and
Figure 3
Marketing and Logistical Channels
sellers helps to identify problems with products and/or sales personnel. Thus, the marketing channel transmits information necessary for product exchange, however, the marketing channel is not responsible for the actual movement of the product.

The Logistical Channel

The purpose of the logistical channel is to coordinate and effectively manage the tasks associated with physically moving the product through the channel of distribution. The logistical channel has full responsibility for the "management of inventory - at rest or in motion" (Bowersox et al 1986) and has ultimate responsibility for seeing that customer service goals are met at an acceptable level of cost. The transactions in the logistical channel center around the actual product exchange, storage and delivery. Communications transmitted between logistical channel partners might include: advance shipment notices, transit times, delivery dates and
product quantities. For the purpose of the current research, the logistical channel was represented by the shipper-carrier link in the channel (See Figure 2).

In addition to the differences between channel goals, transaction flows, and communications transmissions between the two channel types (Bowersox, Closs and Helfrich 1986; Bowersox 1978), it was not unreasonable to believe that decision makers recognize the differences between the channels; they are aware that carrier and customer organizations represent different channel types. Decision makers also recognize that the transactions transmitted between each channel type and the information that is communicated between the different organizations are different. Decision makers view the transactions between themselves and carriers as being different from the transactions between themselves and their customers and themselves and their suppliers. Therefore, it was logically deduced that the decision maker differentiates between channel types. Thus, due to the
findings from prior research and decision makers' recognition of channel differences, the present research studied EDI adoption within both types of channels.

**Rationale For Channel Separation in the Study Of EDI Adoption**

Channel type can explain variance in interorganizational adoption. It can be concluded that the logistical channel will have higher rates of EDI adoption because of 1) the voluminous and routine paperwork transmitted between shippers and carriers and 2) the early influence of the Transportation Data Coordinating Committee (TDCC).

The data transmitted via EDI should be routine and voluminous enough to substantiate the investment in the technology. There are several types of information that are transmitted in the logistical channel that are conducive to EDI transmissions.
The early influence of the TDCC may also explain a significant amount of channel adoption. The TDCC was a group of companies in the transportation industry that was formed a committee as early as 1968 for the purpose of developing a common language or standards for use in the transmission of transportation documentation.

Therefore the early interest in electronic standards and documents capable of electronic transmissions further distinguish the marketing and logistical channels.

Section IV: Theoretical Foundations

This section will review seminal research by Rogers (1962, 1983), Robertson and Gatignon (1986, 1989), Gaski (1984, 1988), and El-Ansary and Stern (1988) that provided the theoretical foundation for the research.
The groundwork for studying the adoption of EDI was laid by the earlier work of Everett Rogers (1962). Although Rogers’ work did not specifically include the study of EDI, it provided the foundation for understanding adoption behavior. According to Rogers "a considerable time lag is required before an innovation reaches wide acceptance" (p. 2). There are three crucial elements in the analysis of innovation diffusion or adoption that will be discussed here: 1) the innovation, 2) communication from one social unit to another, and 3) the social system.

The Innovation

An innovation is an idea perceived as new by the individual. Rogers’ (1983) definition is that an innovation is "an idea, practice or object that is perceived as new by an individual or unit of adoption" (p. 11).
He continues the definition by stating:

It matters little, as far as human behavior is concerned, whether or not an idea is "objectively" new as measured by the lapse of time since its first use or discovery... If the idea seems new to the individual [or adopting] unit, it is an innovation" (p. 11).

Thus EDI, although operational for years (Sokol 1989), is an innovation because of the firm's relatively new involvement with electronic transmissions (Emmelhainz 1990).

**Communication Channels**

The adoption of an innovation requires information about the innovation to be spread. The essence of the adoption process is the human interaction in which one person or organization communicates a new idea to another person or organization. Thus, at its most elemental level of conceptualization, the adoption process requires 1) a new idea, 2) an individual or channel member "A" that knows about the innovation, and
3) an individual or channel member "B" that does not yet know about the innovation. The social relationships between "A" and "B" greatly influence the conditions under which channel member "A" will tell channel member "B" about the innovation.

Social System

A social system is defined as a population of individuals or organizations that perform different functions related to solving a common problem. The sharing of a common objective binds the adopting social system together. The social system will adopt the technological innovation in an effort to solve the common problem.

Independent Variables Studied By Rogers

Rogers' research of innovation adoption at the organizational level primarily included internal organizational characteristics. The specific variables studied included size, centralization, complexity,
formalization, and interconnectedness. The five variables studied by Rogers that were defined and discussed in regard to their applicability to the current study are: 1) Size, 2) Centralization, 3) Organizational Complexity, 4) Formalization, and 5) Interconnectedness.

Size

Size refers to the organizational size or magnitude of the organization under investigation. This variable has been consistently found to be positively related to organizational innovativeness. Size and adoption were found to be positively related in Rogers' work because large firms are thought to have the funds necessary to invest in innovations. Size was included in the present study to investigate its influence on interorganizational innovativeness.
Centralization

Rogers defined centralization as the degree to which power and control in a system are concentrated in the hands of relatively few individuals. Centralization has usually been found to explain a significant amount of variance in organization adoption. Centralization is thought to be positively related to innovation adoption because the approval of an innovation often requires the approval of top management. Centralized organizational structure can facilitate adoption by eliminating "bureaucratic red tape." This variable was included in the present study to investigate its ability to explain interorganizational adoption of an innovation.

Complexity

Organizational complexity is the degree to which an organization's members possess a relatively high level of knowledge and expertise. According to researchers (Moch and Mohr 1977; Rogers 1983), as
organizations increase in size, they are likely to become more complex, specialized and departmentalized. The organization becomes characterized by specialized experts and professionals. Complexity is a measure of organizing specialization and is not applicable to interorganizations. Therefore, complexity was not measured in the current study because of its limited impact on interorganizational channel adoption.

**Formalization**

Rogers defined formalization as the degree to which an organization emphasizes following rules and procedures. This variable has been studied in prior innovation studies that used the organization as the unit of analysis. Since the unit of analysis in this study is interorganizational, formalization of a single organization was not applicable to the present research. The level at which procedures are followed in a single organization is not related to the interorganizational adoption of a technology.
Interconnectedness

Interconnectedness is the degree to which the units in the social system are linked by interpersonal networks. New ideas can flow more easily and rapidly among an organization's members if it has higher interconnectedness. The variable was not applicable to this study because it is limited to the organizational level. However, because the interconnectedness between channel members may impact interorganizational adoption, this research studied the linkages or interconnectedness between channel members by measuring the length of the relationship.
Robertson and Gatignon (1986; 1989)

The 1986 and 1989 research of Robertson and Gatignon has centered on the adoption of innovations at the organizational level. However, unlike Rogers', their work has included both internal and external variables.

Robertson and Gatignon (1986) presented a paradigm of the organizational adoption decision. The paradigm incorporates factors that influence an organization's decision to adopt a technology. The paradigm was the first to introduce internal organizational and external competitive variables into a predictive model of organizational adoption in the marketing literature.

The following section defines the eight variables included in the Robertson and Gatignon (1989) empirical study of computer laptop adoption and evaluates their applicability to the current study. The eight variables presented are: 1) Industry Concentration/Competitiveness, 2) Competitive Price
Intensity, 3) Demand Uncertainty, 4) Communication
Openness 5) Supplier-Side Competitive Environment, 6)
Company Centralization, 7) Selling Task Complexity, and
8) Decision Maker Information Processing
characteristics.

Industry Concentration/Competitiveness

According to Robertson and Gatignon, industry
competitiveness is generally assessed by the number of
competitors and the concentration ratios in the
industry. The concentration of competition in the
industry is thought to impact the adoption of EDI
because in highly competitive markets firms are more
likely to adopt a technology in an effort to
differentiate their product offerings in the
marketplace (Robertson and Gatignon 1989). Since
industry competitiveness is thought to influence the
channel adoption decision, the variable was included in
the present study.
Competitive Price Intensity

A key variable in characterizing an industry is the level of price intensity (Porter 1980). Some industries are more likely to compete on price than on other elements in the marketing mix. This variable was thought to influence the adoption of interorganizational technologies. While this variable was not explicitly included in the current research, it was measured and investigated indirectly by asking about price cutting practices in the industry.

Demand Uncertainty

Demand uncertainty is defined as the difficulty in forecasting demand. Firms experiencing difficulty in forecasting demand are more likely to adopt EDI with channel members because EDI allows channels to be "electronically tied together", therefore decreasing uncertainty in the channel (Emmelhainz 1990). The current study included this variable because it was
expected to significantly contribute to an explanation of the interorganizational adoption of technologies.

**Communication Openness**

Robertson and Gatignon define communication openness as the amount of potentially useful information communicated among competitors. The nature and intensity of competition in the industry should influence interorganizational adoption because channels are expected to adopt an innovation to differentiate themselves in competitive marketplaces. However, the openness with which the competitors communicate is not thought to impact the interorganizational adoption decision. Therefore, the communication openness between competitors, although studied by Robertson and Gatignon, was not applicable to the current research.
Supplier-Side Competitive Environment

The variables of vertical coordination and supplier incentives were used by Gatignon and Robertson (1989) to measure the impact of competitiveness among technology suppliers. However, in the current study both channel members were in the same industry; thus supplier competitiveness was not applicable to this study. After the interorganizational decision to adopt has been made, perhaps then the competition in the vendor industry becomes relevant. Since the present research investigated the adoption decision by two organizations and not the vendor selection decision, the supplier-side competitive environment was not relevant.

Company Centralization

Company centralization occurs when decision making is concentrated at higher levels in the organization. This variable, also investigated in Rogers’ work, is expected to explain technology adoption within channels
because top managers can override and persuade reluctant lower managers. Company centralization was included in the current study because any reservations that lower level managers have about the innovation adoption can be overridden by upper managers.

Selling Task Complexity

Selling task complexity was investigated in the Robertson and Gatignon (1989) study because the adopted technology, the laptop computer, was designed to reduce the selling complexity for sales personnel. The variable, selling task complexity, was specific to the selling task of sales personnel. Robertson and Gatignon expected that a highly complex selling task would provide an incentive for sales personnel to adopt laptop computers. The adoption decision in the present study was not made by individual clerks for their personal task reduction; instead, the adoption decision was made by top managers for the strategic benefits the technology offers channel members. Therefore, selling
task complexity was not applicable to the present study.

**Decision Maker Information Processing Characteristics**

The willingness of decision makers to process information was measured by Gatignon and Robertson (1989) in a study that was centered around the organizational adoption decision. Robertson and Gatignon expected decision maker information processing to significantly explain the variance in organizational adoption. However, this variable was not included because the emphasis in the current study is on the interorganizational adoption decision. The decision to adopt interorganizational EDI is thought to be made by groups of decision makers within two separate organizations. Thus, information processing of individual decision makers was not included in the present study because groups, not individuals, are involved in the interorganizational decision process.

The research performed by El-Ansary and Stern (1972; 1988) and Gaski (1984; 1988) has centered around channel power. Prior research by Rogers and Robertson and Gatignon neglected to investigate the impact of interorganizational power in studying adoption behavior. The current research included channel power because it was thought to influence technology adoption within channels.

Channel power is the influence one channel member has over the other. The presence of influence or power in the channel is thought to be positively related to EDI adoption (Stern and Kaufman 1985). El-Ansary and Stern (1972) state:

"The power of a channel member is his ability to control the decision variables in the marketing strategy of another member in a given channel at a different level of distribution. For this control to qualify as power, it should be different from the influenced member’s original level of control over his own marketing strategy."
p. 47.
See Table 1 for a concise listing of the major sources of variables that were investigated in the current research.

**Table 1**

Major Sources of Constructs

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Size</td>
<td>Centralization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centralization</td>
<td>Centralization</td>
<td>Industry Competitiveness</td>
<td></td>
</tr>
<tr>
<td>Uncertainty</td>
<td>Demand Uncertainty</td>
<td></td>
<td>Channel Power</td>
</tr>
</tbody>
</table>
Why the Current Study

The seminal works by Rogers (1962; 1983) and Robertson and Gatignon (1986; 1989) provide the foundation for the present research. Rogers’ work studied the impact of internal or organizational variables on innovation adoption. However, while Rogers discusses the importance of uncertainty on adoption, he does not investigate its influence on adoption. The research of Robertson and Gatignon, however, fills this void by studying environmental uncertainty along with internal/organizational characteristics. While the Robertson and Gatignon study investigated the influence of both external and internal variables on technology adoption, it, like Rogers’, limits the adopting unit to the organizational level.

The interorganizational dimension of EDI directs the study of adoption to focus on the channel. However, as shown, prior research has not studied
adoption at the interorganizational level. The current study fills the gaps of prior research by studying adoption within two organizations in a channel. Thus, the current study contributes to the body of EDI and information technology research by studying the channel member-to-channel member electronic communication link. The study also contributes to the adoption literature by investigating the impact of previously studied constructs beyond the single organization to the channel.

Section V: Foundation For Research Hypotheses and The Framework Of Interorganizational EDI Adoption

Section V explores the basic foundations for the research hypothesis and the framework of the interorganizational EDI adoption (See Figure 1).
Internal/Organizational Variables

Many researchers have argued that the structural characteristics of an organization significantly influence its adoption behavior (Kimberly and Evanisko 1981; Rogers 1962, 1983). The contention is that certain features of organizations facilitate or encourage adoption of an innovation. This research investigated two organizational variables, organizational size and organizational structure, in relation to interorganizational EDI adoption.

Organizational Size

There have been numerous empirical findings which document a positive relationship between size and adoption behavior (Aiken and Hage 1971, Becker and Stafford 1967, Corwin 1972, Hage and Aiken 1967, Myttinger 1968, Mohr 1969, Rosner 1968). However, to date organizational size has not been applied to understanding the interorganizational adoption of EDI.

Researchers have found that organizations do not
adopt technologies because of their pure size, but because size leads to economies of scale, capital accumulation and/or volume of transmissions. Mohr (1969) has argued that larger organizations simply because they are large are unlikely to adopt innovations. Recognizing that size and adoption are often associated, Mohr states that "size itself is not related to innovativeness by logical necessity; it becomes significant only when it implies or indicates the conceptual variables [i.e., economies of scale, capital accumulation] that are important in themselves" (Mohr 1969, p. 121).

Organizational size may indeed have positive effects on adoption. However, it is likely to lead directly to economies of scale which enhance the feasibility of innovation adoption (Moch and Morse 1977). Larger organizations process a sufficient volume of transactions and have substantial capital to justify the adoption of a new technology, such as electronic data interchange (EDI). Smaller
organizations, however, with fewer transactions and less capital availability might not reasonably expect to benefit from adopting similar innovations (Moch and Mohr 1977). The null and predicted forms of the organizational size hypotheses for both channel types are presented below.

Hypothesis A1:

The relative size of channel members in the marketing channel will not significantly explain the variance of EDI adoption within the marketing channel.

Predicted:

The relative large size of channel members in the marketing channel will significantly explain the variance of EDI adoption within marketing channels.

Hypothesis A2:

The relative size of channel members in the logistical channel will not significantly explain the variance of EDI adoption within the logistical channel.

Predicted:

The relative large size of channel members in logistical channels will significantly explain the variance of EDI adoption within logistical channels.
Organizational Structure

Nearly all researchers hold that organizational structure is important to innovation adoption. The relationship between centralization and adoption of innovation has been found to be positive in some cases and negative in others. Rarely, if ever, has it been found to have no impact (Kimberly and Evanisko 1981). Robertson and Gatignon (1989) state that the findings between centralization and adoption have been inconsistent. Moch and Morse (1977) suggest that the inconsistency is due to the type of innovation being studied. Researchers have defined two types of innovations, "one type directly related to the organization’s core technology and the other related to administrative concerns" (Kimberly and Evanisko 1981; p. 691). An innovation in the core technology where the technology is being applied by professionals who are more or less autonomous, as in the case of physicians working in hospitals, might be adopted more frequently in decentralized structures. However, an
innovation in the administrative subsystem might be expected to be adopted more frequently in a centralized authority structure, where the will of the chief executive can be more easily imposed. Yet other researchers (Coughlin, Cooke and Safer 1972; Wilson 1966; Zaltman, Duncan and Holbeck 1973) state that lower-level personnel are in a better position to facilitate the adoption of innovations which meet their needs and interests while resisting those which do not.

The position taken in this research resembled that taken by Robertson and Gatignon (1989). The thesis of Robertson and Gatignon (1989) is that centralization facilitates acceptance of innovation for technologies requiring organizational standardization (e.g., telephone systems and EDI). Since EDI by its very definition requires an organization to standardize their business transactions in an electronic format to be transmitted to an independent channel member, top management's support and approval is often required.
Thus, a centralized decision making structure is expected to facilitate the interorganizational adoption of EDI faster and more efficiently than a decentralized decision making structure because senior managers can adopt EDI despite the resistance of lower managers. A decentralized structure is expected to slow the interorganizational adoption of EDI as the adoption decision ascends through the levels of management because lower managers do not have the same power and influence over upper managers. The null and predicted organizational structure hypotheses are listed below for both channel types.

Hypothesis A3:

The organizational structure of channel members within marketing channels will not significantly explain the variance of EDI adoption within marketing channels.

Predicted:

The centralized organizational structure of channel members in the marketing channel will significantly explain the variance of EDI adoption within marketing channels.
Hypothesis A4:

The organizational structure of channel members within logistical channels will not significantly explain the variance of EDI adoption within logistical channels.

Predicted:

The centralized organizational structure of channel members in the logistical channel will significantly explain the variance of EDI adoption within logistical channels.

**External/Industry Variables**

Early work by Terreberry (1968) stated that:

"There has been no conceptual breakthrough in understanding environmental evolution which, alone, shapes the direction of change. ... most theorists .. still focus on internal interdependencies of systems - biological, psychological, or social - although the external environments of these systems are changing more rapidly than ever before." (p. 590).

Since then, formal analytical frameworks and empirical investigations focusing on the environmental determinants of channel structures and processes have
appeared in the literature (e.g., Archol, Reve and Stern 1983; Arndt 1983; Dwyer and Welsh 1985; Etgar 1977). These studies are based on an open system perspective for understanding the sociopolitical factors influencing interorganizational exchange. External phenomena are postulated to interact with or mediate observed relationships (such as between power and organizational variables).

Industry Competitiveness

The structural characteristics of the industry are important to the adoption of a technological innovation (Gatignon and Robertson 1989). However, economists have disagreed about the environmental condition most conducive to technology adoption. There often arises a conflict between the true monopoly and pure competition (Loury 1979). Both theoretical (Kamien and Schwartz 1972; 1976) and empirical (Mansfield 1963; Scherer 1967) studies have suggested the existence of a degree of concentration which lies between pure monopoly and
atomistic (perfect) competition that is best for organizational adoption performance (Swan 1970).

The acceptance of technological innovation is posited to be maximized in more concentrated industries (Reinganum 1981). According to Robertson and Gatignon (1986; 1989) the logic is that industry participants operating under oligopoly conditions pay close attention to each others' competitive moves and that the benefits of adopting an innovation increase as the number of competitors decreases (Reinganum 1981). The participants also are more likely to have the discretionary financial resources necessary to innovate than those in industries characterized by numerous firms with small market share.

In oligopolies, according to Levin (1987), the acceptance of technological innovations helps build or maintain barriers to entry and preserves cost advantage. However, Swan (1970) states that in conditions of monopoly, adoption may be hindered because the monopolist is less likely to recognize the
value of the innovation. Economists (Kamien and Schwartz 1975; Swan 1970), have argued that monopolies can use innovations to prevent entries.

Industry competitiveness (e.g., concentration of competition in the industry) was expected to have a significant impact on the adoption of interorganizational EDI within distribution channels. Under high competitive intensity, greater resource allocations and more aggressive pricing policies are likely to materialize, thus encouraging more rapid diffusion (Robertson and Gatignon 1986). Robertson and Gatignon hypothesize that high levels of competitive intensity lead to more rapid diffusion and the achievement of higher levels of market penetration for the innovation. Presented below are the null and predicted hypotheses for industry competitiveness on both channel types.
Hypothesis B1:

Industry competitiveness will not significantly explain the variance in EDI adoption within marketing channels.

Predicted:

High industry competitiveness will significantly explain the variance in EDI adoption within marketing channels.

Hypothesis B2:

Industry competitiveness will not significantly explain the variance in EDI adoption within logistical channels.

Predicted:

High industry competitiveness will significantly explain the variance in EDI adoption within logistical channels.

Demand Uncertainty

A turbulent market environment created by fragmented markets with less brand loyal customers, coupled with intense international competition and rapid product innovations, which today's managers deal with daily, highlight the need for incorporating the element of demand uncertainty in the framework.
It has long been viewed that occurrences in the channel's external environment affect the degree of uncertainty experienced by channel members (Archol and Reve 1988; Archol, Reve and Stern 1983; Terrebbery 1968). Uncertainty is a pivotal notion in organization behavior theory. Thompson (1967, p. 9, 159) views it as the "cutting edge" of organizational analysis and sees coping with uncertainty as the "essence of the administrative process" (e.g., Weick 1969, p. 20, 40). Archol, Reve and Stern (1983) incorporated uncertainty as a key variable affecting channels.

A number of authors including Duncan (1972), Lawrence and Losch (1967), Downey et al. (1975) and Kopp and Litschert (1980) have done much to conceptualize and evaluate the reliability and validity of the measures of perceived environmental uncertainty. However, little systematic work has been done on the impact of this uncertainty or environmental turbulence on the innovativeness of an organization. According to Ettlie and Bridges (1982), the work that has been
published is primarily theoretical, offers conclusions that are inconsistent, or does not deal directly with the issue of the relationship between uncertainty and relatively early adoption and use of innovations.

Pierce and Delbecq (1977, p. 32) hypothesize that "environment uncertainty will be positively related with organizational innovation (i.e., initiation, adoption and implementation)." Based on data from five in-depth case studies of the adoption of innovations in five shoe firms, Duchesneau et al. (1975, p. 92) find that the complexity of a firm’s management (e.g., diversity of skill mix) affects the firm’s perception of the environment. Namely, the perceived environmental uncertainty is reduced. Not only are more technical personnel likely to be recruited under these circumstances but, further, the firm is "more likely to adopt new innovations" (Duchesneau, 1979 p.118).

Demand uncertainty is a component of the broader concept of industry uncertainty, as proposed by
Lawrence and Lorsch (1967) and Duncan (1972). In the current study demand uncertainty, or the inability to accurately predict demand, is a measure of industry or environmental volatility. Although no demand forecasting technique is completely accurate, high levels of demand forecasting error may be characteristic of a volatile industry.

Industries that are unable to forecast demand accurately were thought to have high rates of innovation adoption (Ettlie 1983). The logic is that the higher the degree of uncertainty in predicting demand, the more intense competition will be among competitors and the more likely firms will be to adopt innovations (Robertson and Gatignon 1986, p. 7). Uncertainty of demand heightens perceived competitive vulnerability and makes a firm more willing to adopt an innovation in order to gain a competitive advantage (Robertson and Gatignon 1986). The research hypotheses are:
Hypothesis B3

Demand uncertainty will not significantly explain the adoption of EDI within marketing channels.

Predicted:

High demand uncertainty in marketing channels will significantly explain the variance of EDI adoption in marketing channels.

Hypothesis B4:

Demand uncertainty will not significantly explain the adoption of EDI within logistical channels.

Predicted:

High demand uncertainty in marketing channels will significantly explain the variance of EDI adoption in logistical channels.
Interorganizational Power

Among the phenomena that occur in distribution channels, probably none has gained the attention of researchers as much as interorganizational power (Gaski 1988). The degree of scholarly interest in this topic may come from power’s significance and utility in the real world of distribution, as well as its potential as an explanatory construct in the realm of scientific understanding. The present research will investigate the impact of channel power on interorganizational EDI adoption.

Power is defined as the influence one channel member has over another channel member. However, there is a distinction between the ability to alter another’s behavior and the actual alteration of another’s behavior. That is, power need not be exercised. According to Gaski (1988) perhaps the most dysfunctional tendency throughout the history of channel power research has been to ignore this
distinction. A number of studies have operationalized power as if it were defined as actual alteration of behavior, i.e., exercised power. For example El-Ansary and Stern (1972), Hunt and Nevin (1974), Etgar (1976; 1977; 1978), Wilkinson (1981), Phillips (1981), Nevin and Ruekert (1982) and Lusch and Brown (1982) attempted to measure power by having channel members report how much "control" other channel members have over their decision variables. Using these approaches could result in an underestimate of power. It could be that the other channel member has great power but chooses not to exercise it, allowing the respondent to maintain effective control over decisions. Thus, the distinction between having the ability to control versus actually exercising the control is an important one.

According to Emerson (1962), power is a relational concept inherent in the channel. In other words, there will always be some power existing within distribution channels due to mutual dependencies which exist among channel members, even though that power may
be very low (El-Ansary and Stern 1972). However, power can also be fully concentrated in a single organization which then appears as the undisputed channel administrator (Lusch 1976). Channels with an undisputed channel administrator are described as having a unilateral power system (Bonomo 1976). Because of the numerous flows which tie the channel together, the more common case is where different firms exercise control over different flows, functions or activities (e.g., Etgar 1976). The latter can be referred to as a mixed power system (Bonomo 1976).

Thus, the presence of power in channels was assessed to determine the impact of power on the EDI adoption decision. The power construct was thought to be more influential when there is a unilateral power structure. Literature suggests that channels with unilateral power structures will adopt EDI because the more powerful member will "push" EDI on the less powerful member (Stern and Kaufman 1985). Therefore, the research hypotheses are:
Hypothesis C1:

Channel power will not significantly explain the variance of EDI adoption within marketing channels.

Predicted:

channel power will significantly explain the adoption of EDI in marketing channels.

Hypothesis C2:

Channel power will not significantly explain the variance of EDI adoption within logistical channels.

Predicted:

Channel power will significantly explain the adoption of EDI within logistical channels.

Summary

Chapter II presented a review of the literature. A review of EDI definitions, and state-of-the-art EDI developments were also presented in this chapter. Lastly, the chapter presented the foundations for the research hypotheses and the framework of EDI adoption. Chapter III will present the methodology used in the research.
CHAPTER III
RESEARCH METHODOLOGY

Introduction

The present research is a descriptive study that attempts to explain the interorganizational adoption of EDI within two types of distribution channels. The value of a descriptive study is that it describes and interprets the current state(s) or condition(s) of a phenomenon. The descriptive value of the current research is that it has described the characteristics of both EDI adopting marketing and EDI adopting logistical channels. Its explanatory value lies in its ability to show 1) the dimensionality of theoretical constructs and 2) how EDI adoption within channels is explained by each of the independent variables.
The purpose of Chapter III is to present a detailed overview of the research methodology used in the study. The research methodology was conducted in two separate phases. The first phase obtained qualitative data through five personal interviews conducted with firms that represented marketing and logistical channels. The purpose of phase one was to confirm the five theoretical variables and to identify additional variables that might influence the adoption of EDI. The theoretically founded variables and others identified in phase one were included in the mail questionnaire in phase two.

Phase two collected quantitative data through a mail questionnaire. Questionnaires were mailed to individual firms which were members of marketing and logistical channels. The data obtained from the questionnaire were used to measure dependent and independent variables and test the research hypotheses using a multiple regression model.
Since, as previously discussed, the research was conducted in two phases, this chapter will discuss the research design in phases. First, however, the research hypotheses presented in both the null and the predicted state are stated again as a basis for the discussion in the chapter. The second part of the chapter will discuss the five interviews. Specifically, the organizations represented and the length of interviews will be discussed. The third part of the chapter presents the overall research design of phase two.

**Presentation of The Research Hypotheses**

**Internal Hypotheses**

**Hypothesis A1:**

The relative size of channel members in the marketing channel will not significantly explain the variance of EDI adoption within the marketing channel.

**Predicted:**

The relative large size of channel members in marketing channel will significantly explain the variance of EDI adoption within marketing channels.
Hypothesis A2:

The relative size of channel members in the logistical channel will not significantly explain the variance of EDI adoption within the logistical channel.

Predicted:

The relative large size of channel members in logistical channels will significantly explain the variance of EDI adoption within logistical channels.

Hypothesis A3:

The organizational structure of channel members within marketing channels will not significantly explain the variance of EDI adoption within marketing channels.

Predicted:

The centralized organizational structure of channel members in the marketing channel will significantly explain the variance of EDI adoption within marketing channels.

Hypothesis A4:

The organizational structure of channel members within logistical channels will not significantly explain the variance of EDI adoption within logistical channels.
Predicted:

The centralized organizational structure of channel members in the logistical channel will significantly explain the variance of EDI adoption within logistical channels.

External Hypotheses

Hypothesis B1:

Industry competitiveness will not significantly explain the variance in EDI adoption within marketing channels.

Predicted:

High industry competitiveness will significantly explain the variance of EDI adoption within marketing channels.

Hypothesis B2:

Industry competitiveness will not significantly explain the variance in EDI adoption within logistical channels.

Predicted:

High industry competitiveness will significantly explain the variance of EDI adoption within logistical channels.
Hypothesis B3:

Demand uncertainty will not significantly explain the adoption of EDI within marketing channels.

Predicted:

High demand uncertainty in marketing channels will significantly explain the variance of EDI adoption in marketing channels.

Hypothesis B4:

Demand uncertainty will not significantly explain the adoption of EDI within logistical channels.

Predicted:

High demand uncertainty in marketing channels will significantly explain the variance of EDI adoption in logistical channels.

Interorganizational Hypotheses

Hypothesis C1:

Channel power will not significantly explain the variance of EDI adoption within marketing channels.

Predicted:

Channel power will significantly explain the adoption of EDI in marketing channels.
Hypothesis C2:

Channel power will not significantly explain the variance of EDI adoption within logistical channels.

Predicted:

Channel power will significantly explain the adoption of EDI within logistical channels.

Phase One - The Qualitative Phase

The first phase of the research collected qualitative information using both telephone and personal interviews. An interview method can be beneficial where it may not be possible to formulate all relevant questions in advance, and where self-reporting should not be done without the ability of the researcher to probe for clarification of answers.

The current research focused on understanding the adoption of EDI within marketing and logistical channels. A purposive sample of five organizations was selected to represent members of both channel types. Interviews averaged an hour and thirty minutes. When
possible, interviews were conducted on-site, but where on-site visitation was impossible the interviews were conducted via the telephone. Telephone interviews do not compromise results or data quality because they have the same advantages as in-person interviews (Kidder and Judd 1986). Advantages include the ability to clarify misunderstandings and probe for additional information. While the opportunity to show visual aids is not possible over the telephone, this is compensated for by the smaller interviewer bias (Sudman and Bradburn 1988). Carefully designed studies comparing in-person personal interviews to telephone personal interviews using the same questions have found few if any differences in overall data quality (Groves and Kahn 1979; Quinn, Gutek, and Walsh, 1980; Kidder and Judd 1986). The conclusion by 25 different comparisons is that "researchers have not found consistent support for the contention that telephone interviewing yields less reliable or less valid data than face-to-face interviewing" (Quinn, Gutek & Walsh, 1980, p. 130).
Five interviews were conducted. The interview respondents represented members of both channel types. The marketing channel was sampled by interviewing suppliers and buyers. The terms "buyers" and "customers" will be used interchangeably. The logistics channel was sampled by interviewing shippers and carriers. All interview respondents in each of the organizations held positions at the managerial or vice presidential level. Respondents at these levels were targeted because they were thought to have the frame of reference and conceptual skills to respond to strategic EDI issues.

All interviews were conducted using an interview protocol to provide structure and guidance. The protocol’s combination of open and closed ended questions added flexibility to the interview and allowed the capture of both free flowing opinions and structured responses. The interview protocol was also found appropriate for a variety of respondents, such as carriers, shippers, buyers, suppliers and third party
providers. It limited the need for interpretation and decreased interviewer bias. A copy of the interview protocol can be found in Appendix A.

Phase Two - Quantitative Phase

The following discussion of phase two traces the development of the EDI questionnaires. Included is a discussion of scale development, multiple regression model development and hypothesis testing.

Scale Development

This section will discuss the operationalization of research variables and development of questionnaire items.

Operational Definitions

The present research employed Semantic Differential and Likert scales to measure research variables. Each construct had multiple operationalizations. Using Cronbach alpha and factor
analysis, multiple operationalizations enabled the reliability and validity of measures to be assessed (Mueller 1986). Tables 2 through 7 present the variables of interest in the study along with their operationalizations.
Table 2
Internal Dimension Constructs and Operationalizations

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Operationalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Size</td>
<td>Percentage of market share</td>
</tr>
<tr>
<td></td>
<td>Number of divisions</td>
</tr>
<tr>
<td></td>
<td>Global/Local markets</td>
</tr>
<tr>
<td></td>
<td>Number of employees</td>
</tr>
<tr>
<td></td>
<td>Annual profits</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Control of departmental budgets</td>
</tr>
<tr>
<td></td>
<td>Flow of decisions</td>
</tr>
<tr>
<td></td>
<td>Decentralized/ Centralized structure</td>
</tr>
<tr>
<td></td>
<td>Interference from senior management</td>
</tr>
</tbody>
</table>
### Table 3

**External Dimension Constructs and Operationalizations**

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Operationalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand Uncertainty</td>
<td>Stable/Unstable markets</td>
</tr>
<tr>
<td></td>
<td>Changing customer base</td>
</tr>
<tr>
<td></td>
<td>Certain/Uncertain markets</td>
</tr>
<tr>
<td></td>
<td>Sales volume volatility</td>
</tr>
<tr>
<td></td>
<td>Ease/difficulty in forecasting demand</td>
</tr>
<tr>
<td>Industry Competitiveness</td>
<td>Many major competitors</td>
</tr>
<tr>
<td></td>
<td>Competitors extensive product line</td>
</tr>
<tr>
<td></td>
<td>Concentration of competitors in the industry</td>
</tr>
<tr>
<td></td>
<td>Major product changes to keep up with competitors</td>
</tr>
<tr>
<td></td>
<td>Many entering competitors</td>
</tr>
</tbody>
</table>
Table 4

Interorganizational Dimension Construct and Operationalizations

<table>
<thead>
<tr>
<th>Construct</th>
<th>Operationalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel Power</td>
<td>Channel member’s influence over partner’s credit, payment policy or rates</td>
</tr>
<tr>
<td></td>
<td>Channel member’s influence over partner’s inventory procedures</td>
</tr>
<tr>
<td></td>
<td>Channel member’s influence over partner’s customer service policy</td>
</tr>
<tr>
<td></td>
<td>Channel member’s influence over partner’s composition of services or products</td>
</tr>
</tbody>
</table>
Questionnaire Design

The survey was designed to address the research questions and to provide data to test research hypotheses. To augment the findings from the hypotheses testing, other information regarding the EDI adoption process was also obtained via the questionnaires.

The questionnaire employed multiple scales, including Likert and semantic differential for each variable of interest. The semantic differential and Likert scales were selected because they typically correlate with one another and they are both easy to understand and self-administer.

Likert Scales

The Likert scales used response categories ranging from "strongly agree" to "strongly disagree". Seven categories are fairly standard (i.e., "strongly disagree," "moderately disagree," "slightly disagree", "uncertain," "slightly agree," "moderately agree," and
"strongly disagree") (Van Tillberg 1989). The items for the scale were mostly generated from prior research.

In scoring the Likert items, "strongly disagree" received 1 point, "moderately disagree" received 2 points and so on. For negatively worded items the scoring was reversed ("strongly agree" received 1 point, "strongly disagree" received 6 points and so on). Thus, responses indicating a positive perception toward the attitudinal object ("agree" responses to positive items; "disagree" responses to negative items) resulted in low scale scores. Negative responses toward the attitude object (e.g., competition) resulted in high scale scores.

**Semantic Differential**

The semantic differential (Osgood 1957) is designed to measure the extent to which respondents relate a statement to pairs of adjectives (Mueller 1987). Some adjective pairs were selected from the Osgood et al. (1957) list. Usually a few adjective
pairs are sufficient to produce a scale with high internal consistency (Mueller 1987). The semantic differential scale in the current study consisted of five theoretically founded variables and others from the interviews.

In scoring the semantic differential, each item (i.e., adjective pair) received seven points. The most positive response received 1 point and the most negative 7 points.

Variable Definitions and Scale Items

The next section will define the variables, list their operationalizations and the scale items that were used to measure the research variables.

Internal Variables

Organizational size was defined as a firm's relative magnitude in the industry. Firms that possessed a relatively large market share, or received
above average profits and/or had more employees than the industry average were characteristic of channel members having large organizational size. Organizational size was one of the internal variables investigated for its ability to explain the variation of interorganizational EDI adoption. The impact of organizational size on the adoption of EDI was measured based upon relative market share, profits, sales revenues, the number of employees, divisions and the global or local markets. Organizational size was assessed via 7 point Likert scales.

Multiple measures were used to operationalize the centralization construct. It was measured by the percentage of budgetary control, flow of decisions, the amount of interference from top management and a direct statement about the characteristic of the organization’s structure. Centralization was assessed via 7 point Likert scales.
Table 5
Questionnaire Items Addressing Organizational Size

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>We possess more market share than any other single competitor in the industry.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Our firm is more profitable than average firms in the industry.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>We have more employees than the industry average.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Our firm has more sales revenue than average firms in the industry.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Our firm has many divisions.</td>
<td>7 point SD/SA Semantic Differential Scale</td>
</tr>
<tr>
<td>Global markets/Local markets.</td>
<td>7 point SD/SA Semantic Differential Scale</td>
</tr>
</tbody>
</table>
Table 6

Questionnaire Items Addressing Organizational Structure

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>senior management does little to interfere with my decisions.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>This company's decision making is highly centralized at top management levels.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Most decisions in this firm flow from the top down.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>I have little control over my department's annual budget.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
</tbody>
</table>

External Variables

Demand uncertainty was defined as difficulty in forecasting demand. Regardless of its source, whether managerial error or volatility in demand, demand uncertainty is expected to be significantly correlated with EDI adoption. Demand uncertainty was measured by the change in customer base, stable/unstable markets, volatility in sales volume, certainty/uncertainty in
markets, and ease/difficulty in forecasting sales (See Table 7). The variables were assessed via 7 point semantic differential and Likert scales.

**Table 7**

Questionnaire Items Addressing Demand Uncertainty

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>The customer base for our most significant product is always changing.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>The sales volume for our most significant product is always volatile.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Stable markets/Unstable markets</td>
<td>7 point Semantic Differential Scale</td>
</tr>
<tr>
<td>Easy to forecast sales/Difficult to forecast sales</td>
<td>7 point Semantic Differential Scale</td>
</tr>
<tr>
<td>Certain markets/Uncertain markets</td>
<td>7 point Semantic Differential Scale</td>
</tr>
</tbody>
</table>

Industry competitiveness is the concentration of competition in the industry. The degree of
competitiveness in the industry was measured by the number of major competitors, extensiveness in competitor’s product line, concentration in industry competition, changes to product line and number of new market entrants (See Table 8). Industry competitiveness was assessed via 7 point Likert scales.

Table 8

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>There are many major competitors in the industry.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Our company is planning to make major product/service changes to keep up with competitors.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>The industry is characterized by a few competitors that possess large shares of the market.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>The industry is characterized by many entering competitors.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
<tr>
<td>Competitors offer a more extensive product line.</td>
<td>7 point SD/SA Likert Scale</td>
</tr>
</tbody>
</table>
Interorganizational Variable

Channel power was measured by one channel member’s influence over the other’s credit, payment policy or rates, one channel member’s influence over the other’s inventory procedures, one channel member’s influence over the other’s composition of services or products and one channel member’s influence over the other’s customer service policy. Channel power was assessed via 4 point scales (See Tables 9 through 11).
Table 9

Questionnaire Items Addressing Customer Channel Power

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
</table>
| If your customer wanted you to change your customer credit policy, how much would you change your customer credit policy? | 4 point Scale  
1 = Not at all  
2 = Slightly  
3 = Moderately  
4 = As Much as They wanted |
| If your customer wanted you to change your inventory procedures, how much would you change your inventory procedures?   | 4 point Scale  
1 = Not at all  
2 = Slightly  
3 = Moderately  
4 = As Much as They wanted |
| If your customer wanted you to change your customer service policy, how much would you change your customer service?     | 4 point Scale  
1 = Not at all  
2 = Slightly  
3 = Moderately  
4 = As Much as They wanted |
| If your customer wanted you to change the composition of your product line, how much would you change your product line? | Scale  
1 = Not at all  
2 = Slightly  
3 = Moderately  
4 = As Much as They wanted |
Table 10

Questionnaire Items Addressing Carrier Channel Power

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>If your carrier wanted you to change your payment policy, how much would you change your payment policy?</td>
<td>4 point Scale</td>
</tr>
<tr>
<td></td>
<td>1 = Not at all</td>
</tr>
<tr>
<td></td>
<td>2 = Slightly</td>
</tr>
<tr>
<td></td>
<td>3 = Moderately</td>
</tr>
<tr>
<td></td>
<td>4 = As Much as They wanted</td>
</tr>
<tr>
<td>If your carrier wanted you to change your inventory procedures, how much would you change your inventory procedures?</td>
<td>4 point Scale</td>
</tr>
<tr>
<td></td>
<td>1 = Not at all</td>
</tr>
<tr>
<td></td>
<td>2 = Slightly</td>
</tr>
<tr>
<td></td>
<td>3 = Moderately</td>
</tr>
<tr>
<td></td>
<td>4 = As Much as They wanted</td>
</tr>
<tr>
<td>If your carrier wanted you to change your customer service policy, how much would you change your customer service policy?</td>
<td>4 point Scale</td>
</tr>
<tr>
<td></td>
<td>1 = Not at all</td>
</tr>
<tr>
<td></td>
<td>2 = Slightly</td>
</tr>
<tr>
<td></td>
<td>3 = Moderately</td>
</tr>
<tr>
<td></td>
<td>4 = As Much as They wanted</td>
</tr>
<tr>
<td>If your carrier wanted you to change the composition of services you purchase from them, how much would change your purchases?</td>
<td>4 point Scale</td>
</tr>
<tr>
<td></td>
<td>1 = Not at all</td>
</tr>
<tr>
<td></td>
<td>2 = Slightly</td>
</tr>
<tr>
<td></td>
<td>3 = Moderately</td>
</tr>
<tr>
<td></td>
<td>4 = As Much as They wanted</td>
</tr>
</tbody>
</table>
### Table 11

**Questionnaire Items Addressing Shipper Channel Power**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Scale</th>
</tr>
</thead>
</table>
| If your shipper wanted you to change your customer credit policy, how much would you change your customer credit policy? | Scale  
| 1 = Not at all  
| 2 = Slightly  
| 3 = Moderately  
| 4 = As Much as They wanted                                               |
| If your shipper wanted you to change your rates, how much would you change your rates? | Scale  
| 1 = Not at all  
| 2 = Slightly  
| 3 = Moderately  
| 4 = As Much as They wanted                                               |
| If your shipper wanted you to change your customer service policy, how much would you change your customer service? | 4 point Scale  
| 1 = Not at all  
| 2 = Slightly  
| 3 = Moderately  
| 4 = As Much as They wanted                                               |
| If your shipper wanted you to change the composition of the services you offer, how much would you change your services? | 4 point Scale  
| 1 = Not at all  
| 2 = Slightly  
| 3 = Moderately  
| 4 = As Much as They wanted                                               |
Reliability

Reliability of questionnaire items was assessed by Cronbach alpha. Cronbach alpha measures the internal consistency of scale items. A high Cronbach alpha coefficient represents highly correlated scale items. A high inter-item correlation indicates that the items are reliable in measuring the constructs. A reliable measure has small error component and, therefore, does not fluctuate randomly. After reliability was assessed the researcher then tested the validity of the scale items.

Validity

Validity measures the ability of scale items to tap into the constructs they were designed to measure. All measures with reasonable reliability were factor analyzed to determine convergent and discriminant validity. All measures of a single construct should load strongly on one single factor and have small loadings on other factors that measure other constructs.
Marketing Channel Questionnaire

The marketing channel was sampled by sending questionnaires to supplier and customer organizations. The supplier version of the marketing questionnaire asked respondents to answer the questions while thinking of actual customers. Respondents were asked to mentally select two customers. One customer, designated as large, represented a large part of the respondent's business, while another, designated as small, represented a small part of the respondent's business. Thus, size referred to the trading partner's importance to the respondent. It is not a measure of absolute size.

The customer was asked to respond to similar scales inquiring about supplier organizations. The customer version of the marketing questionnaire asked the respondent to answer the questions while thinking of actual suppliers. Likewise, the customer version of
the questionnaire asked customers to respond to
questions while mentally thinking of a supplier from
whom they purchase a large and small percentage of
their supplies. The designated large suppliers
provided the customer with a large percentage of
supplies, while the designated small supplier provided
a small percentage of supplies. A copy of the
questionnaire can be found in Appendix B.

**Logistical Channel Questionnaire**

The logistical channel was sampled by sending
questionnaires to shippers and carriers. The shipper
version of the logistical questionnaire asked the
respondent to answer the questions while thinking of
actual carriers. Respondents were asked to mentally
select two carriers. One carrier, designated as large,
received a large part of the shipper’s freight bill,
while another, designated as small, received a small
part of the shipper’s freight bill.
Likewise, carriers were asked to respond to similar scales inquiring about shipper organizations. The carrier version of the logistical questionnaire asked the respondent to answer the questions while thinking of actual shippers. Shippers that represented a large part of the carrier’s business were designated as large shippers. Shippers that represented a small part of the carrier’s business were designated as small shippers (See Appendix B).

Survey Development

The preliminary draft of the questionnaire was given to a panel of experts for feedback on wording, clarity, content validity, and appropriateness for the sample. After the comments and suggestions of the panel were reviewed the survey instrument was refined. Items were added, deleted and modified based on the panel comments.
Pretest and Revision

The questionnaires were pretested by a small convenience sample of shippers, carriers and customers. In addition, consultants and third party providers were interviewed to gain an independent and unbiased perspective of interorganizational EDI adoption. The pretests included all elements that were to be included in the actual questionnaire. For example, the questionnaire, cover letter, and follow-up material were presented to respondents. Ten pretest respondents were chosen to represent a cross section of potential respondents. Third party providers were included in the pretest because of their ability to critique questions about shippers, carriers, customers and suppliers (See Table 12).
### Table 12

Questionnaire Pretests

<table>
<thead>
<tr>
<th>Type of Organization</th>
<th>Number Pretested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper/Supplier Organizations</td>
<td>2</td>
</tr>
<tr>
<td>Carrier Organizations</td>
<td>2</td>
</tr>
<tr>
<td>Customer/Buyer Organization</td>
<td>3</td>
</tr>
<tr>
<td>Third party provider/Consultants</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Pretests</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

Pretesting provided a means for the researcher to gather both verbal and nonverbal information about the questionnaire. Pretesting was done in two different designs. The faxed pretest design closely represented the actual survey design. The cover letter and survey where faxed to the respondent, after being completed the survey was faxed back to the researcher.

However, during face-to-face pretesting, the respondents were handed the cover letter and
questionnaire, which they completed and handed back to the researcher. With this design, respondents provided verbal and nonverbal information. All design respondents were asked to verbally comment on their general impression of the questionnaires. However, in the face-to-face design the researcher was allowed to carefully look for nonverbal feedback, such as erasures, hesitations and looks of confusion.

All pretest respondents were told in general terms that a national survey was to be administered to fellow carriers, shippers and customers and that their help was needed in pretesting the instrument. They were instructed to note any misunderstandings, ambiguities, and appropriateness of questions for their group. At this time they were handed or faxed the cover letter and questionnaire. In face-to-face pretests where questionnaires were handed to respondents, the completion time was recorded. In situations where the instruments were faxed the respondents were asked to record the time needed to complete the questionnaire.
Results of the pretest indicated that respondents needed about fifteen to twenty minutes to complete the questionnaires. There were two areas of confusion for respondents. The respondents needed section headings to help them understand the questions and follow the questionnaire. Therefore, section headings such as "Background Information," "Supplier Information," "Carrier Information," "Shipper Information" and "Information About EDI transmissions" were added. The headings, in addition to instructions, allowed respondents to understand the nature of the questions being asked.

The next area revised was the questionnaire's general instructions. The cover letter asked the recipient of the questionnaire to forward it to an appropriate person, if necessary. Therefore, respondents suggested that the purpose of the questionnaire, and the reason information about trading partners was needed, be reiterated in the
questionnaire's general instructions in case the cover letter and questionnaire were separated.

There were no problems or confusion noted about any of the follow-up material. Therefore, no changes or revisions were made.

**Sample Selection**

The customer, shipper, supplier and carrier samples were drawn from the membership list of the Council of Logistics Management (CLM) and the 1992 Second Annual Mason Symposium Attendee list. Consulting firms found within the listings were not sampled. The respondent groups were sampled from three different industries. The customer group was sampled from the retail industry. The shipper and supplier groups were drawn from the manufacturing industry and the carrier group was sampled from the transportation industry.

Two hundred shipper organizations were selected from the CLM list to form the shipper sample. In the twenty-three cases of duplicate listings of shipper
organizations on the CLM membership list, the most senior manager was selected.

Two hundred customer organizations were selected from the CLM mailing list to form the customer sample. In the eighteen cases of duplicate listings of customer organizations on the CLM membership list, the most senior manager was selected. One hundred and forty carrier organizations were selected from both the CLM membership roster and the 1992 Second Annual Mason Symposium Attendee list. No duplications were present on the lists.

A total sample size of five hundred and forty resulted. The sample size was selected because, given the multiple operationalizations of constructs, a maximum of thirty independent variables might have been included in the regression model. Given the standards set forth by Neter, Wasserman and Kutner (1989), ten observations per independent variable, or three hundred observations, might be required to perform the regression analysis. To compensate for non-returns,
five hundred and forty respondents were sampled. It was a reasonable sample size given response rates in similar research studies have been below twenty percent (Robertson and Gatignon 1989).

Implementation of the Questionnaire

A number of steps were taken to increase compliance. The total design method described by Dillman (1978) was utilized. In the first mailing the questionnaire was mailed along with an accompanying cover letter. The cover letter included support from Professor La Londe urging compliance and restating the importance of the study. One week after the mailing of the questionnaire packet, a postcard was mailed to remind respondents of the questionnaire and to ask for their support in the research study (See Appendix B).

Tests For Non-Responses Bias

Two tests for non-response bias were conducted. The first test compared early responses to late
responses on a key EDI adoption question. The second test, however, included contacting non-respondents. The test then compared responses from the non-respondents to those from questionnaire respondents on eight key questions.

**Multiple Regression Models**

Multiple regression models representing each channel type will be discussed below. The regression models were designed to test the research hypotheses.

**Dependent Variables**

The dependent variables of interest were the percentages of EDI adoption within the two types of distribution channels. The first dependent variable was the percentage of EDI adoption within marketing channels. Respondents were asked to provide the percentage of customers with whom they would use EDI when fully on-line. The second dependent variable was the percentage of EDI adoption within logistical
channels. Specifically, the dependent variable was the percentage of customers with whom shippers and carriers planned to use EDI when fully on-line.

**Independent Variables**

The study investigated the adoption of EDI within marketing and logistical channels by focusing on five independent variables. The variables represented three dimensions (e.g., internal, external and interorganizational) thought to impact interorganizational adoption of EDI within the two types of distribution channels. Organizational size and organizational structure represented the internal characteristics hypothesized to impact adoption. The influence of external factors was investigated by studying demand uncertainty and industry competitiveness. Lastly, the effect of the interorganizational factor was tested by incorporating channel power in the model.
Data Analysis

The data was analyzed using multiple regression models. Variables that demonstrated reasonable reliability and validity were used to develop regression models. The multiple regression linear models developed in the research were used to test the research hypotheses. The overall model was evaluated by using the F-statistic at the .05 level of significance. Each of the five independent theoretical variables and variables provided from the interviews of Phase one were tested using the t-statistic at the .05 level. Multiple regression models were used because there were several independent variables that were tested for their ability to explain the variance in the percentage of EDI adoption.
Summary

This chapter has outlined the research methodology and data analyses used in this study. The two methodology phases, while very different, were related. Phase one of the research obtained qualitative data via five interviews. The second phase collected quantitative data via a mail questionnaire. During phase two research hypotheses were measured and tested.

The results from both phases of research are found in Chapter VI. Conclusions and implications of the research are presented in Chapter V.
CHAPTER IV
DATA ANALYSIS AND FINDINGS

Introduction

Chapter IV presents the data analyses and research findings from both the five qualitative interviews and the mail questionnaire. In presenting the analyses this chapter will be organized into three major sections:

1. Findings from the five interviews which were incorporated into the mail questionnaire

2. Analyses of the mail questionnaire data

3. Other findings about EDI that broaden the understanding of the adoption process.
The first section of the chapter will discuss findings from both the telephone and personal interviews. The interviews provided additional insights into the decision process. In addition to providing support for the five theoretically founded variables, the interviews provided support for three additional variables that were thought to influence interorganizational EDI adoption. All variables were incorporated in the mail questionnaire of phase one.

The second section of the chapter will discuss phase two of the research. Phase two consisted of a mail questionnaire. The section will present the data analyses performed on the questionnaire data.

Section I

This section will present the major findings from phase one of the research. Phase one consisted of five interviews (See Table 13).
Major Findings From Phase One

The telephone and personal interviews conducted in phase one provided 1) confirmation of the expected impact of the variables found in the literature and 2) introduction of other variables thought to influence the adoption of EDI within channels. As can be seen in Table 14, eight factors were identified as being influential to interorganizational adoption.
Table 13

Overview of The Five Interviews

<table>
<thead>
<tr>
<th>Organization Type</th>
<th>Respondents' Position</th>
<th>Interview Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper/Supplier*</td>
<td>Manager of Logistics/Transportation</td>
<td>1hr. 30 minutes</td>
</tr>
<tr>
<td>Carrier*</td>
<td>Manager of Information Services</td>
<td>50 minutes</td>
</tr>
<tr>
<td>Buyer</td>
<td>Inventory Manager</td>
<td>1hr. 20 minutes</td>
</tr>
<tr>
<td>Consultant*</td>
<td>Consultant</td>
<td>2hrs. 15 min</td>
</tr>
<tr>
<td>Third party provider of business services</td>
<td>Vice President Manager of Carrier Services</td>
<td>1hr. 20 minutes</td>
</tr>
<tr>
<td>Total Interviews:</td>
<td></td>
<td>Average Time: 1hr 30 min</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1 * Telephone Interview.
Variables Confirmed Through Interviews

All of the interview respondents confirmed that the five variables suggested in the literature had some bearing on the decision to adopt interorganizational EDI (See Table 14).

Organizational Size

All of the respondents indicated that organizational size was a very important predictor of EDI adoption. Large firms were likely to be aggressive users of EDI. One respondent stated that smaller firms, while willing to use EDI at the request of larger customers, were not proactive in adopting the technology. The respondent thought that smaller firms needed the "push" from an outside partner, because smaller firms do not believe that EDI provides the same benefits to them as it does to larger organizations.
<table>
<thead>
<tr>
<th>Variables Confirmed Through Personal Interviews</th>
<th>Other Possible Influential Variables</th>
<th>Nature of Influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Size</td>
<td></td>
<td>Significantly correlated with EDI adoption</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td></td>
<td>Significantly correlated with EDI adoption</td>
</tr>
<tr>
<td>Industry Competitiveness</td>
<td></td>
<td>Significantly correlated with EDI adoption</td>
</tr>
<tr>
<td>Demand Uncertainty</td>
<td></td>
<td>Significantly correlated with EDI adoption</td>
</tr>
<tr>
<td>Channel Power</td>
<td></td>
<td>Significantly correlated with EDI adoption</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Organizational Structure

All respondents suggested that the organizational structure of both firms adopting EDI was very important. However, there was disagreement regarding the direction of this variable. Previous research suggests that centralized organizational structure is positively related to EDI adoption between two independent firms because the support of top management will be required to transmit electronic documents with outside firms. However, statements by respondents only partially supported findings in the literature.

Two of the respondents agreed with the findings in the literature. The other three respondents indicated that decentralized firms were more willing to adopt EDI because the department manager or division head could approve the decision to use EDI processing with a vendor or supplier without going through the "bureaucratic red tape" required to gain top managements' support.
Industry Competitiveness

The respondents discussed the role of industry competition in the decision to adopt EDI. Unanimous support was given for the importance of industry competitiveness in interorganizational EDI adoption. Firms that are innovative and forward thinking see EDI adoption with a trading partner as a means of gaining a competitive advantage. One respondent, however, indicated that EDI is not adopted to gain a competitive advantage, but instead it is used to maintain a competitive equity (e.g., to keep the playing field level).

All respondents indicated that firms operating in highly competitive industries were more likely to adopt EDI than those operating in less competitive industries. One respondent indicated that EDI is most successful in highly competitive industries with low profit margins. In such industries EDI enables firms to decrease both inventory costs and the revenue cycle.
Demand Uncertainty

All respondents confirmed findings in the literature that demand uncertainty was positively related to interorganizational EDI adoption. Respondents indicated that firms with volatile product demand would seek to become closer to their customers. Through EDI firms can become "electronically tied" to customers. By receiving faster more accurate orders managers with high demand uncertainty would be able to reduce demand uncertainty and inventory levels in the channel.

Channel Power

Of all the variables in the study, channel power was by far the most consistently cited reason for interorganizational EDI adoption. According to respondents, smaller firms will be "pushed" to be EDI ready by large customers. In other words, the powerful partner will threaten to withdraw its business unless the less powerful firm becomes EDI ready. According to respondents, the only time that channel power played a less important role in EDI
adoption was when firms had proactive corporate strategies. Firms that are driven to be innovative and forward-thinking are thought to be willing to adopt EDI without the pressure from an outside source.

Other Variables Thought To Influence EDI Adoption

Although support was found for variables in the literature, there were other variables introduced as important to interorganizational EDI adoption.

Organizational Trust

Organizational trust was thought to impact EDI adoption. Firms are willing to use EDI with other firms they trust. Since the human element is removed with EDI communications, trust is not based on long term interpersonal relationships; instead, trust is determined through organizational integrity. Therefore, trust was operationalized as integrity on the mail questionnaire. It was measured by the following 7 point semantic differential
scale: Supplier or Carrier or Customer or Shipper has integrity versus Supplier or Carrier or Customer or Shipper does not have integrity.

**EDI Champion or Executive**

According to four interview respondents, successful EDI adoption is usually pushed through the organizations by an EDI champion or support from a top level manager. People in such positions were thought to understand the strategic benefits of EDI. They see EDI beyond bits and bytes viewing it as a means to gain or maintain a competitive position. The role of an EDI champion was operationalized on the questionnaire through the following 7 point Likert scale item: There was at least one person that truly fought for EDI.

**Long Term Relationships**

All respondents indicated that firms are typically more willing to adopt EDI with other firms with whom they have
had long-term, non-EDI relationships. Thus, length of working relationship may be a prerequisite for selecting an EDI partner. Length of relationships was operationalized by asking: How long have you had a working relationship with your supplier or carrier or customer or shipper.

**Summary of Phase One**

In order to understand the adoption process of interorganizational EDI, five interviews were conducted. The interviews revealed that other variables, in addition to the theoretical variables, were thought to influence EDI adoption process. Therefore, the three variables uncovered during the personal interviews were measured in the mail questionnaire.
Section II

Five steps in the data analysis are presented in section II. In the first step the response rates and tests of nonresponse bias are analyzed. In the second step the univariate statistics of the research measures are discussed. In the third step the findings from reliability and validity analyses are presented. In the fourth step the regression models that were used to test the research hypotheses are presented. In the fifth step high EDI users and low EDI users are compared in an effort to use the research measures to discriminate between the two usage groups.

Response Rates and Tests of Non-Response Bias

Of the 540 shipper, carrier and customer questionnaires mailed, 162 were returned. Five were returned because of incorrect addresses, resulting in 156 usable questionnaires and a response rate of 28.9%. The three versions of the questionnaire were mailed to three groups of respondents. The shipper/supplier version of the questionnaire was mailed
to two hundred shipper/supplier organizations. Of the two hundred questionnaires that were mailed, 51 usable questionnaires were returned, representing a 25.5 percent response rate.

Two hundred of the customer version of the EDI questionnaires were mailed and 67 usable questionnaires were returned, representing a 33 percent response rate.

One hundred and forty of the carrier version of the questionnaires were mailed. Thirty eight usable questionnaires were returned, representing a 27.1 percent response rate.

**Tests For Non-Response Bias**

Non-response bias is a concern with any mail questionnaire that has less than a 100% response rate. Non-response bias assumes the responses of targeted individuals who chose not to respond may be considerably different from those who did respond, and thus it would be problematic to extend the results of the sample analysis to the target population (Masters et al. 1990). Techniques such as a
follow-up mailing, personalized cover letter, first-class outgoing mail, assurance of confidentiality and promise of a copy of results helped to increase response rates above the twenty percent range of other researchers in similar studies (Robertson and Gatignon 1989). However, since the mail questionnaire did not have a 100 percent response rate, non-response bias may still be a concern. The present research tested for non-response bias through 1) the comparison of early versus late respondents and 2) a comparison of nonrespondents versus respondents on key variables.

Comparison of Early versus Late Responses

The belief is that late respondents are characteristic of non-respondents. Therefore, if one can show that there is no statistically significant difference between early versus late respondents, non-response bias is assumed not to be a threat to extending the results to the target population.
All questionnaires were stamped with the date upon arrival. Comparing early responses about percentage of EDI adoption to late responses about percentage of EDI yielded a t-test of .872. This indicated that there was no significant difference in the percentage of fully on-line EDI between the early versus late respondents at the .05 level.

Comparison of Nonrespondents versus Respondents

In addition to performing the early versus late comparison, an additional method was used. The method supported by Lambert and Harrington (1990) involves sampling nonrespondents after the mailings are completed and comparing their responses to key questions with those respondents of the mail questionnaire. If no differences are observed between the two groups, the absence of nonresponse bias is inferred. If significant differences are observed between the two groups, caution should be used in extending results to the target population.
To test for the existence of nonresponse bias, a condensed one-page questionnaire containing all the key questions of interest was administered to a sample of thirty-two non-respondents over the telephone. The questionnaire was condensed to one page by selecting the 8 variables that had high internal consistency, as identified by Cronbach alpha. The condensed questionnaire can be found in Appendix C.

To test whether any statistically significant differences existed between the groups, t-statistics were used. Table 15 presents the mean and sample size for each measure.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Respondents Mean</th>
<th>Respondents N</th>
<th>Non-Respondents Mean</th>
<th>Non-Respondents N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of EDI Adoption</td>
<td>43.5</td>
<td>109</td>
<td>44%</td>
<td>32</td>
</tr>
<tr>
<td>Organizational Size</td>
<td>2.56</td>
<td>154</td>
<td>2.43</td>
<td>32</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>4.09</td>
<td>154</td>
<td>4.1</td>
<td>32</td>
</tr>
<tr>
<td>Industry Competitiveness</td>
<td>4.54</td>
<td>154</td>
<td>4.39</td>
<td>32</td>
</tr>
<tr>
<td>Demand Uncertainty</td>
<td>3.52</td>
<td>154</td>
<td>3.49</td>
<td>32</td>
</tr>
<tr>
<td>Shipper’s Influence (Power) over Carrier’s Customer Service</td>
<td>3.52</td>
<td>38</td>
<td>3.54</td>
<td>10</td>
</tr>
<tr>
<td>Carrier’s Influence (Power) over Shipper’s Customer Service</td>
<td>2.28</td>
<td>51</td>
<td>2.31</td>
<td>12</td>
</tr>
<tr>
<td>Customer’s Influence (Power) over Supplier’s Customer Service</td>
<td>2.92</td>
<td>51</td>
<td>2.87</td>
<td>12</td>
</tr>
<tr>
<td>Supplier’s Influence (Power) over Customer’s Customer Service</td>
<td>2.875</td>
<td>64</td>
<td>1.84</td>
<td>10</td>
</tr>
</tbody>
</table>
There were no statistically significant differences at the .05 level. Therefore, it was inferred that the results could be generalized to the target population.

Univariate Statistics of Variables

Univariate statistics, specifically means, standard deviations and frequencies, are presented in both aggregate form and by shipper, carrier and supplier groups (See Appendix D). A histogram of percentage of EDI adoption is presented in Figure 4.

Cronbach Alpha

The Cronbach alpha was used to test internal consistency of questionnaire responses, and to provide information about similarity in measurement across items. It was an appropriate test for inter-item consistency because the item measures were scored on a scale ranging from one to seven (Mueller 1986). Results of the Cronbach alpha are shown in Table 16.
Figure 4

Histogram of Percentage of EDI Adoption
Table 16

Reliability as Measured By Cronbach Alpha

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Initial Cronbach Alpha</th>
<th>Final Cronbach Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>organizational Size</td>
<td>.403</td>
<td>.665</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>.199</td>
<td>.724</td>
</tr>
<tr>
<td>Industry Competitiveness</td>
<td>.414</td>
<td>.794</td>
</tr>
<tr>
<td>Demand Uncertainty</td>
<td>.677</td>
<td>.677</td>
</tr>
<tr>
<td>Marketing Channel Power</td>
<td>.824</td>
<td>.824</td>
</tr>
<tr>
<td>Logistical Channel Power</td>
<td>.814</td>
<td>.814</td>
</tr>
</tbody>
</table>

Including all of the measures for organizational size yielded a Cronbach alpha of .403. However, by dropping two measures the Cronbach alpha was increased to .665. The measure indicates a relatively high level of internal consistency.
The initial Cronbach alpha for organizational structure was .199. By removing two measures the Cronbach alpha increased to an acceptable level of .724, indicating an adequate level of internal consistency.

The initial Cronbach alpha for industry competitiveness was .414. However, after removing two measures, the Cronbach alpha was raised to .794.

The Cronbach alpha for demand uncertainty .677, marketing channel power .824, and logistical channel power .814 had initial Cronbach alphas of acceptable levels (Briggs and Cheek 1986). Therefore, no measures of these constructs were dropped.

Any measure with a low contribution to Cronbach alpha was removed from the factor analysis.

Factor Analysis

Factor analysis can be used to determine the structure of constructs. The basic structure of a group of variables can be assessed by factor analyzing the measures. Factor analysis was performed on the data in this study for this
purpose primarily. The factor analysis technique was performed on each data set to determine if the variables demonstrated adequate levels of convergent and discriminant validity by loading on factors that could be interpreted as the eight constructs of interest.

Supplier Factor Analysis Findings

Based on an interpretation of prior research, the constructs of interest were assumed to be unidimensional. To assess the unidimensionality of the constructs of the supplier data set, a factor analysis was performed. Using the Scree plots and the eigenvalue of greater than one criterion, nine factors were retained. The nine factors were then rotated using varimax rotation to investigate whether a simple interpretable structure existed. Table 17 lists the measures and rotated factor loadings for the constructs of interest. The abbreviations F1, F2, F3, F4, F5, F6, F7, F8, and F9 represent Factor 1 through Factor 9.

As shown by Table 17, all of the high factor loadings for organizational size measures loaded on Factor 3.
Table 17
Supplier Factor Analysis

<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARKET SHARE</td>
<td>0.06</td>
<td>0.08</td>
<td>0.77</td>
<td>-0.07</td>
<td>0.00</td>
<td>-0.16</td>
<td>-0.23</td>
<td>-0.02</td>
<td>-0.16</td>
</tr>
<tr>
<td># EMPLOYEES</td>
<td>-0.16</td>
<td>-0.14</td>
<td>0.75</td>
<td>0.11</td>
<td>0.13</td>
<td>-0.08</td>
<td>0.20</td>
<td>0.07</td>
<td>0.11</td>
</tr>
<tr>
<td>PROFITABILITY</td>
<td>0.11</td>
<td>-0.23</td>
<td>0.41</td>
<td>-0.32</td>
<td>-0.28</td>
<td>-0.10</td>
<td>-0.04</td>
<td>-0.40</td>
<td>0.32</td>
</tr>
<tr>
<td>SALES REVENUE</td>
<td>0.04</td>
<td>-0.06</td>
<td>0.90</td>
<td>-0.01</td>
<td>-0.13</td>
<td>0.14</td>
<td>0.07</td>
<td>0.05</td>
<td>0.40</td>
</tr>
<tr>
<td>CENTRALIZED</td>
<td>-0.13</td>
<td>-0.01</td>
<td>0.04</td>
<td>0.89</td>
<td>-0.13</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>VOLATILITY</td>
<td>0.05</td>
<td>0.04</td>
<td>0.15</td>
<td>0.04</td>
<td>0.17</td>
<td>0.03</td>
<td>-0.04</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>DECISION FLOW</td>
<td>-0.20</td>
<td>-0.16</td>
<td>-0.05</td>
<td>0.86</td>
<td>-0.09</td>
<td>0.17</td>
<td>-0.03</td>
<td>-0.10</td>
<td>-0.00</td>
</tr>
<tr>
<td>CHANGING CUSTOMERS</td>
<td>-0.21</td>
<td>-0.04</td>
<td>-0.11</td>
<td>0.01</td>
<td>-0.02</td>
<td>0.65</td>
<td>-0.06</td>
<td>0.37</td>
<td>0.13</td>
</tr>
<tr>
<td># COMPETITORS</td>
<td>0.08</td>
<td>-0.10</td>
<td>-0.01</td>
<td>-0.10</td>
<td>-0.17</td>
<td>0.18</td>
<td>0.79</td>
<td>0.33</td>
<td>0.05</td>
</tr>
<tr>
<td>ENTERING COMPETITION</td>
<td>0.13</td>
<td>-0.01</td>
<td>0.02</td>
<td>0.15</td>
<td>0.06</td>
<td>0.83</td>
<td>0.11</td>
<td>-0.11</td>
<td>-0.13</td>
</tr>
<tr>
<td>EDI CHAMPION</td>
<td>-0.32</td>
<td>0.01</td>
<td>0.16</td>
<td>0.08</td>
<td>0.14</td>
<td>-0.03</td>
<td>0.55</td>
<td>-0.44</td>
<td>-0.66</td>
</tr>
<tr>
<td>STABLE/UNSTABLE</td>
<td>0.09</td>
<td>-0.02</td>
<td>-0.02</td>
<td>-0.6</td>
<td>0.83</td>
<td>0.13</td>
<td>-0.02</td>
<td>0.33</td>
<td>0.09</td>
</tr>
<tr>
<td>CERTAIN/UNCERTAIN</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.15</td>
<td>0.86</td>
<td>-0.25</td>
<td>-0.15</td>
<td>-0.08</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>FORECAST SALES</td>
<td>0.28</td>
<td>-0.13</td>
<td>-0.02</td>
<td>0.12</td>
<td>0.21</td>
<td>0.35</td>
<td>0.09</td>
<td>0.05</td>
<td>0.10</td>
</tr>
</tbody>
</table>

Table 17 (continued)

<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>(L) PAYMENT POLICY INFLUENCE</td>
<td>0.17</td>
<td>0.06</td>
<td>0.21</td>
<td>-0.11</td>
<td>0.23</td>
<td>0.47</td>
<td>-0.55</td>
<td>-0.21</td>
<td>0.09</td>
</tr>
<tr>
<td>(S) PAYMENT POLICY INFLUENCE</td>
<td>-0.25</td>
<td>0.59</td>
<td>-0.06</td>
<td>-0.07</td>
<td>0.01</td>
<td>0.24</td>
<td>-0.54</td>
<td>0.14</td>
<td>0.06</td>
</tr>
<tr>
<td>(L) INFLUENCE OVER INVENTORY</td>
<td>0.75</td>
<td>0.12</td>
<td>-0.11</td>
<td>-0.30</td>
<td>0.04</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.15</td>
<td>0.10</td>
</tr>
<tr>
<td>(S) INFLUENCE OVER INVENTORY</td>
<td>0.21</td>
<td>0.67</td>
<td>-0.09</td>
<td>-0.35</td>
<td>-0.23</td>
<td>-0.24</td>
<td>0.02</td>
<td>0.19</td>
<td>0.04</td>
</tr>
<tr>
<td>(L) CUSTOMER SERVICE INFLUENCE</td>
<td>0.69</td>
<td>0.04</td>
<td>0.08</td>
<td>-0.14</td>
<td>0.05</td>
<td>0.02</td>
<td>-0.04</td>
<td>-0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>(S) CUSTOMER SERVICE INFLUENCE</td>
<td>0.48</td>
<td>0.59</td>
<td>-0.04</td>
<td>-0.27</td>
<td>-0.02</td>
<td>-0.15</td>
<td>-0.08</td>
<td>-0.08</td>
<td>-0.02</td>
</tr>
<tr>
<td>(L) INFLUENCE OVER PURCHASE</td>
<td>0.59</td>
<td>0.60</td>
<td>-0.04</td>
<td>0.16</td>
<td>0.08</td>
<td>0.14</td>
<td>0.12</td>
<td>-0.11</td>
<td>-0.05</td>
</tr>
<tr>
<td>(S) INFLUENCE OVER PURCHASE</td>
<td>0.03</td>
<td>0.90</td>
<td>-0.04</td>
<td>-0.05</td>
<td>0.04</td>
<td>0.01</td>
<td>-0.14</td>
<td>0.01</td>
<td>0.12</td>
</tr>
<tr>
<td>INTEGRITY</td>
<td>0.38</td>
<td>0.05</td>
<td>-0.11</td>
<td>0.11</td>
<td>0.05</td>
<td>0.19</td>
<td>0.02</td>
<td>0.07</td>
<td>0.73</td>
</tr>
</tbody>
</table>

'Channel Power = (L and S) Payment Policy, (L and S) Influence Over Inventory, (L and S) Customer Service Influence, (L and S) Influence Over Purchases Organizational Integrity = Integrity
Therefore, factor 3 was interpreted as organizational size. All of the measures of organizational structure loaded on factor 4. Therefore, factor 4 was interpreted as organizational structure.

For measures of industry competitiveness one measure loaded on factor 7, but another measure loaded on factor 6. Thus, no single factor could be interpreted as industry competitiveness. Although two of the five measures of demand uncertainty loaded on factor 5, the other three loaded on other factors. The measures of the construct did not clearly and separately load on one factor. Thus, there was no clear factor interpretation for demand uncertainty.

When responding to channel power statements the respondents were asked to select two channel members, one that represented a large part of their business and one that represented a small part of the respondents business. Therefore, large and small used here are not measures of size, but rather are an indication of the trading partner's importance to the respondent.
Three of the measures of large channel power clearly loaded on factor 1, however, since the other measures did not clearly and separately load on factor 1, factor 1 could not be interpreted as channel power. Three of the four measures of small channel power loaded on factor 2. However, since the other measure loaded on another factor, factor 2 could not be interpreted as small channel power.

The individual measure of an EDI champion had a factor loading of .55 on factor 7. The measure of organizational integrity for the supplier group had a factor loading of .73 on factor 9. Length of relationship, although not presented in the table, had a factor loading of .64 on factor 9. Since factors 7 and 9 also had high factor loadings from other variables, neither factor 7 and 9 could be interpreted as EDI champion, organizational integrity, or length of relationship, respectively.
Customer Factor Analysis Findings

Using the Scree plots and the eigenvalue of greater than one criterion, eight factors were retained. The eight factors were then rotated using varimax rotation to investigate whether a simple interpretable structure existed. Table 18 lists the measures and rotated factor loadings for the constructs of interest. The abbreviations F1, F2, F3, F4, F5, F6, F7, and F8 represent Factor 1 through Factor 8.

Table 18 shows the rotated factor loadings for the measures of organizational size. The four measures of organizational size were scattered across four factors. Therefore, none of the factors could be interpreted as organizational size. However, since both measures of organizational structure loaded on factor 4, and no other construct measures loaded on factor 4, factor 4 was interpreted as organizational structure. The table also lists the rotated factor loadings for industry competitiveness measures. Since both measures of industry competitiveness and a measure of demand uncertainty loaded
<table>
<thead>
<tr>
<th>STATMENTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARKET SHARE</td>
<td>0.04</td>
<td>0.34</td>
<td>0.08</td>
<td>-0.06</td>
<td>0.01</td>
<td>-0.09</td>
<td>0.07</td>
<td>-0.20</td>
</tr>
<tr>
<td># EMPLOYEES</td>
<td>0.04</td>
<td>0.11</td>
<td>-0.01</td>
<td>0.08</td>
<td>0.08</td>
<td>0.10</td>
<td>0.38</td>
<td>-0.21</td>
</tr>
<tr>
<td>PROFITABILITY</td>
<td>-0.10</td>
<td>0.41</td>
<td>0.05</td>
<td>0.12</td>
<td>-0.06</td>
<td>0.19</td>
<td>-0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>SALES REVENUE</td>
<td>-0.01</td>
<td>0.33</td>
<td>0.02</td>
<td>0.05</td>
<td>0.02</td>
<td>-0.07</td>
<td>-0.07</td>
<td>0.04</td>
</tr>
<tr>
<td>CENTRALIZED</td>
<td>0.03</td>
<td>0.07</td>
<td>-0.03</td>
<td>0.34</td>
<td>0.00</td>
<td>-0.11</td>
<td>0.02</td>
<td>-0.07</td>
</tr>
<tr>
<td>VOLATILITY</td>
<td>0.12</td>
<td>-0.12</td>
<td>0.10</td>
<td>0.20</td>
<td>0.18</td>
<td>-0.06</td>
<td>-0.18</td>
<td>-0.02</td>
</tr>
<tr>
<td>DECISION FLOW</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.08</td>
<td>0.42</td>
<td>-0.07</td>
<td>0.10</td>
<td>-0.04</td>
<td>0.11</td>
</tr>
<tr>
<td>CHANGING CUSTOMS</td>
<td>0.13</td>
<td>0.02</td>
<td>0.10</td>
<td>0.14</td>
<td>0.30</td>
<td>-0.05</td>
<td>0.05</td>
<td>0.00</td>
</tr>
<tr>
<td># COMPETITORS</td>
<td>0.86</td>
<td>0.01</td>
<td>0.03</td>
<td>0.06</td>
<td>0.41</td>
<td>-0.10</td>
<td>-0.17</td>
<td>0.20</td>
</tr>
<tr>
<td>ENTERING COMPETITION</td>
<td>-0.05</td>
<td>-0.06</td>
<td>-0.13</td>
<td>-0.12</td>
<td>0.40</td>
<td>0.20</td>
<td>0.13</td>
<td>-0.00</td>
</tr>
<tr>
<td>EDI CHAMPION</td>
<td>-0.03</td>
<td>0.00</td>
<td>-0.10</td>
<td>0.03</td>
<td>0.12</td>
<td>0.02</td>
<td>-0.07</td>
<td>0.62</td>
</tr>
<tr>
<td>STABLE/UNSTABLE</td>
<td>0.05</td>
<td>0.05</td>
<td>0.46</td>
<td>-0.05</td>
<td>-0.03</td>
<td>-0.12</td>
<td>-0.14</td>
<td>-0.10</td>
</tr>
<tr>
<td>CERTAIN/UNCERTAIN</td>
<td>-0.06</td>
<td>0.02</td>
<td>0.41</td>
<td>-0.14</td>
<td>-0.04</td>
<td>0.09</td>
<td>0.12</td>
<td>-0.05</td>
</tr>
<tr>
<td>FORECAST SALES</td>
<td>-0.13</td>
<td>0.07</td>
<td>0.15</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.47</td>
<td>0.04</td>
<td>0.03</td>
</tr>
</tbody>
</table>

1 Organizational size = Market Share, # Employees, Profitability, Sales Revenue.
Organizational Structure = Decision Flow, Centralized.
Industry Competitiveness = # Competitors, Entering Competition.
Demand Uncertainty = Stable/Unstable, Certain/Uncertain, Forecast Sales, Changing Customers, Volatility.
Table 18 (continued)

<table>
<thead>
<tr>
<th>Statements'</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
</tr>
</thead>
<tbody>
<tr>
<td>(L) Payment</td>
<td>0.10</td>
<td>0.03</td>
<td>0.07</td>
<td>0.10</td>
<td>-0.24</td>
<td>0.14</td>
<td>0.11</td>
<td>0.17</td>
</tr>
<tr>
<td>Policy Influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S) Payment</td>
<td>0.12</td>
<td>-0.14</td>
<td>-0.08</td>
<td>0.14</td>
<td>-0.17</td>
<td>0.09</td>
<td>0.12</td>
<td>0.25</td>
</tr>
<tr>
<td>Policy Influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L) Influence</td>
<td>0.16</td>
<td>0.03</td>
<td>0.10</td>
<td>-0.13</td>
<td>0.02</td>
<td>-0.15</td>
<td>0.13</td>
<td>0.17</td>
</tr>
<tr>
<td>Over Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S) Influence</td>
<td>0.21</td>
<td>-0.01</td>
<td>0.19</td>
<td>-0.24</td>
<td>0.02</td>
<td>-0.20</td>
<td>-0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Over Inventory</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L) Customer</td>
<td>0.08</td>
<td>-0.06</td>
<td>-0.08</td>
<td>-0.05</td>
<td>0.04</td>
<td>0.33</td>
<td>-0.01</td>
<td>-0.07</td>
</tr>
<tr>
<td>Service Influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S) Customer</td>
<td>0.12</td>
<td>-0.06</td>
<td>-0.08</td>
<td>-0.05</td>
<td>0.08</td>
<td>0.27</td>
<td>-0.06</td>
<td>-0.05</td>
</tr>
<tr>
<td>Service Influence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(L) Influence</td>
<td>0.27</td>
<td>0.05</td>
<td>-0.05</td>
<td>0.13</td>
<td>0.09</td>
<td>-0.10</td>
<td>-0.03</td>
<td>-0.07</td>
</tr>
<tr>
<td>Over Purchase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S) Influence</td>
<td>0.29</td>
<td>-0.02</td>
<td>-0.01</td>
<td>0.03</td>
<td>0.02</td>
<td>-0.14</td>
<td>-0.14</td>
<td>-0.18</td>
</tr>
<tr>
<td>Over Purchase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrity</td>
<td>-0.06</td>
<td>-0.11</td>
<td>-0.03</td>
<td>-0.07</td>
<td>-0.08</td>
<td>0.02</td>
<td>0.58</td>
<td>0.03</td>
</tr>
</tbody>
</table>

'Channel Power = (L and S) Payment Policy, (L and S) Influence Over Inventory,
(L and S) Customer Service Influence, (L and S) Influence Over Purchases
Organizational Integrity = Integrity
on factor 5, it could not be interpreted as industry competitiveness. Since all measures of channel power clearly and separately loaded on factor 1, it was interpreted as channel power.

The individual measure of an EDI champion had a factor loading of .83 on factor 8. The measure of organizational integrity for the supplier group had a factor loading of .84 on factor 7. Length of relationship had a factor loading of .58 on factor 7. However, since factors 7 and 8 also had high factor loadings from other variables, they could not be interpreted as EDI champion, organizational integrity or length of relationship.

Shipper Factor Analysis Findings

The factor analysis of the shipper data set are shown below. Using the eigenvalue greater than one criterion (Rummel 1970) and Scree plots, the number of factors in the shipper data set was determined to be 9. After the number of factors had been determined the factor were rotated with varimax rotation to aid in factor interpretation.
Table 19 lists the rotated factor loadings for the measures of organizational size, organizational structure, industry competitiveness, demand uncertainty and channel power. The factor loading for the role of an EDI champion, length of relationship, and organizational integrity are also presented in this section.

All rotated factor loadings for measures of organizational size loaded on factor 2, indicating that factor 2 can be interpreted as organizational size. Both measures of organizational structure loaded on factor 5, indicating that factor 5 could be interpreted as organizational structure. However, the lack of clear factor loadings for measures of industry competitiveness, demand uncertainty and channel power made these factors uninterpretable.

The individual measure of an EDI champion had a factor loading of -.76 on factor 6. The measure of organizational integrity for the supplier group had a factor loading of -.68 on factor 9. Length of relationship, although not shown, had a factor loading of .83 on factor 9.
Table 19

Shippers' Factor Analysis

<table>
<thead>
<tr>
<th>Statements</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Share</td>
<td>0.14</td>
<td>0.65</td>
<td>-0.04</td>
<td>-0.16</td>
<td>0.05</td>
<td>-0.02</td>
<td>-0.18</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td># Employees</td>
<td>0.06</td>
<td>0.75</td>
<td>-0.02</td>
<td>0.10</td>
<td>0.01</td>
<td>-0.16</td>
<td>-0.09</td>
<td>0.06</td>
<td>-0.04</td>
</tr>
<tr>
<td>Profitability</td>
<td>-0.14</td>
<td>0.48</td>
<td>0.06</td>
<td>-0.17</td>
<td>-0.26</td>
<td>-0.05</td>
<td>-0.07</td>
<td>-0.46</td>
<td>-0.12</td>
</tr>
<tr>
<td>Sales Revenue</td>
<td>0.13</td>
<td>0.92</td>
<td>0.02</td>
<td>-0.04</td>
<td>-0.02</td>
<td>0.11</td>
<td>0.10</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td>Centralized</td>
<td>0.01</td>
<td>0.08</td>
<td>-0.02</td>
<td>-0.05</td>
<td>0.89</td>
<td>-0.10</td>
<td>0.01</td>
<td>0.21</td>
<td>-0.09</td>
</tr>
<tr>
<td>Volatility</td>
<td>-0.10</td>
<td>0.16</td>
<td>0.01</td>
<td>0.05</td>
<td>0.14</td>
<td>0.06</td>
<td>0.02</td>
<td>0.84</td>
<td>0.08</td>
</tr>
<tr>
<td>Decision Flow</td>
<td>-0.09</td>
<td>0.01</td>
<td>0.09</td>
<td>0.02</td>
<td>0.86</td>
<td>0.01</td>
<td>0.16</td>
<td>-0.03</td>
<td>-0.10</td>
</tr>
<tr>
<td>Changing Customers</td>
<td>0.09</td>
<td>-0.04</td>
<td>-0.19</td>
<td>0.06</td>
<td>-0.61</td>
<td>0.09</td>
<td>0.65</td>
<td>0.46</td>
<td>-0.24</td>
</tr>
<tr>
<td># Competitors</td>
<td>-0.25</td>
<td>0.08</td>
<td>0.36</td>
<td>0.10</td>
<td>-0.26</td>
<td>-0.44</td>
<td>0.28</td>
<td>0.01</td>
<td>0.51</td>
</tr>
<tr>
<td>Entering Competition</td>
<td>0.28</td>
<td>-0.09</td>
<td>-0.08</td>
<td>0.08</td>
<td>0.22</td>
<td>-0.01</td>
<td>0.85</td>
<td>-0.07</td>
<td>0.01</td>
</tr>
<tr>
<td>EDI Champion</td>
<td>0.14</td>
<td>0.07</td>
<td>0.02</td>
<td>0.00</td>
<td>0.01</td>
<td>-0.76</td>
<td>0.06</td>
<td>-0.23</td>
<td>-0.01</td>
</tr>
<tr>
<td>Stable/Unstable</td>
<td>-0.21</td>
<td>0.07</td>
<td>0.06</td>
<td>0.70</td>
<td>-0.07</td>
<td>-0.07</td>
<td>0.17</td>
<td>0.16</td>
<td>-0.05</td>
</tr>
<tr>
<td>Certain/Uncertain</td>
<td>0.08</td>
<td>-0.06</td>
<td>-0.18</td>
<td>0.83</td>
<td>-0.09</td>
<td>-0.15</td>
<td>-0.11</td>
<td>-0.11</td>
<td>-0.18</td>
</tr>
<tr>
<td>Forecast Sales</td>
<td>-0.12</td>
<td>-0.18</td>
<td>-0.10</td>
<td>0.62</td>
<td>0.20</td>
<td>0.28</td>
<td>0.27</td>
<td>0.04</td>
<td>0.26</td>
</tr>
</tbody>
</table>

1 Organizational size = Market Share, # Employees, Profitability, Sales Revenue.
Organizational Structure = Decision Flow, Centralized.
Industry Competitiveness = # Competitors, Entering Competition.
Demand Uncertainty = Stable/Unstable, Certain/Uncertain, Forecast Sales, Changing Customers, Volatility.
<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>(L) PAYMENT POLICY INFLUENCE</td>
<td>0.23</td>
<td>0.25</td>
<td>0.24</td>
<td>-0.12</td>
<td>-0.13</td>
<td>0.72</td>
<td>0.21</td>
<td>-0.15</td>
<td>0.02</td>
</tr>
<tr>
<td>(S) PAYMENT POLICY INFLUENCE</td>
<td>0.07</td>
<td>0.07</td>
<td>0.31</td>
<td>0.16</td>
<td>-0.04</td>
<td>0.55</td>
<td>-0.08</td>
<td>-0.16</td>
<td>0.60</td>
</tr>
<tr>
<td>(L) INFLUENCE OVER RATES</td>
<td>0.85</td>
<td>0.22</td>
<td>0.02</td>
<td>-0.25</td>
<td>-0.05</td>
<td>0.16</td>
<td>0.14</td>
<td>-0.05</td>
<td>0.07</td>
</tr>
<tr>
<td>(S) INFLUENCE OVER RATES</td>
<td>0.69</td>
<td>-0.03</td>
<td>-0.10</td>
<td>-0.18</td>
<td>-0.07</td>
<td>0.09</td>
<td>-0.08</td>
<td>-0.22</td>
<td>0.34</td>
</tr>
<tr>
<td>(L) CUSTOMER SERVICE INFLUENCE</td>
<td>0.87</td>
<td>0.15</td>
<td>0.22</td>
<td>0.02</td>
<td>-0.09</td>
<td>-0.01</td>
<td>0.10</td>
<td>0.04</td>
<td>-0.08</td>
</tr>
<tr>
<td>(S) CUSTOMER SERVICE INFLUENCE</td>
<td>0.84</td>
<td>0.13</td>
<td>0.27</td>
<td>0.20</td>
<td>-0.01</td>
<td>-0.14</td>
<td>-0.10</td>
<td>0.04</td>
<td>-0.06</td>
</tr>
<tr>
<td>(L) INFLUENCE OVER PURCHASE</td>
<td>0.16</td>
<td>-0.12</td>
<td>0.87</td>
<td>-0.21</td>
<td>-0.03</td>
<td>0.07</td>
<td>-0.01</td>
<td>-0.08</td>
<td>-0.00</td>
</tr>
<tr>
<td>(S) INFLUENCE OVER PURCHASE</td>
<td>0.19</td>
<td>-0.10</td>
<td>0.86</td>
<td>0.02</td>
<td>0.13</td>
<td>0.12</td>
<td>-0.21</td>
<td>0.06</td>
<td>-0.00</td>
</tr>
<tr>
<td>INTEGRITY</td>
<td>-0.18</td>
<td>0.04</td>
<td>0.17</td>
<td>0.23</td>
<td>0.25</td>
<td>0.00</td>
<td>0.18</td>
<td>-0.24</td>
<td>-0.68</td>
</tr>
</tbody>
</table>

1 Channel Power = (L and S) Payment Policy, (L and S) Influence Over Inventory, (L and S) Customer Service Influence, (L and S) Influence Over Purchases
Organizational Integrity = Integrity
Since factors 6 and 9 also had high factor loadings from other variables, they could not be interpreted as EDI champion, organizational integrity or length of relationship.

**Carrier Factor Analysis Findings**

Using the eigenvalue of greater than one criterion and Scree plots, eight factors were retained. The eight factors were then rotated using varimax rotation to investigate whether a simple interpretable structure existed. Table 20 lists the measures and rotated factor loadings for the constructs of interest.

The rotated factor loadings for the measures of organizational size, organizational structure, industry competitiveness, demand uncertainty and channel power, respectively, revealed that no clear interpretable factors existed for the constructs.
Table 20

Carrier Factor Analysis

<table>
<thead>
<tr>
<th>Statements</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>MARKET SHARE</td>
<td>0.05</td>
<td>0.26</td>
<td>-0.02</td>
<td>-0.02</td>
<td>0.04</td>
<td>0.00</td>
<td>-0.05</td>
<td>0.04</td>
<td>0.04</td>
</tr>
<tr>
<td># EMPLOYEES</td>
<td>-0.02</td>
<td>0.34</td>
<td>-0.06</td>
<td>0.10</td>
<td>0.07</td>
<td>-0.04</td>
<td>-0.06</td>
<td>-0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>PROFITABILITY</td>
<td>-0.14</td>
<td>0.25</td>
<td>0.06</td>
<td>-0.11</td>
<td>-0.11</td>
<td>0.01</td>
<td>0.06</td>
<td>-0.27</td>
<td>-0.01</td>
</tr>
<tr>
<td>SALES REVENUE</td>
<td>-0.06</td>
<td>0.44</td>
<td>0.05</td>
<td>0.04</td>
<td>-0.02</td>
<td>0.00</td>
<td>0.10</td>
<td>-0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>CENTRALIZED</td>
<td>0.02</td>
<td>0.02</td>
<td>-0.00</td>
<td>-0.06</td>
<td>0.47</td>
<td>-0.06</td>
<td>-0.06</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>VOLATILITY</td>
<td>-0.03</td>
<td>0.06</td>
<td>0.05</td>
<td>-0.07</td>
<td>0.00</td>
<td>0.01</td>
<td>-0.06</td>
<td>0.57</td>
<td>0.04</td>
</tr>
<tr>
<td>DECISION FLOW</td>
<td>-0.03</td>
<td>0.03</td>
<td>0.05</td>
<td>0.00</td>
<td>0.47</td>
<td>-0.00</td>
<td>0.06</td>
<td>-0.12</td>
<td>0.04</td>
</tr>
<tr>
<td>CHANGING CUSTOMERS</td>
<td>0.06</td>
<td>-0.01</td>
<td>-0.05</td>
<td>-0.09</td>
<td>-0.16</td>
<td>-0.4</td>
<td>0.38</td>
<td>0.28</td>
<td>-0.19</td>
</tr>
<tr>
<td># COMPETITORS</td>
<td>-0.13</td>
<td>0.09</td>
<td>0.24</td>
<td>0.02</td>
<td>-0.10</td>
<td>-0.33</td>
<td>0.27</td>
<td>-0.01</td>
<td>0.40</td>
</tr>
<tr>
<td>ENTERING COMPETITION</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.03</td>
<td>0.08</td>
<td>-0.05</td>
<td>0.56</td>
<td>-0.16</td>
<td>0.08</td>
</tr>
<tr>
<td>EDI CHAMPION</td>
<td>0.07</td>
<td>-0.00</td>
<td>0.04</td>
<td>0.01</td>
<td>0.01</td>
<td>-0.44</td>
<td>0.10</td>
<td>-0.15</td>
<td>0.09</td>
</tr>
<tr>
<td>STABLE/UNSTABLE</td>
<td>-0.05</td>
<td>0.10</td>
<td>0.11</td>
<td>0.32</td>
<td>-0.10</td>
<td>-0.02</td>
<td>0.04</td>
<td>0.16</td>
<td>-0.04</td>
</tr>
<tr>
<td>CERTAIN/UNCERTAIN</td>
<td>0.10</td>
<td>-0.00</td>
<td>-0.07</td>
<td>0.47</td>
<td>-0.05</td>
<td>-0.02</td>
<td>-0.14</td>
<td>-0.16</td>
<td>-0.12</td>
</tr>
<tr>
<td>FORECAST SALES</td>
<td>-0.01</td>
<td>-0.01</td>
<td>-0.06</td>
<td>0.31</td>
<td>0.12</td>
<td>0.14</td>
<td>0.10</td>
<td>-0.11</td>
<td>0.24</td>
</tr>
</tbody>
</table>

1 Organizational size = Market Share, # Employees, Profitability, Sales Revenue.
Organizational Structure = Decision Flow, Centralized.
Industry Competitiveness = # Competitors, Entering Competition.
Demand Uncertainty = Stable/Unstable, Certain/Uncertain, Forecast Sales, Changing Customers, Volatility.
<table>
<thead>
<tr>
<th>Statements</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>F9</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Payment Policy Influence</td>
<td>0.01</td>
<td>0.05</td>
<td>-0.02</td>
<td>0.08</td>
<td>-0.08</td>
<td>0.09</td>
<td>-0.09</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>(2) Payment Policy Influence Over Rate</td>
<td>-0.04</td>
<td>0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.15</td>
<td>0.15</td>
<td>-0.04</td>
<td>-0.02</td>
<td></td>
</tr>
<tr>
<td>(3) Influence over Rate</td>
<td>0.27</td>
<td>-0.10</td>
<td>-0.16</td>
<td>-0.03</td>
<td>0.17</td>
<td>-0.02</td>
<td>0.04</td>
<td>0.11</td>
<td></td>
</tr>
<tr>
<td>(4) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(5) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(6) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(7) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(8) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(9) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(10) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(11) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(12) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(13) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(14) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(15) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(16) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(17) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(18) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
<tr>
<td>(19) Influence over Rate</td>
<td>0.29</td>
<td>-0.09</td>
<td>-0.09</td>
<td>0.02</td>
<td>-0.04</td>
<td>0.04</td>
<td>-0.04</td>
<td>-0.04</td>
<td></td>
</tr>
<tr>
<td>(20) Influence over Rate</td>
<td>0.02</td>
<td>-0.01</td>
<td>-0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
<td></td>
</tr>
</tbody>
</table>
The individual measure of an EDI champion had a factor loading of .75 on factor 8. The measure of organizational integrity and length of relationship had factor loadings of .57 and .69, respectively. Since factors 3 and 8 also had high factor loadings from other variables they could not be interpreted as EDI champion, organizational integrity or length of relationship.

**Composite Score Calculations**

When interpretable factors were found in the data set, composite scores were calculated using the Cattell (1957) approach. Following this approach, measures that had high convergent and discriminant validity were summed. The summed variables represented the factor score estimate. The composite score was then included to develop the regression models.

When composite score estimates were not possible due to scattered factor loadings, the individual measures were used in the regression model development. Thus, regression models
were developed based upon both composite scores and individual measures.

Regression Model Development

The Forward Stepwise regression technique was used to develop regression models. The Forward Stepwise regression technique inserts variables into a regression model until a satisfactory regression equation is reached. The order of insertion is determined based upon the partial coefficient. The partial coefficient determines the importance of variables not yet in the equation.

The results of the Forward Stepwise regression technique will be discussed below. Each model was used to test the research hypotheses.
Marketing Channel Regression Models

In this research the marketing channel represented the perceptions of suppliers and customers. Thus, in discussing the results from the mail questionnaire it is necessary to present the model resulting from suppliers and then discuss the model from the customer responses.

Suppliers Multiple Regression Model

Performing Stepwise regression on all measures, both theoretically founded and interview supported, resulted in the following supplier regression model. The supplier multiple regression model was found to be significant at the .05 level.

\[ Y_1 = 14.29 + 1.63X_1 + 12.5X_2 \]

\[ P < F = .0070 \quad R^2 = .26 \quad n = 35 \]

\( Y_1 \) = Percentage of customers with whom suppliers share information via EDI

14.29 = Intercept

\( X_1 \) = Composite Score of Supplier Size

\( X_2 \) = Individual Measure of Demand Uncertainty
Using a 2-tailed test, the Betas were significant at the .05 level. The supplier size composite score increases adoption by 1.63 if the value for demand uncertainty is held constant. Likewise, if the value for supplier size is held constant the percentage of EDI adoption increases by 12.5.

**Customer Regression Model**

Performing Stepwise regression on the responses from customers in the marketing channel resulted in the following model. The Customer Multiple Regression Model was found to be significant at the .05 level.

\[ Y_1 = 51.88 + 12.26X_1 \]

\[ P < F = .05 \quad R^2 = .09 \quad n = 40 \]

\( Y_1 \) = Percentage of customers with whom buyers share information via EDI.

51.88 = Intercept

\( X_1 \) = Individual Measure of Demand Uncertainty
Using a 2-tailed test, the Beta was found significant at the .05 level. The beta for \( X \), increases the percentage of adoption by 12.26 for every unit increase in the measure of demand uncertainty.

Logistical Channel Regression Models

The present research investigated adoption within the logistical channel by analyzing the perceptions of shippers and carriers. Thus, in discussing the results from the mail questionnaire it is necessary to present the model resulting from shipper responses and then discuss the model from the carrier responses.

Shipper Regression Model

The following shipper model was obtained from the Stepwise regression technique. The Shipper Multiple Regression Model was found to be significant at the .05 level.
\[ Y_1 = 42.56 + 12.11X_i \]

\[ P < F = .0459 \quad R^2 = .12 \quad n = 32 \]

\( Y_1 \) = Percentage of customers with whom shippers share information via EDI

42.56 = Intercept

\( X_i \) = Individual Channel Power Measure

Using a 2-tailed test, the Beta was found significant at the .05 level. The beta for \( X_i \) increases the percentage of adoption by 12.26 for every unit increase in the measure of channel power.
Carrier Regression Model

Using the Forward Stepwise regression technique on carrier data set resulted in the following regression model. The regression model was significant at the .05 level.

\[ Y_1 = 59.6 + 6.77X_1 - 14.4X_2 \]

\[ P < F = .013 \quad R^2 = 29.3\% \quad n = 27 \]

\( Y_1 \) = Percentage of customers with whom suppliers share information via EDI.

59.6 = Intercept

6.77\( X_1 \) = Individual Measure of Industry Competitiveness

-14.4\( X_2 \) = Individual Measure of Channel Power

A 2-tailed test was used to test the significance of the Betas. Both betas were found to be significant at the .05 level. The measure of industry competitiveness increases adoption by 6.77 if the value for channel power is held constant. According to the sign on the Beta, as carriers loose power in the channel, the adoption percentage
increases by 14.4, if industry competitiveness is held constant.

Summary Of Hypotheses Testing

Table 21 presents the findings from the hypotheses testing in relation to the predicted hypotheses. Therefore, a supported hypothesis indicates support of the predicted hypothesis.

From the table, one can see that in both the supplier and customer models demand uncertainty significantly explained variance in interorganizational EDI adoption. Organizational size was also found to significantly explain interorganizational EDI adoption. As suggested by the research, demand uncertainty was also found to significantly explain interorganizational EDI adoption. The sign on the Beta indicates that large organizational firms are operating in uncertain markets. Such firms are expected to have the investment capital for EDI implementation and external uncertainty that would cause them to adopt EDI as a strategy to reduce uncertainty in the channel.
The findings from testing the logistical channels hypotheses indicate that channel power significantly explains variance in adoption at the .05 level. The logistical channel is characterized by a different set of variables. Channel power is a characteristic of logistical channels. The power between shippers and carriers significantly explained the variance in adoption.
<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Supplier</th>
<th>Customer</th>
<th>Shipper</th>
<th>Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Size</td>
<td>Support</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
<tr>
<td>Industry Competitiveness</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
<td>Support</td>
</tr>
<tr>
<td>Demand Uncertainty</td>
<td>Support</td>
<td>Support</td>
<td>Reject</td>
<td>Reject</td>
</tr>
<tr>
<td>Channel Power</td>
<td>Reject</td>
<td>Reject</td>
<td>Support</td>
<td>Support</td>
</tr>
<tr>
<td>EDI Champion</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
<tr>
<td>Length of Relationship</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
<tr>
<td>Organizational Integrity</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
<td>Reject</td>
</tr>
</tbody>
</table>
Differentiating EDI Usage

In an effort to determine if variables were able to differentiate high users of EDI from low users of EDI, the data was divided into three equal partitions. The high and low users were then compared using cross tabulations to determine if any of the construct measures helped to discriminate between EDI usage rates. The findings of this analysis are presented in Appendix E. Although differences between user groups are not statistically significant at the .05 level, the discrimination between high and low EDI users does indicate characteristics of EDI users.

According to the mean responses presented in the appendix, high users of EDI perceive themselves as operating in more uncertain markets. High users of EDI also appear to be larger than low users of EDI.
Section III. Additional Findings

The information presented in this section is designed to augment the findings from hypotheses testing. The following section provides additional information about EDI-adopting channels. In particular other findings about the EDI adoption process, the nature of EDI relationships, the reasons for adoption, and practical implications of adoption are presented in this section.

The EDI Adoption Process

To explore the adoption process within customer, carrier and shipper/supplier organizations, respondents were asked to provide information about four stages of adoption. As a starting point, it seems appropriate to identify the dates of adoption. According to the data presented in Tables 25, 26, and 27 the dates of EDI adoption indicate that it is a relatively new phenomenon. No one was fully operational prior to 1979 and most respondents did not begin to even
consider EDI until 1985. This information is interesting given that the technology for EDI has been around since the 1960’s (Emmelhainz 1990). This is an indication that organizations did not adopt EDI for the sake of adopting a new technology; instead, it appears organizations were resistant until they were able to see the benefits of adopting (Norris 1990).
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitted By EDI</td>
<td>(Cumulative Frequency)</td>
<td>(Cumulative Frequency)</td>
<td>(Mean)</td>
<td>(Mean)</td>
</tr>
<tr>
<td>Fre3 hse Ord</td>
<td>82</td>
<td>73</td>
<td>34%</td>
<td>72%</td>
</tr>
<tr>
<td>Fund Trnfr</td>
<td>46</td>
<td>33</td>
<td>39%</td>
<td>67%</td>
</tr>
<tr>
<td>Remittance</td>
<td>47</td>
<td>37</td>
<td>52%</td>
<td>74%</td>
</tr>
<tr>
<td>B. Lading</td>
<td>48</td>
<td>38</td>
<td>29%</td>
<td>79%</td>
</tr>
<tr>
<td>A Shp Not</td>
<td>57</td>
<td>43</td>
<td>36%</td>
<td>74%</td>
</tr>
<tr>
<td>Wnse Info</td>
<td>53</td>
<td>43</td>
<td>32%</td>
<td>74%</td>
</tr>
<tr>
<td>Frgt Trkng</td>
<td>58</td>
<td>47</td>
<td>41%</td>
<td>85%</td>
</tr>
<tr>
<td># of Relationships with Customers</td>
<td>(Mean)</td>
<td>(Mean)</td>
<td>(Mean)</td>
<td>(Mean)</td>
</tr>
<tr>
<td></td>
<td>257</td>
<td>181</td>
<td>10</td>
<td>495</td>
</tr>
<tr>
<td>% of Interorganizatn EDI</td>
<td>(Mean)</td>
<td>(Mean)</td>
<td>(Mean)</td>
<td>(Mean)</td>
</tr>
<tr>
<td></td>
<td>52%</td>
<td>53%</td>
<td>11%</td>
<td>55%</td>
</tr>
</tbody>
</table>
### Table 23

General Information About Carrier EDI Adoption

<table>
<thead>
<tr>
<th>Dates</th>
<th>Considering EDI</th>
<th>Planning to Use EDI</th>
<th>Pilot Testing EDI</th>
<th>Fully On-Line</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freq Dates</td>
<td>Freq Dates</td>
<td>Freq Dates</td>
<td>Freq Dates</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transmitted By EDI</th>
<th>(Cumulative Frequency)</th>
<th>(Cumulative Frequency)</th>
<th>(Means)</th>
<th>(Means)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Lading</td>
<td>50</td>
<td>47</td>
<td>41%</td>
<td>65%</td>
</tr>
<tr>
<td>Fund Trnfr</td>
<td>56</td>
<td>53</td>
<td>29%</td>
<td>63%</td>
</tr>
<tr>
<td>Remittance</td>
<td>65</td>
<td>68</td>
<td>31%</td>
<td>64%</td>
</tr>
<tr>
<td>Frgt Trkng</td>
<td>75</td>
<td>78</td>
<td>32%</td>
<td>67%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th># of Relationships with Customers</th>
<th>(Means)</th>
<th>(Means)</th>
<th>(Means)</th>
<th>(Means)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29</td>
<td>27</td>
<td>23</td>
<td>67</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>% of Interorganizational EDI</th>
<th>(Means)</th>
<th>(Means)</th>
<th>(Means)</th>
<th>(Means)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25%</td>
<td>27%</td>
<td>11%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Considering EDI</td>
<td>Planning to Use EDI</td>
<td>Pilot Testing EDI</td>
<td>Fully On-Line</td>
</tr>
<tr>
<td>------------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>Dates</td>
<td>Freq Dates</td>
<td>Freq Dates</td>
<td>Freq Dates</td>
<td>Freq Dates</td>
</tr>
<tr>
<td>Transmitted By EDI</td>
<td>(Cumulative Frequency)</td>
<td>(Cumulative Frequency)</td>
<td>(Means)</td>
<td>(Means)</td>
</tr>
<tr>
<td>Invoices</td>
<td>69</td>
<td>61</td>
<td>36%</td>
<td>70%</td>
</tr>
<tr>
<td>Prchse Ord</td>
<td>75</td>
<td>69</td>
<td>47%</td>
<td>74%</td>
</tr>
<tr>
<td>Payments</td>
<td>47</td>
<td>45</td>
<td>40%</td>
<td>77%</td>
</tr>
<tr>
<td>Remittance</td>
<td>41</td>
<td>37</td>
<td>45%</td>
<td>76%</td>
</tr>
<tr>
<td>B. Lading</td>
<td>53</td>
<td>47</td>
<td>32%</td>
<td>78%</td>
</tr>
<tr>
<td>A Ship Not</td>
<td>49</td>
<td>53</td>
<td>36%</td>
<td>64%</td>
</tr>
<tr>
<td>Whse Info</td>
<td>35</td>
<td>29</td>
<td>42%</td>
<td>72%</td>
</tr>
<tr>
<td>Shp Status</td>
<td>59</td>
<td>51</td>
<td>70%</td>
<td>75%</td>
</tr>
<tr>
<td>Frgt Trkng</td>
<td>49</td>
<td>39</td>
<td>42%</td>
<td>85%</td>
</tr>
<tr>
<td># of Relationships with Customers</td>
<td>(Means)</td>
<td>(Means)</td>
<td>(Means)</td>
<td>(Means)</td>
</tr>
<tr>
<td></td>
<td>37</td>
<td>42</td>
<td>20</td>
<td>52</td>
</tr>
<tr>
<td>% of Interorganizational EDI</td>
<td>(Means)</td>
<td>(Means)</td>
<td>(Means)</td>
<td>(Means)</td>
</tr>
<tr>
<td></td>
<td>36%</td>
<td>38%</td>
<td>15%</td>
<td>40%</td>
</tr>
</tbody>
</table>
To determine if the documents transmitted via EDI changed throughout the adoption process, respondents were asked to indicate the documents they considered transmitting in the early stages of adoption and the documents they actually transmitted in the latter stages. By comparing the documents insights into the adoption process were gained.

The findings indicate that the documents actually transmitted most often through EDI were generally quite different from what respondents originally considered or planned. Across all organizations, documents related to freight tracking consistently remained one of the most electronically transmitted documents. Customer organizations planned for purchase orders and advanced shipment notices to round out the top three transmitted documents, but in actuality bills of lading and warehouse information represented the other two highest transmitted documents. According to the information provided in Tables 25 and 27 similar findings were evident in both the carrier and
shipper/supplier organizations.

By examining the documents that were transmitted most often through EDI, some information about future trends in EDI usage was gained. As seen below, freight tracking was consistently ranked within the highest three transmissions when EDI was fully on-line.

Table 25

<table>
<thead>
<tr>
<th>Transmissions When Fully On-Line With EDI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shipper/Supplier</strong></td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Freight Tracking 85%</td>
</tr>
<tr>
<td>Advance Shipment Notice 78%</td>
</tr>
<tr>
<td>Payments 77%</td>
</tr>
</tbody>
</table>

Shipper/supplier organizations were more likely to transmit additional information about freight availability and delivery information as evidenced by the high percentages of warehouse information and
advanced shipment notices that are transmitted. However, carrier and customer organizations were more likely to venture into transmitting financial information such as remittances and payments. This suggests that carriers in the logistics channel and customers in the marketing channel are directing the future use of EDI into the financial arena, indicating that future electronic transmissions will involve more frequent EFT transmissions. This finding supports the work of Sokol (1989), Emmelhainz (1990) and Baker (1991) which suggests future EDI growth in the area of financial information.

To determine if the future growth trends of interorganizational EDI center around the number of EDI relationships, respondents were asked to estimate the number of EDI relationships they expected throughout the adoption process. Customer organizations indicated more EDI relationships than any other organization studied. Customers considered approximately 250 EDI relationships early in the adoption process, however,
near the end of the process, the number had almost
doubled to 495. Although not as dramatic, a similar
growth pattern emerged for the carrier and
shipper/supplier organizations. Carriers originally
considered adopting 29 EDI relationships but the number
more than doubled to 67. The number of EDI
relationships noted by shippers/suppliers was 52, 
although the respondents indicated they originally only
considered 37.

The findings regarding the number of EDI
relationships suggest that organizations are willing to
extend the number of EDI relationships when they were
fully on-line. This finding is supported by the
overall agreement by both high and low users of EDI
that their overall experience with EDI was much better
than expected. Thus, respondents were willing to
become more involved in EDI relationships than
originally planned.

When respondents were asked about the percentage
of their customers with whom they would share
information via EDI, a consistent growth trend emerged across all organizations. This finding is again supported by agreement among both high and low users of EDI. Both user groups indicated that the benefits from EDI turned out to be better than expected and that the problems they experienced were less serious than expected. Thus, one could conclude that EDI’s unexpected benefits combined with fewer adoption problems were driving forces in the decision to become more involved in EDI than planned.

While both the percentage of adoption and the number of EDI relationships are expected to grow, the data in Tables 25, 26 and 27 demonstrate that more dramatic growth trend is expected in the number of EDI relationships.

It appears that the true growth for interorganizational EDI will be in the number of EDI relationships. This finding provides insight into why the expected percentage of EDI adoption is not materializing (Norris 1990). Researchers (Emmelhainz
1990 and Dreyer 1990) have projected high percentage increases in EDI use. According to the findings of this study, while the percentage of EDI adoption is expected to grow, the major growth in EDI will center around the number of EDI partnerships. In addition to explaining some the inconsistent findings of past research, this finding supports the observation made by Clark (1990) that the future growth of EDI will be in bringing external trading partners on-line with EDI. The next section provides insights into the nature of EDI relationships.

Nature of Interorganizational EDI Relationships

In an attempt to determine if EDI-adopting channels have characteristics of strategic partnerships, questions about the EDI partner were asked (See Table 26). The scales used were similar to those used in the Gardner and Cooper (1988) study. Therefore the measures were assessed via seven point semantic differential type scales. The actual scales
can be seen in Appendix B.

When asked about the expected length of the relationship, respondents indicated they had high expectations of long-term relationships. They further suggested that loyalty, risk sharing, reliability and willingness to help in difficult situations were present in EDI channel relationships. All of these characteristics are in the direction Gardner and Cooper hypothesized to be indicative of strategic partnerships. Thus, the findings here indicate that EDI relationships are strategically focused, suggesting the presence of strategic partnerships.
Table 26

Measures of Strategic Partnerships

<table>
<thead>
<tr>
<th>Statement</th>
<th>Supplier</th>
<th>Customer</th>
<th>Carrier</th>
<th>Shipper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long term Relationship</td>
<td>2.60</td>
<td>2.57</td>
<td>2.85</td>
<td>2.38</td>
</tr>
<tr>
<td>Loyalty</td>
<td>5.04</td>
<td>4.91</td>
<td>5.47</td>
<td>4.58</td>
</tr>
<tr>
<td>Risk Sharing</td>
<td>4.50</td>
<td>3.92</td>
<td>4.30</td>
<td>3.29</td>
</tr>
<tr>
<td>Help in difficult situations</td>
<td>3.79</td>
<td>3.22</td>
<td>3.36</td>
<td>2.45</td>
</tr>
<tr>
<td>Monitoring</td>
<td>4.59</td>
<td>N/A</td>
<td>4.28</td>
<td>N/A</td>
</tr>
</tbody>
</table>

This finding is not difficult to believe. When firms decide to invest the capital, human resources, and time into the interorganizational EDI adoption process, one would expect organizations to forge strategic as opposed to transactional type relationships.

The findings suggest the EDI partners consider themselves to be loyal to one another. This loyalty

---

2 Mean Responses
may translate into the willingness to share risk and help one another in difficult situations.

The following discussion presents findings about the reasons organizations decide to adopt interorganizational EDI relationships.

Reasons For Interorganizational Adoption

In an attempt to understand why organizations decide to take on the task of adopting EDI, respondents were asked to rank a set of statements researchers (Sokol 1989, Emmelhainz 1990 and Baker 1991) believe might drive adoption. The results are presented in Table 27. By comparing responses across organizations, different reasons for adoption became apparent.

According to respondents from customer organizations the three highest ranked reasons for adoption were the reduction of costs, order cycle time and errors. The reasons centered around solving internal operational problems. Therefore, the responses suggest that customer organizations were
driven to adopt to improve operational efficiency.

According to the carrier respondents, however, a
different set of reasons drove their adoption decision.
The highest ranked reason was influence from channel
partners. Since the second and third ranked reasons
were to increase customer service and remain
competitive, one could conclude that the adoption
decision is customer and competitor driven. At the
request of shippers, to remain competitive and to
increase customer service levels carriers adopt EDI,
suggesting that, unlike customer organizations, the
carrier's decision is externally driven. This finding
is consistent with the results from hypotheses testing.
According to hypothesis testing, carrier's perceptions
of industry competitiveness and channel power
positively correlate with their adoption decision.

For shipper/supplier organizations', the drivers
for adoption were not uniquely internal or external in
nature. The shipper/supplier organizations' top ranked
reasons for EDI adoption were to stay competitive,
increase customer service and decrease order cycle time. To remain competitive and increase customer service are external reasons for adoption. The reduction of order cycle time and cost are concerned with internal operations. Thus, the results indicate that shipper/supplier organizations were driven by a combination of internal and external reasons.
Table 27
Reasons Given For EDI Adoption

<table>
<thead>
<tr>
<th>Statement</th>
<th>Customer</th>
<th>Carrier</th>
<th>Shipper/Supplier</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>To stay competitive</td>
<td>20</td>
<td>37</td>
<td>60</td>
<td>117</td>
</tr>
<tr>
<td>To reduce costs</td>
<td>35</td>
<td>38</td>
<td>40</td>
<td>113</td>
</tr>
<tr>
<td>Influence for Channel partner</td>
<td>10</td>
<td>64</td>
<td>39</td>
<td>113</td>
</tr>
<tr>
<td>To increase customer service</td>
<td>--</td>
<td>50</td>
<td>57</td>
<td>107</td>
</tr>
<tr>
<td>To decrease order cycle time</td>
<td>30</td>
<td>--</td>
<td>44</td>
<td>74</td>
</tr>
<tr>
<td>To free personnel</td>
<td>15</td>
<td>--</td>
<td>37</td>
<td>52</td>
</tr>
<tr>
<td>To reduce errors</td>
<td>22</td>
<td>--</td>
<td>--</td>
<td>22</td>
</tr>
</tbody>
</table>

* Cumulative frequencies of the number one and two ranked reasons for EDI adoption.
Practical Implications Of EDI Adoption

In order to understand the practical implications of EDI adoption, respondents were asked about third party providers and organizational integration through EDI. Since no strong differences were observed between the respondent groups, the aggregated results are presented.

When asked about third party transmissions, most respondents (59%) indicated they transmitted interorganizational documents through a third party (See Table 28). All respondents perceive themselves paying over half of the cost of transmitting through a third party. The respondents indicate that the remaining cost is shared equally between carriers and customers.

Respondents were also asked about EDI's role in internal integration. Approximately half of all respondents stated that their purchasing, accounts payable and transportation functions used EDI, although only 28% suggested that the three functions were
integrated with EDI. However, when asked about future direction, several respondents did state that they planned to integrate the functions using EDI.

An indication that EDI may not yet be fully operational is the occasional need by 58% of respondents to manually re-enter data. Since EDI is one computer communicating with another computer, without human intervention, firms that are manually re-entering large percentages of data may not fully operational with EDI.
**Table 28**

**Practical Implications of EDI Adoption**

<table>
<thead>
<tr>
<th>Statement</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your firm transmit thru a third party?</td>
<td>59% Yes</td>
</tr>
<tr>
<td>What percentage of cost do you pay?</td>
<td>68% Yes</td>
</tr>
<tr>
<td>What percentage of cost do your carriers pay?</td>
<td>50% Yes</td>
</tr>
<tr>
<td>What percentage of cost do your customers pay?</td>
<td>50% Yes</td>
</tr>
<tr>
<td>Does your firm use EDI in purchasing?</td>
<td>62% Yes</td>
</tr>
<tr>
<td>Does your firm use EDI in accounts payable?</td>
<td>47% Yes</td>
</tr>
<tr>
<td>Does your firm use EDI in Transportation?</td>
<td>55% Yes</td>
</tr>
<tr>
<td>Is purchasing, accounts payable, and transportation integrated?</td>
<td>28% Yes</td>
</tr>
<tr>
<td>After initial data entry, on some occasions do you manually re-enter data?</td>
<td>58% Yes</td>
</tr>
</tbody>
</table>

The findings from this section provided directions for future research that will be discussed in Chapter V.
Summary

Section I of this chapter presented the major findings from the five personal interviews of phase one. Section II presented the Marketing Channel and Logistical Channel Multiple Regression Models. The section also tested and researched hypotheses for each channel type. Section III presented the results from other findings about the EDI adoption process.

Chapter V will present summary, conclusions and future research implications.
CHAPTER V

SUMMARY AND
IMPLICATIONS FOR FUTURE RESEARCH

Introduction

This chapter presents a summary of the research, draws conclusions based on the findings of the study, and discusses the implications for theory and practice. This chapter is organized into four major sections. The first section summarizes the research and reviews research questions and methodology. The second section presents the findings based upon the hypotheses tested. The third section presents contributions to theory and practice. Section four suggests areas for future research.
Section I - Summary of The Research

The purpose of this research was to investigate the decision making process involved in the adoption of interorganizational EDI adoption within marketing and logistical channels. The environment in which businesses operate has become extremely competitive. As a means of competing, organizations are becoming strategically focused. Exchanges of products, services and information are occurring on a long-term basis instead of the short-term transactional type relationships of the past. Therefore, effective coordination and maintenance of channel relationships has become even more important. The distribution channel was studied from the marketing perspective and the logistical perspective because both channels have different goals and communication transmission.

While there is substantial research on the subject of electronic data interchange (EDI), only one known piece (Stern and Kaufman 1985) has examined it from the
interorganizational perspective. And no research to date has examined the unique variables that differentiate EDI adopting marketing channels from EDI adopting logistical channels.

By testing research hypotheses about EDI adoption within channels, the research investigated the different characteristics between the marketing and logistical channels.

The next two parts of Section I will review the research questions and methodology employed in the current study.
Research Questions

The research focused on three questions relevant to EDI adoption within marketing and logistical channels:

1. What are the distinguishing characteristics of EDI-adopting marketing channels?

2. What are the distinguishing characteristics of EDI-adopting logistical channels?

3. Which internal, external and/or interorganizational variables discriminate EDI adoption among channel types?

INTERNAL

a. Does large organizational size characterize EDI-adopting channels?

b. Does centralized organizational structure characterize EDI-adopting channels?

EXTERNAL

a. Does high industry competitiveness characterize EDI-adopting channels?

b. Does high demand uncertainty characterize EDI-adopting channels?

INTERORGANIZATIONAL

a. Does unilateral channel power characterize EDI-adopting channels?
Research Methodology

The research was conducted in two phases. The first phase of the research utilized both telephone and personal interviews. The interviews were conducted to gain an understanding of the decision making process not provided by the literature. In order to understand the interorganizational EDI decision making process, interviews were conducted with a purposive sample. Five interviews were conducted with organizations representing suppliers and buyers in the marketing channel and shippers and carriers in the logistical channel. In addition, consultants and EDI third party providers were interviewed to gain an independent perspective of EDI adoption in both channel types. The interviews both confirmed the variables suggested in the literature and provided additional variables. The three additional variables, organizational integrity, length of relationship and EDI champion were included in phase two of the methodology.

In the second phase data were collected via a mail
questionnaire. Selected sections of the Customer and Supplier Questionnaires was designed so that supplier responses could be directly compared with customer responses. Likewise, sections of the Shipper and Carrier Questionnaires were constructed so that shipper and carrier responses could be directly compared.

The questionnaire consisted of a series of interval scales and open-ended questions. Seven point semantic differential style scales with bipolar descriptors and 7 point Likert scales anchored with "strongly disagree" and "strongly agree" were used as anchors for interval scales.

Each construct of interest organizational size, organizational structure, industry competitiveness, demand uncertainty and channel power, was represented by variables. Each of the five theoretical variables had multiple operational definitions that were used to test reliability and validity. Internal consistency, determined by Cronbach alpha, assessed the amount of inter-item correlations between the variable measures.
Convergent and discriminant validity were determined through factor analysis.

The scales were designed to measure the impact of constructs on EDI adoption within channels. Therefore, five theoretically founded variables and three additional variables provided from phase one were included in the mail questionnaire.

**Respondent Sampling**

A purposive sample of five organizations were interviewed in phase I. Interviews were conducted with shipper, carrier, customer and supplier organizations. Consultants and third party EDI providers were also interviewed for their perspectives on interorganizational EDI adoption.

The shipper and supplier sample for phase II was comprised of a convenience and judgment sample taken from the membership list of the Council of Logistics Management (CLM). The carrier sample was obtained from both the CLM membership roster and the 1992 Second
Annual Mason Symposium attendee list. After duplication of firms was eliminated by subjectively selecting the most appropriate title for the respondent, and after firms not classified as shippers, carriers/suppliers or customers were deleted, the questionnaires were mailed to the remaining members.

Data Analysis

Several data analyses techniques were performed on the data. First, univariate statistics, specifically frequency counts and mean analysis, was performed on variables in the study. The data were then analyzed using Cronbach’s alpha to assess internal consistency and reliability. Internal consistency, as a measure of reliability, assessed inter-item correlations. Reasonable Cronbach alphas were an indication that the items were consistent and reliable in measuring the research variables. Third, principal component factor analysis was used to determine the number of factors present in the data. To interpret the factors, test
for validity and calculate composite factor scores, factor analysis with varimax rotation was performed. Both composite scores and independent measures were used to develop regression models, which were used to test the research hypotheses. Lastly, cross tabulations on high versus low users of EDI were done to determine which variables, if any, differentiate high users of EDI from low users of EDI.

Section II - Hypotheses Testing

This section presents conclusions from hypotheses testing. Consistent with previous sections the findings and conclusions related to the marketing channel will be discussed first, followed by the logistical channel.
Conclusions Related To The Marketing Channel Research Hypotheses

Internal Variables Hypotheses

Hypothesis A1:

The relative size of channel members in the marketing channel will not significantly explain the variance of EDI adoption within the marketing channel.

Findings:

Comparing the supplier and buyer multiple regression models, measures of the relative size of channel members in the marketing channel significantly explained variance of EDI adoption within marketing channels. The hypothesis was tested at the .05 alpha level.

Conclusions:

The prediction of the hypothesis was accepted. The relative size of channel members does explain variance in EDI adoption in the marketing channel at the .05 level. This supports the premise of Rogers (1962; 1983) and Robertson and Gatignon (1986; 1989) that organizational size influences the adoption of innovations.
A composite score of organizational size was found significant in the supplier multiple regression model. Therefore, one could conclude that size of the supplier organization significantly explains interorganizational adoption at the .05 level. This finding supports the work of Rogers (1983) and Moch and Mohr (1977) that size of organization significantly explains adoption behavior.

Hypothesis A3:

The organizational structure of channel members within marketing channels will not significantly explain the variance of EDI adoption within marketing channels.

Findings:

Through the comparison of the supplier and customer regression models, the centralized organizational structure of channel members in the marketing channel did not significantly explain the variance of EDI adoption within marketing channels. The hypothesis was tested using a t-test at the .05 level.
Conclusions:

The null hypothesis was accepted. The organizational structure of channel members in the marketing channel did not significantly explain the variance in interorganizational EDI adoption. The findings from this test do not support the findings of Rogers (1962; 1983). According to his work, the organizational structure, specifically centralization, has usually been found to explain a significant amount of variance in organization adoption.

The findings from this hypothesis, however, do support the findings of Robertson and Gatignon (1989). According to their study, company centralization was found to be insignificant in explaining the adoption of innovations at the organizational level. Thus, this research did not find any support that the degree of centralization in channel member firms significantly explains EDI adopting marketing channels.
External Variables Hypotheses

Hypothesis H1:

Industry competitiveness will not significantly explain the variance in EDI adoption within marketing channels.

Findings:

Comparing the supplier and customer regression multiple regression models revealed that industry competitiveness did not significantly explain the variance of EDI adoption within marketing channels. The hypothesis was tested using a t-test statistic at the .05 level.

Conclusions:

The findings from this test support the null hypothesis. Industry competitiveness did not significantly explain interorganizational adoption at the .05 level. The findings do not support the proposition by Robertson and Gatignon (1986) that industry competitiveness influences technology adoption. Thus, one could infer that the channel's
perception about industry competitiveness does not significantly correlate with their adoption behavior.

Hypothesis B3:

Demand uncertainty will not significantly explain the adoption of EDI within marketing channels.

Findings:

Testing the hypothesis using a t-test at the .05 level revealed demand uncertainty significantly explained the variance of EDI adoption within marketing channels.

Conclusions:

The findings from this test support the work of Archol and Reve (1988), Archol, Reve and Stern (1983), Terreberry (1968), and Robertson and Gatignon (1989) that the external environment affects the organization. According to the above hypothesis, the demand uncertainty in the industry significantly influences the interorganizational adoption of EDI.
According to both customers and suppliers in the marketing channel, measures of demand uncertainty were found to be significant at the .05 level. The customer regression model revealed that the measure of sales revenue volatility significantly explained interorganizational EDI adoption. This provides support for the findings of phase one that demand uncertainty positively correlates with interorganizational EDI adoption. Respondents indicated that channels may forge EDI relationships in an effort to reduce the uncertainty. By being electronically connected with channel partners, organizations reduce the uncertainty in demand. Since purchase orders can be received sooner, EDI adopting marketing channels can facilitate long-term trading by having ready access to pertinent information and being more responsive to customer needs through faster purchase order receipt and credit processing.
**Interorganizational Hypothesis**

Hypothesis C1:

Channel power will not significantly explain the variance of EDI adoption within marketing channels.

Findings:

According to the supplier and customer multiple regression models, channel power did not significantly explain the adoption of EDI in marketing channels. The hypothesis was tested at the .05 level.

Conclusions:

The findings support the null hypothesis that channel power will not explain interorganizational EDI adoption. The findings do not provide support for the work of Gaski (1984) and El-Ansary (1988). One might infer from this finding that supplier and customer perceptions about channel power do not significantly correlate with EDI adoption. The hypothesis was tested at the .05 level.
Conclusions Related to The Logistical Channels Research Hypotheses

This part of section II presents the conclusions based on the results of the logistical channel hypotheses testing.

Internal Variables Hypotheses

Hypothesis A2:

The relative size of channel members in the logistical channel will not significantly explain the variance of EDI adoption within the logistical channel.

Findings:

Comparison of the shipper and carrier multiple regression models showed that the relative size of channel members in logistical channels did not significantly explain the variance of EDI adoption within logistical channels. This hypothesis was tested at the .05 alpha level.

Conclusions:

The above finding provides support for the null hypothesis that organizational size will not explain interorganizational EDI adoption. Comparison of both
shipper and carrier multiple regression models reveal that neither the shipper nor carrier organization's decision to adopt EDI was significantly influenced by their size. The findings do not provide support for the work of Rogers (1983) or Kimberly and Evanisko (1981). Thus, one can infer that the relative size of shipper and carrier firms in the industry does not significantly explain EDI adoption at the .05 level.

Hypothesis A4:

The organizational structure of channel members within logistical channels will not significantly explain the variance of EDI adoption within logistical channels.

Findings:

Comparing the shipper and carrier multiple regression models indicated that the centralized organizational structure of channel members in the logistical channel does not significantly explain the variance of EDI adoption within logistical channels. This hypothesis was tested at the .05 alpha level.
Conclusions:

The findings from the hypothesis testing support the null hypothesis that organizational structure does not explain variance in interorganizational EDI adoption. The findings, however, do not provide support for the findings of Robertson and Gatignon (1989) or Rogers (1983). One could infer from the findings that EDI adoption is not significantly explained by the organizational structure of shippers and carriers, at the .05 level.

Hypothesis B2:

Industry competitiveness will not significantly explain the variance in EDI adoption within logistical channels.

Findings:

Comparison of shipper and carrier multiple regression models revealed that industry competitiveness significantly explained the variance of EDI adoption within logistical channels. The hypothesis was tested at the .05 alpha level.
Conclusions:

Both the shipper and carrier regression models were compared. The carrier model measure of industry competitiveness was significant at the .05 level. The findings provide support for Robertson and Gatignon (1989), Archol, Reve and Stern (1983) and Terreberry (1968) that external environment affects a firm's decision process.

Hypothesis B4:

Demand uncertainty will not significantly explain the adoption of EDI within logistical channels.

Findings:

High demand uncertainty in marketing channels will not significantly explain the variance of EDI adoption in logistical channels. This hypothesis was adopted at the .05 alpha level.

Conclusions:

This hypothesis was tested by comparing the regression model from shipper organizations with the regression model from carrier organizations. The
findings from this comparison support the null hypothesis. Demand uncertainty did not significantly explain interorganizational adoption at the .05 level. The findings do not support the findings of Robertson and Gatignon (1989) that demand uncertainty will influence technology adoption. The findings of this study suggest that the amount of perceived demand uncertainty does not significantly correlate with EDI adoption behavior.

Hypothesis C2:

Channel power will not significantly explain the variance of EDI adoption within logistical channels.

Findings:

Comparison of the shipper and carrier regression models reveals that channel power significantly explained the adoption of EDI within logistical channels. The hypothesis was tested at the .05 alpha level.

Conclusions:

The regression models from both the shipper and carrier organizations included measures of channel power. The shipper model contained a measure of
channel power. The significant measure inquired about the shippers' willingness to abide with carriers' requests to change payment policy. The significant measure for the carrier model inquired about their willingness to change rates at the shipper's request.

The findings suggest that channel power does significantly, at the .05 level, explain interorganizational adoption.

Section III. - Contributions To Theory and Practice

The present research provides a number of contributions that aid in understanding the factors that influence both marketing and logistical channels' adoption decision. The implications from this research contribute to both practice and theory. The contributions this research makes to theory will be discussed first, followed by a discussion of the implication of this research for managers.
Contribution to Theory

The testing of convergent and discriminate validity through factor analysis can provide insights into the factor structure of the constructs. Construct dimensionality, as evidenced by factor structures, can provide the foundation for understanding the constructs thought to influence EDI adoption.

The study contributes to theory by extending the study of innovation adoption beyond single organizations to include interorganizational adoption. By using the channel as the focal unit of study, the research contributes to theory by investigating the adoption beyond the boundaries of individual consumers and individual firms.

The study contributes to theory by investigating the impact channel type has on interorganizational EDI adoption. Bowersox (1978) and Bowersox, Closs and Helfrich (1986) define the distribution channel in terms of two separate channels. The present research contributes to the understanding of channel behavior by
determining how channel type affects adoption behavior.

**Contribution to Practice**

Managers considering EDI adoption can benefit from knowing the percentage of EDI other managers plan to adopt with their channel members. This environmental information can prove beneficial to corporations during competitive strategy planning. Those firms possessing information about the competition can adjust their market strategy, product offering or counter-attack by adopting EDI. In today’s fiercely competitive environment information about the competition can be vital to marketplace success.

There are also implications for EDI providers. By determining the predictive power of variables in the model, EDI vendors may be able to assess which organizations are likely to adopt EDI. With this information their managers will be able to improve sales force efficiency by allocating the sales force to those organizations worthy of the time and
investment.

**Section IV - Implications For Future Research**

Although EDI receives a great deal of attention in the literature and the popular press, there is still a great deal of opportunity for further research. The following research ideas are suggested as potential topics for further investigation.

1. **Future research should focus on a within-industry comparison.** By doing so, the limitation of cross sectional analysis can be overcome. Limiting the sample to one focal industry would reduce variance and increase the explanatory power of the model.

2. **Future research should also extend the current analysis to confirm the validity of the model.** Additional responses should be gathered to enable model testing. The best method of model validation is through the collection of new data (Neter, Wasserman and Kutner 1989). By collecting new data the model can be examined for its applicability to new data, thereby strengthening the assurance of model validity.

3. **Future research should be longitudinal in nature.** Through a longitudinal research methodology, an organization’s full adoption process can be observed. As indicated in the section on additional findings about EDI adoption, organizations may not yet be fully operational in
EDI. A longitudinal study can closely follow the adoption process of one organization, note the direction of future usage, observe internal EDI integration and the formation of external EDI relationships.

4. Additional research studies should be conducted on the adoption of other evolving technologies within marketing and logistical channels. Such studies will help to determine if the adoption decisions differ by technology.

5. Future channel research should focus on an actual dyad as the focal unit of analysis. The dyadic perspective is important to the study of EDI because, by the definition used in the present study, EDI is an "interorganizational communication." However, research that has focused on a direct dyad has been very limited. Future studies that isolate actual dyads, as opposed to hypothetical dyads, will provide valuable insights into the study of interorganizational behavior.

6. The results from this research indicate a strong correlation between EDI-adopting channels and strategic relationships. Future studies should study the correlation in an attempt to understand which of the two drives the other. Do firms decide to develop a strategic relationship and then develop EDI relationships? Or is it that firms first in EDI relationships decide to develop long-term strategic relationships? Understanding the antecedents to EDI relationships and strategic relationships can provide a better understanding of adoption behavior and strategic channel formation.
Chapter V presented conclusions based upon the findings from this study. In summary, the original goals of this research were largely met. The study developed and pre-tested three versions of a questionnaire that was designed to assess shipper, supplier, carrier and customer responses to a series of inquiries about their EDI channel relationships. Using the factor analysis variables were measured and tested for discriminate and convergent validity. Multiple regression models were developed, and were used to test research hypotheses about both marketing and logistical channels.
Appendix A - Interview Protocol
Interview Guide

1. What is your industry? ____________________________

2. Does your firm use computerized or electronic transmissions with suppliers or customers? Yes___ No___

   [If the respondent answered YES to question 2.]

3. When did your firm adopt EDI? __________

   Why did your firm adopt EDI?

   [Don’t Read listen then check all that apply]

   a. influence from supplier _____
   b. influence from customer _____
   c. to stay competitive _____
   d. to reduce costs _____
   e. to reduce paperwork _____
   f. to decrease order cycle time _____
   g. to reduce safety stock _____
   h. to free personnel for other tasks _____
   i. other ______________________
   j. other ______________________

3. Does your firm transmit

   thru a third party network Yes___ No___
   purchase orders Yes___ No___
   bill of lading Yes___ No___
   payments Yes___ No___
   promotion announcements Yes___ No___
   request for quotes Yes___ No___
   funds transfers Yes___ No___

   Other __________________________
   __________________________

   Other __________________________
   __________________________
[If the respondent answered NO to question 2.]

Is/Will your firm be

a. considering EDI adoption ____
b. planning EDI adoption ____
c. reject EDI adoption ____
d. never formally considered EDI adoption ____
e. testing ____

[If the respondent selected option a or b]

4. When does your firm expect to adopt EDI?

a. within 1 year ____
b. within 2 years ____
c. within 3 years ____
d. within 4 years ____
e. within 5 years ____
f. within 6 years ____
g. within 7 years ____
h. within 8 years ____
i. within 9 years ____
j. within 10 years ____
k. in more than 10 years ____

5. Please describe the history of EDI use with a carrier (or customer). Discuss the decision to use EDI with this trading partner. Begin with the idea to use EDI and end with the final decision to implement.

[Prompt respondent about key personnel, decision stages]

6. Please describe the carrier (or customer) with whom your firm has decided to use EDI.

[Prompt respondent about revenues, profits, partners influence]

7. Why did your firm decide to use EDI with this carrier (or customer)?

8. In your opinion, what factors contributed to the success of EDI use with this carrier (or customer)? Please list in order of importance these success factors?

9. List and rank in order of severity any problems faced that may have jeopardized EDI use with this trading partner?
10. How were the above problems resolved?

11. Who was in charge of the EDI effort with the carrier (or customer)? Please list by name, title, and function all those involved.

12. With 100% being all your transactions, what percentage of them are transmitted via EDI? See the grid below.

<table>
<thead>
<tr>
<th>Total Transactions</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EDI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non EDI</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. On the chart below please indicate the change before and after EDI use with your carrier (or customer).

<table>
<thead>
<tr>
<th>Before EDI</th>
<th>After EDI</th>
</tr>
</thead>
<tbody>
<tr>
<td># of vendors</td>
<td></td>
</tr>
<tr>
<td># of customer</td>
<td></td>
</tr>
<tr>
<td># of carriers</td>
<td></td>
</tr>
<tr>
<td># of employees</td>
<td></td>
</tr>
<tr>
<td># of transactions</td>
<td></td>
</tr>
<tr>
<td>annual sales</td>
<td></td>
</tr>
<tr>
<td>freight tracking</td>
<td></td>
</tr>
<tr>
<td>scheduling</td>
<td></td>
</tr>
</tbody>
</table>

(Please circle)

competitive position good average poor good average poor

15. Please indicate how you think your relationship with your selected carrier (or customer) would fit between the polar alternatives by placing an X on the appropriate line on the scale.

Focus on current transactions 1 2 3 4 5 6 Focus on future transactions

Not at all loyal to this carrier (or customer) 1 2 3 4 5 6 Very loyal to this carrier (or customer)

High Expectation of a 1 2 3 4 5 6 Low Expectation of a
<table>
<thead>
<tr>
<th>longterm relationship</th>
<th>longterm relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier (or customer) shares risk</td>
<td>Carrier (or customer) does not share risk</td>
</tr>
<tr>
<td>High carrier (customer) willingness to help us in difficult situations</td>
<td>Low carrier (customer) willingness to help us in difficult situations</td>
</tr>
</tbody>
</table>

Based on your experience with EDI

16. Did the **BENEFITS** of EDI turn out to be:

<table>
<thead>
<tr>
<th>Much better than expected</th>
<th>Much worse than expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>

What were they ________________________________

| ________ |
| ________ |

17. Overall your **EXPERIENCE** with EDI was:

<table>
<thead>
<tr>
<th>Much better than expected</th>
<th>Much worse than expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6</td>
<td>1 2 3 4 5 6</td>
</tr>
</tbody>
</table>

Why ________________________________

| ________ |
| ________ |

How do you plan to use EDI in the future ________

| ________ |
| ________ |
Appendix B - Questionnaires
ELECTRONIC DATA INTERCHANGE (EDI)
SHIPPER QUESTIONNAIRE

General Information:

This questionnaire is designed to understand the decision process involved in selecting a customer and carrier to share electronic information (e.g., EDI). Therefore, there are some sections that ask you for information about customers and carriers. Remember all responses to this questionnaire will be strictly confidential. Neither you nor your firm will ever be associated with responses to this questionnaire.

General Instructions:

1. All responses to this questionnaire will be strictly confidential.

2. If you are not sure of the answer to a question, please provide your best estimate.

3. For questions which require an answer expressed in dollars or percentages, please answer in whole dollars or percentages (e.g., $7,000 or 2%).

4. A copy of the results will be mailed to you if you send your name and address or business card.

5. Please return this questionnaire in the self-addressed, stamped envelope by May 1, 1992. Your participation is greatly appreciated.

If you have any questions, please don't hesitate to contact:

Lisa Williams
Marketing/Logistics Department
Ohio State University
1775 College Road
Columbus, OH 43210

(614) 292-8808 or (614) 487-8271
Background Information Continued

The industry is characterized by many entering competitors.  1 2 3 4 5 6 7

Our company's production cycle is shorter than the competition's.  1 2 3 4 5 6 7

There was at least one person in the firm that truly fought for EDI.  1 2 3 4 5 6 7

The benefits of EDI turned out to be better than expected.  1 2 3 4 5 6 7

The problems with EDI were less serious than expected.  1 2 3 4 5 6 7

The overall experience with EDI was much better than expected.  1 2 3 4 5 6 7

2. Please circle a number between the anchor pairs that closely represents your opinion.

How would you describe the market for your company's products:

Easy to reach 1 2 3 4 5 6 7 Difficult to reach
Stable 1 2 3 4 5 6 7 Unstable
Easy to Monitor 1 2 3 4 5 6 7 Difficult to monitor
Certain 1 2 3 4 5 6 7 Uncertain
Easy to Forecast Sales 1 2 3 4 5 6 7 Difficult to Forecast Sales
Global markets 1 2 3 4 5 6 7 Local markets

3. How frequently does price cutting take place in your industry

Never 1 2 3 4 5 6 7 Constantly

4. How deep are the price cuts in your industry

Shallow Price 1 2 3 4 5 6 7 Deep Price
Cutting

Deep Price Cutting
**Background Information**

1. Please respond to statements about your firm and its industry by circling a "1" if you strongly disagree with the statement, a "7" if you strongly agree with the statement and a number in between depending on the degree of your agreement or disagreement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We possess more market share than any other single competitor in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Competitors offer a more extensive product line.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>We have more employees than the industry average.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm is more profitable than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has more sales revenue than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Senior management does little to interfere with my decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has many divisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The company's decision making is highly centralized at top management levels.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The sales volume for our most significant product is very volatile.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Most decisions in this firm flow from the top down.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The customer base for our most significant product is always changing.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There are many major competitors in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>I have little control over my department's annual budget.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company is planning to make major product/service changes to keep up with competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by a few competitors that possess large shares of the market.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
Customer Information

Now information about your customers is needed. However, the names of your customers are not needed. Please think of a customer that represents a large part of your business and a customer that represents a small part of your business. Please indicate your response to each of the following questions while thinking about your selected large and small customer. Please circle the number between 1 and 5 that closely represents your relationship with the selected large and small customer. Remember all responses will be strictly confidential.

5. How would you describe the profitability of your:

<table>
<thead>
<tr>
<th>Large Customer</th>
<th>Small Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Profitable</td>
<td>Very Unprofitable</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

6. How would you describe the profits you receive from your:

<table>
<thead>
<tr>
<th>Large Customer</th>
<th>Small Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Significant</td>
<td>Very Insignificant</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

7. How long have you had a working relationship with:

your large customer ________ years

your small customer ________ years

8. Please indicate what you think about your selected large customer by circling a number between 1 and 7. Then indicate what you think about your small customer by placing a square around a number between 1 and 7.

For Example:

Customer is located close 1 [3 5 6 7] Customer is located far away

High Expectation of a long term relationship 1 2 3 4 5 6 7 Low Expectation of a long term relationship

Not at all loyal to this customer 1 2 3 4 5 6 7 Very loyal to this customer

Customer shares risk 1 2 3 4 5 6 7 Customer does not share risk

High customer willingness to help in difficult situations 1 2 3 4 5 6 7 Low customer willingness to help in difficult situations

Customer has integrity 1 2 3 4 5 6 7 Customer does not have integrity

Customer monitors all handling/ routing methods 1 2 3 4 5 6 7 Customer only monitors end results
9. Please indicate your response to each of the following questions while thinking about your selected large and small customer. Please circle the number between 1 and 5 that closely represents your relationship with the selected small and large customer.

1 = Not at all
2 = Slightly
3 = Moderately
4 = Significantly
5 = As much as they wanted

<table>
<thead>
<tr>
<th>Large Customer</th>
<th>Small Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

If your customer wanted you to change your customer credit policy, how much would you change your customer credit policy?

1 2 3 4 5

If your customer wanted you to change your inventory procedures, how much would you change your inventory procedures?

1 2 3 4 5

If your customer wanted you to change your customer service policy, how much would you change your customer service?

1 2 3 4 5

If your customer wanted you to change the composition of your product line, how much would you change your product line?

1 2 3 4 5

Carrier Information

Now information about your carriers is needed. However, the names of your carriers are not needed. Please think of a carrier to whom you pay a large percentage of your freight bill and a carrier to whom you pay a small percentage of your freight bill. Now, please indicate your response to each of the following questions while thinking about your selected large and small carrier. Please circle the number between 1 and 5 that closely represents your relationship with the selected large and small carrier. Remember all responses are confidential.

10. How would you describe the profitability of your:

<table>
<thead>
<tr>
<th>Large Carrier</th>
<th>Small Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Profitable</td>
<td>Very Unprofitable</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

11. How would you describe the amount you pay to your:

<table>
<thead>
<tr>
<th>Large Carrier</th>
<th>Small Carrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Significant</td>
<td>Very Insignificant</td>
</tr>
<tr>
<td>1 2 3 4 5</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>

12. How long have you had a working relationship with:

your large carrier _______ years
your small carrier _______ years
13. Please indicate what you think about your selected large customer by circling a number between 1 and 7. Then please indicate what you think about your small customer by placing a square around a number between 1 and 7.

For Example:

<table>
<thead>
<tr>
<th>Carrier is located close</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier is located far away</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- High Expectation of a long-term relationship
  - 1 2 3 4 5 6 7
  - Low Expectation of a long-term relationship

- Not at all loyal to this carrier
  - 1 2 3 4 5 6 7
  - Very loyal to this carrier

- Carrier shares risk
  - 1 2 3 4 5 6 7
  - Carrier does not share risk

- High carrier willingness to help in difficult situations
  - 1 2 3 4 5 6 7
  - Low carrier willingness to help in difficult situations

- Carrier has integrity
  - 1 2 3 4 5 6 7
  - Carrier does not have integrity

- Carrier is very reliable
  - 1 2 3 4 5 6 7
  - Carrier is not very reliable

14. Please indicate your response to each of the following questions while thinking about your selected large and small carrier with whom you share information via EDI. Please circle the number between 1 and 5 that closely represents your relationship with the selected large and small customer.

<table>
<thead>
<tr>
<th>1 = Not at all</th>
<th>2 = Slightly</th>
<th>3 = Moderately</th>
<th>4 = Significantly</th>
<th>5 = As much as they wanted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Carrier</td>
<td>Small Carrier</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If your carrier wanted you to change your payment policy, how much would you change your payment policy?

| 1 2 3 4 5 | 1 2 3 4 5 |

If your carrier wanted you to change your inventory procedures, how much would you change your inventory procedures?

| 1 2 3 4 5 | 1 2 3 4 5 |

If your carrier wanted you to change your customer service policy, how much would you change your customer service?

| 1 2 3 4 5 | 1 2 3 4 5 |

If your carrier wanted you to change the composition of services you purchase from them, how much would you change your purchases?

| 1 2 3 4 5 | 1 2 3 4 5 |
### Information about EDI Transmissions

15. Please fill in the grid below with information about your stages of EDI implementation.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Considering EDI</th>
<th>Planning to use EDI</th>
<th>Pilot Testing EDI</th>
<th>Fully On-Line with EDI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When did you first start considering EDI?</td>
<td>When did you first start planning to use EDI?</td>
<td>When did you first start pilot testing EDI?</td>
<td>When did you expect to be fully on-line with EDI?</td>
</tr>
<tr>
<td>Title of person responsible for EDI at each stage:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answer questions in the next four stages while thinking about the following:</td>
<td>Which did you consider sharing via EDI?</td>
<td>Which did you plan to share via EDI?</td>
<td>What percentage did you share via EDI during the pilot stage?</td>
<td>What percentage do/will you share when fully on-line with EDI?</td>
</tr>
<tr>
<td>invoices</td>
<td>Put an “X” next to all that apply.</td>
<td>Put an “X” next to all that apply.</td>
<td>(0% to 100%)</td>
<td>(0% to 100%)</td>
</tr>
<tr>
<td>purchase orders</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>remittance</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>bills of lading</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>advance shipment notice</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>warehouse information shipment status</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>freight tracking other:</td>
<td>Yes</td>
<td>Yes</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Total Number of EDI Relationships</td>
<td># Customers:</td>
<td># Customers:</td>
<td># Customers:</td>
<td># Customers:</td>
</tr>
<tr>
<td># Carriers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage of customers that you share information via EDI</td>
<td>With what percentage of your customers did you consider using EDI?</td>
<td>With what percentage of your customers did you plan to use EDI?</td>
<td>With what percentage of your customers did you pilot test EDI?</td>
<td>With what percentage of your customers do/will you use EDI when fully on-line?</td>
</tr>
<tr>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

20. Why did your firm decide to use EDI? Rank from "1" to "6" with "1" being very important.

- a. influence from your customer
- b. to stay competitive
- c. to reduce costs
- d. to decrease order cycle time
- e. to free up personnel
- f. increase customer service
21. Are there any other reasons your firm decided to use EDI? __________________________________________________________________________________________________________________________________________________________________________________________________________________________________________

22. Does your firm transmit thru a third party EDI provider? Yes ___ No ___
   If yes, what percentage of the cost do you pay? _____ %
   what percentage of the cost do your carriers pay _____ %
   what percentage of the cost do your customers pay _____ %
   Total _____ 100 %

23. Does your firm use EDI in: Purchasing Yes ___ No ___ What Standards?
      Accounts payable Yes ___ No ___ What Standards?
      Transportation Yes ___ No ___ What Standards?

Are all of the above functions integrated via EDI? Yes ___ No ___

if no, why not?

________________________________________________________________________________________________________________________________________________________________________________________________________________________________________

24. After initial data entry, on some occasions do you manually re-enter data? Yes ___ No ___

25. How do you plan to use EDI in the future?

________________________________________________________________________________________________________________________________________________________________________________________________________________________________________

26. What is your industry? ________________________________________________________________________________________________

27. What combined market share do the top 3 firms in your industry have ____________ %

28. What is your title? ________________________________________________________________________________________________

29. The title and department of the individual you report to is:
   Title: ____________________________ Department: ____________________________

30. Any additional comments about using EDI with outside firms:

   __________________________________________________________________________________________________________________________________________________________________________________________________________________________________________

   __________________________________________________________________________________________________________________________________________________________________________________________________________________________________________

Thank you for your time. Your help has been greatly appreciated. If you would like copy of the results please attach your business card to the questionnaire and drop both into the self addressed stamped envelope.
THE OHIO STATE UNIVERSITY

ELECTRONIC DATA INTERCHANGE (EDI) CARRIER QUESTIONNAIRE

General Information:

This questionnaire is designed to understand the decision process involved in selecting a shipper to share electronic information (e.g., EDI). Therefore, there are some sections that ask you for information about actual shippers. Remember all responses to this questionnaire will be strictly confidential. Neither you or your firm will ever be associated with responses to this questionnaires.

General Instructions:

1. All responses to this questionnaire will be strictly confidential.

2. If you are not sure of the answer to a question, please provide your best estimate.

3. For questions which require an answer expressed in dollars or percentages, please answer in whole dollars or percentages (e.g., $7,000 or 2%).

4. A copy of the results will be mailed to you if you send your name and address or business card.

5. Please return this questionnaire in the self-addressed, stamped envelope by May 1, 1992. Your participation is greatly appreciated.

If you have any questions, please don't hesitate to contact:

Lisa Williams
Marketing/Logistics Department
Ohio State University
1775 College Road
Columbus, OH 43210

(614) 292-8808 or (614) 487-8271
### Background Information

1. Please respond to statements about your firm and its industry by circling a "1" if you strongly disagree with the statement, a "7" if you strongly agree with the statement, and a number in between depending on the degree of your agreement or disagreement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We possess more market share than any other single competitor in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Competitors offer more extensive services.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>We have more employees than the industry average.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm is more profitable than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has more sales revenue than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Senior management does little to interfere with my decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has many divisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>This company's decision making is highly centralized at top management levels.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Sales revenues for our services are very volatile.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Most decisions in this firm flow from the top down.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The customer base for our services is always changing.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There are many major competitors in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>I have little control over my department's annual budget.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company is planning to make major service changes to keep up with competition.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by a few competitors that possess large shares of the market.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by many entering competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There was at least one person in the firm that truly fought for EDI.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The benefits of EDI turned out to be better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The problems with EDI were less serious than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The overall experience with EDI was much better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
Background Information Continued

Please circle a number between the anchor pairs that closely represents your opinion.

2. How would you describe the market for your company's services:
   
<table>
<thead>
<tr>
<th>Easy to reach</th>
<th>Stable</th>
<th>Easy to monitor</th>
<th>Certain</th>
<th>Easy to forecast</th>
<th>Global markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Difficult to reach</td>
<td>Unstable</td>
<td>Difficult to monitor</td>
<td>Uncertain</td>
<td>Difficult to forecast</td>
<td>Local markets</td>
</tr>
</tbody>
</table>

3. How frequently does price cutting take place in your industry?
   
   | Never | 1 2 3 4 5 6 7 | Constantly |

4. How deep are the price cuts in your industry?
   
<table>
<thead>
<tr>
<th>Shallow Price Cutting</th>
<th>Deep Price Cutting</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4 5 6 7</td>
<td>1 2 3 4 5 6 7</td>
</tr>
</tbody>
</table>

Shipper Information

Now information about your shippers is needed. However, the names of your shippers are not needed. Please think of a shipper that represents a large percentage of your business and a shipper that represents a small percentage of your business. Please indicate your response to each of the following questions while thinking about your selected small and large shipper. Please circle the number between 1 and 5 that closely represents your relationship with the selected small and large customer. Remember all responses will be strictly confidential.

5. How would you describe the profitability of your:
   
   | Large Shipper | Small Shipper |
   | Very Profitable | Very Unprofitable |
   | Very Profitable | Very Unprofitable |
   | 1 2 3 4 5      | 1 2 3 4 5        |

6. How would you describe the profits received from your:
   
   | Large Shipper | Small Shipper |
   | Very Significant | Very Insignificant |
   | Very Significant | Very Insignificant |
   | 1 2 3 4 5      | 1 2 3 4 5        |

7. How long have you had a working relationship with:
   
   | your large shipper | ________ years |
   | your large shipper | ________ years |
8. Please indicate what you think about your large shipper by circling a number between 1 and 7. Then indicate what you think about your small shipper by placing a square around a number between 1 and 7.

For Example:

Shipper is located close 1 2 3 4 5 6 7 Shipper is located far away

High Expectation of a long term relationship 1 2 3 4 5 6 7 Low Expectation of a long term relationship

Not at all loyal to this shipper 1 2 3 4 5 6 7 Very loyal to this shipper

High shipper understanding in difficult situations 1 2 3 4 5 6 7 Low shipper understanding in difficult situations

Shipper shares risk 1 2 3 4 5 6 7 Shipper does not share risk

Shipper has integrity 1 2 3 4 5 6 7 Shipper does not have integrity

Shipper monitors all handling/transport methods 1 2 3 4 5 6 7 Shipper only monitors end results

9. Please indicate your response to each of the following questions while thinking about your selected large and small shipper. Please circle the number between 1 and 5 that closely represents your relationship with the selected small and large customer.

1 = Not at all
2 = Slightly
3 = Moderately
4 = Significantly
5 = As much as they wanted

<table>
<thead>
<tr>
<th>Large Shipper</th>
<th>Small Shipper</th>
</tr>
</thead>
<tbody>
<tr>
<td>If your shipper wanted you to change your customer credit policy, how much would you change your customer credit policy?</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>If your shipper wanted you to change your rates, how much would you change your rates?</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>If your shipper wanted you to change your customer service policy, how much would you change your customer service?</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>If your shipper wanted you to change the composition of the services you offer, how much would you change your services?</td>
<td>1 2 3 4 5</td>
</tr>
</tbody>
</table>
### Information about EDI Transmissions

10. Please fill in the grid below with information about your stages of EDI implementation.

<table>
<thead>
<tr>
<th><strong>Considering EDI</strong></th>
<th><strong>Planning to use EDI</strong></th>
<th><strong>Testing EDI</strong></th>
<th><strong>Fully On-Line with EDI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dates</td>
<td>When did you first start considering EDI?</td>
<td>When did you first start planning to use EDI?</td>
<td>When did you first start pilot testing EDI?</td>
</tr>
<tr>
<td>Title of person responsible for EDI at each stage</td>
<td>Which did you consider sharing via EDI?</td>
<td>Which did you plan to share via EDI?</td>
<td>What percentage did you share via EDI during the pilot stage?</td>
</tr>
<tr>
<td>Answer questions in the next four stages while thinking about the following:</td>
<td>Put an “X” next to all that apply.</td>
<td>Put an “X” next to all that apply.</td>
<td>(0% to 100%)</td>
</tr>
<tr>
<td>bills of lading</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>funds transfer</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>remittance</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>freight tracking</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>other:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total number of EDI Relationships</td>
<td># Shippers:</td>
<td># Shippers:</td>
<td># Shippers:</td>
</tr>
<tr>
<td>Percentage of customers that you share information via EDI?</td>
<td>With what percentage of your customers did you consider using EDI?</td>
<td>With what percentage of your customers did you plan to use EDI?</td>
<td>With what percentage of your customers did you pilot test EDI?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15. Why did your firm decide to use EDI? Rank from "1" to "4" with "1" being very important.

a. influence from shipper  
b. to stay competitive  
c. to reduce costs  
d. to improve customer service  

Are there any other reasons your firm decided to use EDI?
16. Does your firm transmit through a third party EDI Provider?  
Yes ___  No ___  
If yes, what percentage of the cost do you pay?  
___________%  
what percentage of the cost do your shippers pay?  
___________%  
Total  
___________ 100%  

17. After initial data entry, on some occasions do you manually re-enter data?  Yes ___  No ___  

18. How do you plan to use EDI in the future?  
_________________________________________________________  
_________________________________________________________  
_________________________________________________________  

19. What is your industry:  LTL ___  TL ___  

20. What combined market share do the top 3 firms in your industry have?  
________________________%  

21. What is your title:  
_________________________________________________________  

22. The title and department of the individual you report to is:  
Title:  
_________________________________________________________  
Department:  
_________________________________________________________  

23. Any additional comments about using EDI with outside firms:  
_________________________________________________________  
_________________________________________________________  
_________________________________________________________  

Thank you for your time. Your help has been greatly appreciated. If you would like a copy of the results please attach your business card to the questionnaire and drop both into the self-addressed stamped envelope.
ELECTRONIC DATA INTERCHANGE (EDI) QUESTIONNAIRE

General Information:

This questionnaire is designed to understand the decision process involved in selecting a supplier to share electronic information (e.g., EDI). Therefore, there are some sections that ask you for information about actual suppliers. Remember all responses to this questionnaire will be strictly confidential. Neither you or your firm will ever be associated with responses to this questionnaire.

General Instructions:

1. All responses to this questionnaire will be strictly confidential.

2. If you are not sure of the answer to a question, please provide your best estimate.

3. For questions which require an answer expressed in dollars or percentages, please answer in whole dollars or percentages (e.g., $7,000 or 2%).

4. A copy of the results will be mailed to you if you send your name and address or business card.

5. Please return this questionnaire in the self-addressed, stamped envelope by May 1, 1992. Your participation is greatly appreciated.

If you have any questions, please don’t hesitate to contact:

Lisa Williams
Marketing/Logistics Department
Ohio State University
1775 College Road
Columbus, OH 43210

(614) 292-8808 or (614) 487-8271
### Background Information

1. Please respond to statements about your firm and its industry by circling "1" if you strongly disagree with the statement, a "7" if you strongly agree with the statement and a number in between depending on the degree of your agreement or disagreement.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We possess more market share than any other single competitor.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Competitors offer a more extensive product line.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>We have more employees than the industry average.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm is more profitable than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has more sales revenue than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Senior management does little to interfere with my decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has many divisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>This company's decision making is highly centralized at top management levels.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The sales volume for our most significant product is very volatile.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Most decisions in this firm flow from the top down.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The customer base for our most significant product is always changing.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There are many major competitors in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>I have little control over my department's annual budget.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company is planning to make major product/service changes to keep up with competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by a few competitors that possess large shares of the market.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by many entering competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company's production cycle is shorter than the competition's.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There was at least one person in the firm that truly fought for EDI.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The benefits of EDI turned out to be better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The problems with EDI were less serious than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The overall experience with EDI was much better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>
**Background Information Continued**

Please circle a number between the anchor pairs that closely represents your opinion.

2. How would you describe the market for your company's products:

- Easy to reach: 1 2 3 4 5 6 7
- Stable: 1 2 3 4 5 6 7
- Easy to monitor: 1 2 3 4 5 6 7
- Certain: 1 2 3 4 5 6 7
- Easy to forecast sales: 1 2 3 4 5 6 7
- Global markets: 1 2 3 4 5 6 7

3. How frequently does price cutting take place in your industry?

- Never: 1 2 3 4 5 6 7
- Constantly

4. How deep are the price cuts in your industry?

- Shallow: 1 2 3 4 5 6 7
- Deep: 1 2 3 4 5 6 7
- Price cutting

**Supplier Information**

Now information about your suppliers is needed. However, the names of your suppliers are not needed. Please think of a supplier from which your firm buys a large percentage of supplies and a supplier from which your firm buys a small percentage of supplies. Please indicate your responses to each of the following questions while thinking about your selected small and large supplier. Circle the number between 1 and 5 that closely represents your relationship. Remember all responses will be strictly confidential.

5. How would you describe the profitability of your

- Large Supplier: Very Profitable 1 2 3 4 5
- Very Unprofitable 1 2 3 4 5
- Small Supplier: Very Profitable 1 2 3 4 5
- Very Unprofitable 1 2 3 4 5

6. How would you describe the percentage of supplies you purchase from your:

- Large Supplier: Very Significant 1 2 3 4 5
- Very Insignificant 1 2 3 4 5
- Small Supplier: Very Significant 1 2 3 4 5
- Very Insignificant 1 2 3 4 5

7. How long have you had a working relationship with:

- your large supplier _______ years
- your small supplier _______ years
8. Please indicate what you think about your selected large supplier by circling a number between 1 and 7. Then indicate what you think about your small supplier by placing a square around a number between 1 and 7.

For Example:

Supplier is located close 1 2 3 4 5 6 7 Supplier is located far away
High Expectation of a longterm relationship 1 2 3 4 5 6 7 Low Expectation of a longterm relationship
Not at all loyal to this supplier 1 2 3 4 5 6 7 Very loyal to this supplier
Supplier shares risk 1 2 3 4 5 6 7 Supplier does not share risk
High supplier willingness to help in difficult situations 1 2 3 4 5 6 7 Low supplier willingness to help in difficult situations
Supplier is very reliable 1 2 3 4 5 6 7 Supplier is not reliable
Supplier has integrity 1 2 3 4 5 6 7 Supplier does not have integrity

9. Please indicate your response to each of the following questions while thinking about your selected large and small supplier. Please circle the number between 1 and 5 that closely represents your relationship with the selected small and large supplier.

1 = Not at all
2 = Slightly
3 = Moderately
4 = Significantly
5 = As much as they wanted

If your supplier wanted you to change your payment policy, how much would you change your payment policy?

Large Supplier 1 2 3 4 5 Small Supplier 1 2 3 4 5

If your supplier wanted you to change your inventory procedures, how much would you change your inventory procedures?

Large Supplier 1 2 3 4 5 Small Supplier 1 2 3 4 5

If your supplier wanted you to change your customer service policy, how much would you change your customer service?

Large Supplier 1 2 3 4 5 Small Supplier 1 2 3 4 5

If your supplier wanted you to change the composition of the products you purchase from them, how much would you change your purchases?

Large Supplier 1 2 3 4 5 Small Supplier 1 2 3 4 5
### Information about EDI Transmissions

10. Please fill in the grid below with information about your stages of EDI implementation.

<table>
<thead>
<tr>
<th>Dates</th>
<th><strong>Considering EDI</strong></th>
<th><strong>Planning to use EDI</strong></th>
<th><strong>Pilot Testing EDI</strong></th>
<th><strong>Fully On-line with EDI</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>When did you first start considering EDI?</td>
<td>When did you first start planning to use EDI?</td>
<td>When did you first start pilot testing EDI?</td>
<td>When did you or do you expect to be fully on-line with EDI?</td>
</tr>
<tr>
<td>Title of person responsible for EDI at each stage.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answer questions in the next for stages while thinking about the following:</td>
<td>Which did you consider sharing via EDI?</td>
<td>Which did you plan to share via EDI?</td>
<td>What percentage did you share via EDI during the pilot stage?</td>
<td>What percentage do/will you share when fully on-line with EDI?</td>
</tr>
<tr>
<td>Purchase orders, transfer data, advance shipment notice, warehouse information, freight tracking other:</td>
<td>Put an &quot;X&quot; next to all that apply.</td>
<td>Put an &quot;X&quot; next to all that apply.</td>
<td>(0% to 100%)</td>
<td>(0% to 100%)</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Total Number of EDI Relationships</td>
<td># Suppliers:</td>
<td># Suppliers:</td>
<td># Suppliers:</td>
<td># Suppliers:</td>
</tr>
<tr>
<td># Carriers:</td>
<td></td>
<td># Carriers:</td>
<td></td>
<td># Carriers:</td>
</tr>
<tr>
<td>Percentage of customers that you share information via EDI:</td>
<td>With what percentage of your customers did you consider using EDI?</td>
<td>With what percentage of your customers did you plan to use EDI?</td>
<td>With what percentage of your customers did you pilot test EDI?</td>
<td>With what percentage of your customers do/will you use EDI when fully on-line?</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
15. Why did your firm decide to use EDI? Rank from "1" to "7" with "1" being most important.
   a. influence from supplier
   b. to stay competitive
   c. to reduce costs
   d. to decrease order cycle time
   e. to free up personnel
   f. JIT/Quick Response
   g. reducing errors

Are there any other reasons your firm decided to use EDI?

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

16. Does your firm transmit thru a EDI third party EDI Provider? Yes ___ No ___

If yes, what percentage of cost do you pay? ___________ %
what percentage of cost do your suppliers pay? ___________ %
what percentage of cost do your carriers pay? ___________ %

Total: ___________ 100 %

17. Does your firm use EDI in: Purchasing Yes ___ No ___ What Standards?
    Accounts payable Yes ___ No ___ What Standards?
    Transportation Yes ___ No ___ What Standards?

18. Are all of the above functions integrated via EDI? Yes ___ No ___

If no, why not?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

19. How do you plan to use EDI in the future?
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

20. After initial data entry, on some occasions do you manually re-enter data? Yes ___ No ___
21. What combined market share do the top 3 firms in your industry have ____________% 

22. What is your industry ____________________________

23. What is your Title: ________________________________

24. The title and department of the individual you report to is:
   Title ___________________________________________
   Department ______________________________________

25. Any additional comments about using EDI with outside firms:
   __________________________________________________
   __________________________________________________
   __________________________________________________

Thank you for your time. Your help has been greatly appreciated. If you would like copy of the results please attach your business card to the questionnaire and drop both into the self addressed stamped envelope.
April 2, 1992

Dear:

We are asking for your help in a research project. Attached is a questionnaire that has been prepared by Ms. Lisa Williams, a Ph.D. Candidate at OSU. She is working on a dissertation in the area of Electronic Data Interchange (EDI). She is trying to better understand the decision process involved in using EDI with outside firms like, carriers and customers. We would appreciate your taking a few minutes to complete the attached questionnaire.

Ms. Williams has already conducted interviews with some people in the field. She would like to have more input about EDI processing by asking experts like yourself. As a token of her appreciation a summary of the results will be mailed if you send your name and address or business card to her.

She is sending this questionnaire to a limited number of distribution/logistics decision makers. Your opinions and expertise are needed to identify factors involved in using EDI, so please take a few minutes to complete the attached questionnaire and return by May 1, 1992. All your responses will be strictly confidential. The number found on the last page of the questionnaire is being used to track response rates and will not be associated with your company or your responses.

It is our hope that you will personally answer the questionnaire, but if you think others in your organization will be better able to answer the questions please feel free to forward the questionnaire. Your words of support and endorsement of the study would be greatly appreciated. Thank you for your help and support in this research project.

Sincerely,

Bernard J. La Londe
Mason Professor of Transportation and Logistics

Lisa R. Williams
Ph.D. Candidate
Logistics and Marketing

enclosures
THE OHIO STATE UNIVERSITY

April 12, 1992

You recently received a letter from Dr. Bernard LaLonde asking for your participation in a Electronic Data Interchange (EDI) study I am conducting. Please help me to understand the decision process involved in using EDI with outside firms by returning the completed questionnaire by MAY 1, 1992.

If you have already completed and returned the questionnaire please accept my sincere appreciation. If not, please do so today because you are a part of a small group of very select firms that are asked to participate. Your opinions and expertise are important inputs in the study.

If you have any questions, of if by some chance you did not receive the questionnaire, please contact me at (614) 292-8808 or (614) 487-8271.

Sincerely,

Lisa Williams
Appendix C - Condensed Questionnaire
Condensed questionnaire

Please respond to the following statements with a "1" if you strongly disagree with the statement, or a "7" if you strongly agree with the statement. Of course, your answers can fall between "1" and "7".

We possess more market share than any other single competitor in the industry.
1 2 3 4 5 6 7

Most decisions in this flow from the top down.
1 2 3 4 5 6 7

The industry is characterized by many entering competitors.
1 2 3 4 5 6 7

The sales volume for our most significant product is very volatile.
1 2 3 4 5 6 7

For the following questions please respond with a "1" if you if you would not accommodate changes made by your channel partner a "2" if you would slightly accommodate the request, a "3" if you would moderately respond, a "4" if you would significantly accommodate, and a "5" if you would accommodate the request as much as the channel member wanted.

If your supplier wanted you to change your customer service policy how much would you change your customer service policy?
1 2 3 4 5

If your customer wanted you to change your customer service policy how much would you change your customer service policy?
1 2 3 4 5
If your carrier wanted you to change your customer service policy, how much would you change your customer service policy? 252

1 2 3 4 5

If your shipper wanted you to change your customer service policy, how much would you change your customer service policy?

1 2 3 4 5

What percentage of customers do you plan to use EDI when fully on-line?

__________%
Table 29

A1. We possess more market share than any other single competitor in the industry.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.99</td>
<td>4.35</td>
<td>3.96</td>
<td>4.14</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>2.24</td>
<td>2.10</td>
<td>2.01</td>
<td>2.35</td>
</tr>
</tbody>
</table>

Table 30

A2. Competitors offer a more competitive production line.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>2.55</td>
<td>2.87</td>
<td>2.34</td>
<td>3.53</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.58</td>
<td>1.67</td>
<td>1.49</td>
<td>1.54</td>
</tr>
</tbody>
</table>

Table 31

A3. We have more employees than the industry average.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.64</td>
<td>3.59</td>
<td>3.86</td>
<td>3.53</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.94</td>
<td>1.81</td>
<td>2.20</td>
<td>1.90</td>
</tr>
</tbody>
</table>
Table 32

A4. Our firm is more profitable than average firms in the industry.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>4.70</td>
<td>4.26</td>
<td>4.94</td>
<td>4.87</td>
</tr>
<tr>
<td><strong>St. Dev.</strong></td>
<td>1.84</td>
<td>1.83</td>
<td>2.03</td>
<td>1.69</td>
</tr>
</tbody>
</table>

Table 33

A5. Our firm has more sales revenue than average firms in the industry.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>4.99</td>
<td>4.48</td>
<td>4.89</td>
<td>5.40</td>
</tr>
<tr>
<td><strong>St. Dev.</strong></td>
<td>1.77</td>
<td>1.88</td>
<td>1.82</td>
<td>1.56</td>
</tr>
</tbody>
</table>

Table 34

A6. Senior management does little to interfere with my decisions.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>4.78</td>
<td>4.61</td>
<td>5.13</td>
<td>4.71</td>
</tr>
<tr>
<td><strong>St. Dev.</strong></td>
<td>1.47</td>
<td>1.35</td>
<td>1.41</td>
<td>1.57</td>
</tr>
</tbody>
</table>
Table 35

A7. Our firm has many divisions.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.01</td>
<td>4.71</td>
<td>3.57</td>
<td>3.75</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>2.14</td>
<td>2.27</td>
<td>1.88</td>
<td>2.09</td>
</tr>
</tbody>
</table>

Table 36

A8. This company's decision making is highly centralized at top management levels.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.09</td>
<td>3.75</td>
<td>4.39</td>
<td>4.17</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.64</td>
<td>1.62</td>
<td>1.56</td>
<td>1.67</td>
</tr>
</tbody>
</table>

Table 37

A9. The sales volume for our most significant product is very volatile.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.52</td>
<td>3.79</td>
<td>3.67</td>
<td>3.23</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.69</td>
<td>1.67</td>
<td>1.79</td>
<td>1.63</td>
</tr>
</tbody>
</table>
Table 38

A10. Most decisions in this firm flow from the top down.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.02</td>
<td>3.91</td>
<td>4.28</td>
<td>3.95</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.51</td>
<td>1.57</td>
<td>1.67</td>
<td>1.36</td>
</tr>
</tbody>
</table>

Table 39

A11. The customer base for our most significant product is always changing.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.02</td>
<td>3.06</td>
<td>3.15</td>
<td>2.92</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.55</td>
<td>1.53</td>
<td>1.49</td>
<td>1.62</td>
</tr>
</tbody>
</table>

Table 40

A12. There are many major competitors in the industry.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.93</td>
<td>4.57</td>
<td>5.44</td>
<td>4.91</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.85</td>
<td>1.79</td>
<td>1.60</td>
<td>1.97</td>
</tr>
</tbody>
</table>
Table 41

A13. I have little control over my department's annual budget.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>2.64</td>
<td>3.22</td>
<td>2.24</td>
<td>2.43</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.73</td>
<td>2.00</td>
<td>1.36</td>
<td>1.61</td>
</tr>
</tbody>
</table>

Table 42

A14. Our company is planning to make major product/service changes to keep up with competitors.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.80</td>
<td>5.02</td>
<td>4.48</td>
<td>4.82</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.51</td>
<td>1.49</td>
<td>1.46</td>
<td>1.55</td>
</tr>
</tbody>
</table>

Table 43

A15. The industry is characterized by few competitors that possess large shares of the market.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>4.35</td>
<td>4.87</td>
<td>4.34</td>
<td>3.98</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.96</td>
<td>1.70</td>
<td>2.07</td>
<td>2.03</td>
</tr>
</tbody>
</table>
Table 44

A16. The industry is characterized by many entering competitors.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.22</td>
<td>2.61</td>
<td>4.02</td>
<td>3.22</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.72</td>
<td>1.55</td>
<td>1.76</td>
<td>1.66</td>
</tr>
</tbody>
</table>

Table 45

A17. Our company's production cycle is shorter than the competition's.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>3.79</td>
<td>3.75</td>
<td></td>
<td>3.83</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.53</td>
<td>1.40</td>
<td></td>
<td>1.63</td>
</tr>
</tbody>
</table>

Table 46

A18. There was at least one person in the firm that truly fought for EDI.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>5.09</td>
<td>5.26</td>
<td>4.97</td>
<td>5.03</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.88</td>
<td>1.81</td>
<td>2.04</td>
<td>1.86</td>
</tr>
</tbody>
</table>
A22. How would you describe the market for your company's products?

<table>
<thead>
<tr>
<th>Anchors</th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy to Reach/</td>
<td>Mean: 2.96</td>
<td>Mean: 3.38</td>
<td>Mean: 3.15</td>
<td>Mean: 2.54</td>
</tr>
<tr>
<td>Difficult to Reach</td>
<td>St Dev: 1.49</td>
<td>St Dev: 1.59</td>
<td>St Dev: 1.36</td>
<td>St Dev: 1.39</td>
</tr>
<tr>
<td>Stable/ Unstable</td>
<td>Mean: 3.33</td>
<td>Mean: 3.51</td>
<td>Mean: 3.52</td>
<td>Mean: 3.09</td>
</tr>
<tr>
<td>Mean: 1.49</td>
<td>St Dev: 1.47</td>
<td>St Dev: 1.51</td>
<td>St Dev: 1.47</td>
<td></td>
</tr>
<tr>
<td>Easy/ Difficult to Monitor</td>
<td>Mean: 3.50</td>
<td>Mean: 3.48</td>
<td>Mean: 3.86</td>
<td>Mean: 3.29</td>
</tr>
<tr>
<td>Mean: 1.56</td>
<td>St Dev: 1.65</td>
<td>St Dev: 1.52</td>
<td>St Dev: 1.49</td>
<td></td>
</tr>
<tr>
<td>Certain/ Uncertain</td>
<td>Mean: 3.73</td>
<td>Mean: 3.87</td>
<td>Mean: 3.76</td>
<td>Mean: 3.62</td>
</tr>
<tr>
<td>Mean: 1.42</td>
<td>St Dev: 1.42</td>
<td>St Dev: 1.14</td>
<td>St Dev: 1.29</td>
<td></td>
</tr>
<tr>
<td>Easy/ Difficult to forecast Sales</td>
<td>Mean: 4.26</td>
<td>Mean: 4.65</td>
<td>Mean: 3.71</td>
<td>Mean: 4.30</td>
</tr>
<tr>
<td>Mean: 1.46</td>
<td>St Dev: 1.53</td>
<td>St Dev: 1.13</td>
<td>St Dev: 1.50</td>
<td></td>
</tr>
<tr>
<td>Global/ Local Markets</td>
<td>Mean: 4.32</td>
<td>Mean: 3.46</td>
<td>Mean: 4.78</td>
<td>Mean: 4.70</td>
</tr>
<tr>
<td>Mean: 1.83</td>
<td>St Dev: 1.83</td>
<td>St Dev: 1.78</td>
<td>St Dev: 2.21</td>
<td></td>
</tr>
</tbody>
</table>
### Table 48
Large trading partner's influence over credit policy.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.41</td>
<td>2.44</td>
<td>2.69</td>
<td>2.39</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.02</td>
<td>1.05</td>
<td>1.06</td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Table 49
Small trading partner's influence over credit policy.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.01</td>
<td>1.76</td>
<td>1.80</td>
<td>2.21</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.02</td>
<td>0.89</td>
<td>.085</td>
<td>1.07</td>
</tr>
</tbody>
</table>

### Table 50
Large trading partner's influence over inventory procedure.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.65</td>
<td>3.20</td>
<td>2.23</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.21</td>
<td>1.22</td>
<td>1.03</td>
</tr>
</tbody>
</table>

### Table 51
Small trading partner's influence over inventory procedure.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.14</td>
<td>2.48</td>
<td>1.89</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.13</td>
<td>1.24</td>
<td>1.13</td>
</tr>
</tbody>
</table>
Table 52

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.62</td>
<td>3.58</td>
<td>3.86</td>
<td>1.87</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.43</td>
<td>1.19</td>
<td>1.04</td>
<td>1.13</td>
</tr>
</tbody>
</table>

Table 53

Small trading partner's influence over customer service policy.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.629</td>
<td>2.98</td>
<td>3.11</td>
<td>1.76</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.26</td>
<td>1.13</td>
<td>1.11</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Table 54

Large trading partner's influence over service/product line offering.

<table>
<thead>
<tr>
<th></th>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean:</strong></td>
<td>2.64</td>
<td>3.06</td>
<td>3.55</td>
<td>2.31</td>
</tr>
<tr>
<td><strong>St. Dev.:</strong></td>
<td>1.09</td>
<td>1.18</td>
<td>0.93</td>
<td>0.89</td>
</tr>
</tbody>
</table>
Table 55
Shipper's Influence over carrier's rates.

<table>
<thead>
<tr>
<th></th>
<th>Large Shipper</th>
<th>Small Shipper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>2.72</td>
<td>2.08</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>1.22</td>
<td>0.84</td>
</tr>
</tbody>
</table>

Table 56
Small trading partner's influence over service/product offering.

<table>
<thead>
<tr>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>2.20</td>
<td>2.32</td>
<td>2.69</td>
</tr>
<tr>
<td>St. Dev.:</td>
<td>0.98</td>
<td>1.05</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Table 57
Percentage of interorganizational EDI Adoption.

<table>
<thead>
<tr>
<th>All Data</th>
<th>Shipper</th>
<th>Carrier</th>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean:</td>
<td>43.49</td>
<td>39.07</td>
<td>32.48</td>
</tr>
</tbody>
</table>
Figure 5
Histogram of Responses From Key Questions

"Our firm has many divisions."
Figure 5 (continued)

Competitors offer a more extensive product line.
"We have more employees than the industry average."
Figure 5 (continued)

"Our firm is more profitable than average firms in the industry."
"Our firm has more sales revenue than average firms in the industry."
"Senior management does little to interfere with my decisions."
We possess more market share than any other single competitor in the industry.
"This company's decision making is highly centralized at top management levels."
Figure 5 (continued)

Strongly Disagree  Strongly Agree

"The sales volume for our most significant product is very volatile."
Figure 5 (continued)

"The customer base for our most significant product is always changing."
Figure 5 (continued)

"Most decisions in this firm flow from the top down."
Figure 5 (continued)

There are many major competitors in the industry.
Figure 5 (continued)

*I have little control over my department's annual budget.*
"Our company is planning to make major product/service changes to keep up with competitors."
Figure 5 (continued)

"The industry is characterized by a few competitors that possess large shares of the market."
"The industry is characterized by many entering competitors."
"Our company's production cycle is shorter than the competition's."
"There was at least one person in the firm that truly fought for EDI."
"How would you describe the market for your company's product?"
"How would you describe the market for your company's products?"
Figure 5 (continued)

"How would you describe the market for your company's products?"
Figure 5 (continued)

"How would you describe the market for your company's products?"
Figure 5 (continued)

*How would you describe the market for your company's products?*
Figure 5 (continued)

"How would you describe the market for your company's product?"
Figure 5 (continued)

"How frequently does price cutting take place in your industry?"
"How deep are the price cuts in your industry?"
Figure 5 (continued)

Large trading partner's influence over credit policy.
Small trading partner's influence over credit policy.
Figure 5 (continued)

Large trading partner's influence over inventory procedure.
Figure 5 (continued)

![Bar graph showing small trading partner's influence over inventory procedure.](image)

Small trading partner's influence over inventory procedure.
Figure 5 (continued)

High trading partner's influence over customer service.
Small trading partner's influence over customer service.
Figure 5 (continued)

Small trading partner's influence over service/product offering.
Figure 5 (continued)

Large shippers influence over carrier rates.
Figure 5 (continued)

Large trading partner's influence over service/product offering
Figure 5 (continued)

Small shippers influence over carrier rates.
Appendix E

Differentiating High and Low EDI Users
<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>We possess more market share than any other single competitor. in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Competitors offer a more extensive product line.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>We have more employees than the industry average.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm is more profitable than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has more sales revenue than average firms in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Senior management does little to interfere with my decisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our firm has many divisions.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>This company's decision making is highly centralized at top management levels.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The sales volume for our most significant product is very volatile.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Most decisions in this firm flow from the top down.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The customer base for our most significant product is always changing.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There are many major competitors in the industry.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>I have little control over my department's annual budget.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company is planning to make major product/service changes to keep up with competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by a few competitors that possess large shares of the market.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The industry is characterized by many entering competitors.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>Our company's production cycle is shorter than the competition's.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>There was at least one person in the firm that truly fought for EDI.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The benefits of EDI turned out to be better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The problems with EDI were less serious than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td>The overall experience with EDI was much better than expected.</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
</tbody>
</table>

- High Users
- Low Users
2. How would you describe the market for your company's products:

| Easy to reach | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Difficult to reach |
| Stable        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Unstable |
| Easy to monitor | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Difficult to monitor |
| Certain       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Uncertain |
| Easy to forecast Sales | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Difficult to forecast Sales |
| Global markets | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Local markets |

3. How frequently does price cutting take place in your industry

| Never | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Constantly |

4. How deep are the price cuts in your industry

| Shallow Price Cutting | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Deep Price Cutting |
Bibliography


———. "Channel Member Satisfaction: Laboratory Insights" *Journal of Retailing* 56 (Summer 1980).


Lawrence, Paul and Jay Lorsh. "Differentiation and Integration in Complex Organizations." *Administrative Quarterly* 12 (March 1967).


Reich, Caroline. "How to Get Started in EDI." Purchasing World (June 1985)


Van Tillberg, E. "Class Notes" The Ohio State University (Winter 1989)


