INTERNATIONAL FREIGHT FORWARDER PERSPECTIVES ON ELECTRONIC DATA INTERCHANGE AND INFORMATION MANAGEMENT ISSUES

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A well-run electronic data interchange (EDI) system will result in timely and accurate information, at a lower cost, than other types (e.g., paper-oriented, telephone-oriented) of information systems. EDI can be defined as "the computer-to-computer exchange of business information electronically, in a structured format, between business trading partners."[1]

Although EDI usage is growing rapidly, implementation among transportation companies appears to lag behind the U.S. business community as a whole.[2] Perhaps the relative infancy of EDI implementation in transportation is best illustrated by the limited number of empirical studies among transportation carriers and transportation service providers. Indeed, a literature review reveals only six empirical pieces concerned with EDI usage among transportation companies. Four of the six are devoted to EDI utilization by motor carriers. Each of the six studies will be briefly summarized below.

A Council of Logistics Management (CLM) study conducted by LaLonde and Cooper is the most comprehensive in terms of responses from different modes and various forms (e.g., common, contract) within the modes.[3] The CLM study found approximately 80% of the 88 transportation respondents participating in EDI, with 54% indicating at least one EDI project fully operational.

Crum and Allen surveyed 266 Class I and II motor carriers and found nearly 30% using EDI.[4] The users indicated that EDI was helpful in meeting shipper requirements and improving customer service. In contrast, non-users avoided EDI because shippers have not demanded it and costs are too great. Allen, Crum, and Braunschweig, using the same database as Crum and Allen, suggested that EDI

implementation is largely based on marketing—as opposed to operating—considerations.[5]

Hellberg and Sannes reported the experiences of three Norwegian freight forwarders using EDI for customs clearance.[6] The three forwarders experienced dramatic reductions in both time needed for customs clearance, and number of processing errors, coupled with improved information services for customers.

Johnson, Allen, and Crum surveyed 78 Class I and II motor carriers reporting EDI usage to the Management System Council of the American Trucking Associations.[7] According to respondents, EDI was implemented to meet customer requirements, improve customer service, and gain competitive advantage. The major reason for not expanding EDI usage was lack of customer demand.

Millen's study used the same sampling frame as Johnson and colleagues. Millen, however, focused only on Class I carriers (33 respondents), and reported that EDI was most beneficial in making individual firms more competitive in the marketplace.[8] Senior management acceptance and support were viewed as the major hurdles to EDI implementation.

CURRENT STUDY

All but one of the studies previously described focused on EDI usage for domestic business decisions. However, Ferguson and colleagues point out that EDI may be most useful in global trade due, in part, to the magnitude of documentation requirements for many cross-border shipments.[9] For one international shipment to require over 100 separate documents is not unheard of.[10] And, cross-border shipments cannot clear customs unless all pieces of documentation are in order. International shipments with incomplete documentation sit at port facilities, adding to business costs and negatively impacting upon customer service.

Most firms employ international trade specialists to assist with documentation requirements and other vagaries of cross-border commerce. One of the most popular logistical specialists is the international freight forwarder (IFF). IFFs provide a variety of functions to their customers, including, but not limited to, the securing of vessel space, the payment of freight charges, shipment consolidation, and the preparation of documentation.[11] Recent research has suggested that dramatic changes are occurring among IFFs, due in large part to the increasing strategic importance of global trade.[12] Because traditional business practices have proven insufficient

for dealing with the highly competitive global marketplace, international trade participants have adopted new ways of doing business.

Many IFFs have chosen to differentiate themselves through development of sophisticated information management systems, particularly with respect to EDI. The development of these information management systems is crucial to the future existence of many IFFs. Indeed, recent research suggested that IFFs who are laggards in information systems may be forced to leave the industry.[13]

Because good information systems are critical to the survival of many IFFs, an empirical study was developed to learn about selected EDI and information management issues. Specific questions addressed include:

1. What is the current usage of EDI among IFFs? How important is EDI perceived to be to successful forwarding operations?
2. What do IFFs view as the major benefits to the implementation of EDI systems?
3. What do IFFs view as the major obstacles to the implementation of EDI systems?
4. How do IFFs evaluate the importance of selected information management issues?
5. Are the answers to Questions 1-4 influenced by (a) use/non use of EDI, (b) firm size, (c) whether the forwarder provides "one-stop" shopping?

METHODOLOGY

The sample consisted of 441 United States-based IFFs, identified from a recent edition of the *Official Directory of Transportation Middlemen*. Each company received two mailings of a six-page survey that dealt with strategic, operational, and tactical issues of IFFs. The two mailings consisted of a cover letter, a copy of the survey, and a postage-paid return envelope.

An unusually high number (105) of surveys were returned as undeliverable, reducing the effective sample size to 336. This high number was surprising, as this same sampling frame was used just three years previously. Why each of the 105 surveys was undeliverable is not known; however, such a large number would appear to support the previous discussion about volatility in the IFF industry.

A total of 98 usable responses, representing an effective response rate of 29.16%, were received. Nonresponse bias was examined by comparing completed surveys received within 21 days of the initial mailing to those received after this time. The rationale behind such a comparison is that late respondents tend to have more in common with nonrespondents than do early respondents.[14] While the comparison of earlier and later respondents yielded a total of five statistically significant differences (at the .05 level), nearly 100 separate variables were included in the survey. As a result, nonresponse bias does not appear to be a major problem in this study.

With respect to respondent and firm demographic characteristics, 75% of the respondents were either corporate vice-presidents or presidents. The responding companies tend to be smaller businesses, with 70% employing fewer than 50 workers. These results are in line with previous work by Pope and Thomchick[15] as well as Murphy and colleagues,[16] which found a majority of forwarders to be smaller in size.

On average, slightly more than 50% of total corporate revenues come from IFF operations; the remainder is generally derived from providing services as customshouse brokers (CHBs) and nonvessel operating common carriers (NVOCCs). Eighty percent of the respondents provide CHB services, while 48% operate as NVOCCs. Forty-two percent offer forwarding, CHB, and NVOCC services.

RESULTS

Usage and importance of EDI. All respondents were provided with a common definition of EDI, namely, "the computer-to-computer exchange of business information electronically, in a structured format, between business trading partners."[17] With this background, respondents were asked to describe their company's usage of EDI. The results from this question, presented in Table 1, appear to support suggestions that operational EDI systems are no longer a luxury, but a necessity, for contemporary IFFs. While just under 50% of the responding organizations currently use EDI, another 40% plan to add EDI capabilities within the next three years.

Information on the importance of EDI, also presented in Table 1, shows that slightly more than 75% of the responding organizations believe that EDI is either

TABLE 1

USAGE AND IMPORTANCE OF EDI

Usage	
Degree of Usage	Percent of Respondents
Currently use	47
Plan to use	40
No plan to use	13
Importance	
Degree of Importance	Percent of Respondents
Very important	43
Important	33
Neutral	19
Unimportant	2
Very unimportant	3

"important" or "very important" for success as an IFF. Alternatively, only 5% indicate that EDI is either "unimportant" or "very unimportant."

Major benefits of EDI implementation. Respondents were asked to indicate the two major benefits of EDI implementation for IFFs. These benefits, presented in Table 2, were largely drawn from Ferguson, Hill, and Hansen's survey of EDI usage from a cross-section of over 1,000 U.S. firms.[18] Respondents also had the opportunity to provide benefits other than those listed; however, this option was used by only four participants.

The information in Table 2 shows that, by far, the most frequently cited benefit of EDI implementation is "quick access to information," named by 57% of the

TABLE 2

MAJOR BENEFITS OF EDI IMPLEMENTATION

Benefit	Percent of Respondents
Quick access to information	57
Better customer service	34
Reduced paperwork	17
Better communications	17
Increased productivity	14
Improved tracing and expediting	13
Cost efficiency	11
Staying ahead of competitors	10
Accuracy	8
Improved billing	2

Note: Numbers sum to more than 100% because respondents were permitted to check a maximum of two benefits. Several chose to provide only one benefit, which explains why the numbers do not sum to 200%.

respondents. "Better customer service," cited by one-third of the participants, was the second most frequently mentioned benefit. On the other hand, the two least frequently cited benefits of EDI implementation were "accuracy" (8% of respondents) and "billing" (2%).

A comparison of these findings with those of previous EDI studies is complicated by the fact that each study investigated slightly different constructs. For example, "competitive advantage" appears as "staying ahead of competitors" in the present study, "gain competitive advantage" in Crum and Allen[19] and "make the firm more competitive and aid in achieving strategic goals" in Millen.[20] Nevertheless, IFFs

appear to place less emphasis on "competitive advantage" (ranked eighth) as a benefit than do motor carriers (ranked first in Millen and fourth in Crum and Allen). On the other hand, IFFs have a higher regard for "reduced paperwork" (ranked third) as a benefit than do motor carriers (ranked eighth in Crum and Allen).

Major barriers of EDI implementation. Similar to the previous section, respondents were asked to indicate the two major barriers of their EDI implementation. All of the barriers, with the exception of "corporate culture," were derived from research by Ferguson and colleagues.[21] "Corporate culture" was included because research in the logistics field has indicated this variable is often an obstacle to adopting new technologies or new ideas (e.g., Just-in-Time).

Information concerning the major barriers of EDI implementation is presented in Table 3. The most commonly perceived obstacle is "high setup costs," cited by 50% of the respondents. This was followed by "compatibility of hardware/software" (38% of respondents) and "lack of standard formats" (33%). The two least frequently mentioned barriers were the "IFFs corporate culture" (5% of respondents) and "customer resistance" (6%).

Again, comparison of these findings to the obstacles reported in previous EDI studies is made difficult by the different constructs used. Nonetheless, "lack of awareness of EDI benefits" is viewed as less of an obstacle by IFFs (ranked fifth) than by motor carriers (ranked first in Johnson, Allen, and Crum).[22] Similarly, "lack of customer sophistication" is less of an obstacle to IFFs (ranked fourth) than to motor carriers (ranked first in Crum and Allen).[23] "High setup costs," the top-ranked obstacle for IFFs, ranked second in Crum and Allen and third in Johnson, Allen, and Crum.

Evaluation of key information systems (IS) issues. Using a 1 (very unimportant) to 10 (very important) scale, respondents evaluated ten contemporary information system issues. These issues and the 1 to 10 scale are drawn from research among senior IS executives by Neiderman and colleagues.[24] A complete description of each issue is provided in the Appendix.

Results for the ten IS issues, presented in Table 4, identify "organizational learning" (mean score = 7.26) as the most important. This supports previous contentions about the importance of EDI to the economic viability of IFFs, as the "organizational learning" issue suggests that organizations that prosper will be those making use of appropriate IS techniques. The second most important issue, "telecommunication," (mean = 7.06) is based on communication being the lifeblood

TABLE 3

MAJOR BARRIERS OF EDI IMPLEMENTATION

Barrier	Percentage of Respondents
High setup costs	50
Compatibility of hardware/software	38
Lack of standard formats	33
Lack of customer sophistication	24
Lack of awareness of EDI benefits	19
Customer education/training	11
Customer resistance	6
Corporate culture	5

Note: Numbers sum to more than 100% because respondents were permitted to check a maximum of two barriers. Several chose to provide only one barrier, which explains why the numbers do not sum to 200%.

of the organization. This also supports the earlier finding that IFFs believe "better communications" to be one of the more important benefits of implementing EDI systems.

"Competitive advantage" (mean score = 6.89) and "strategic planning" (mean score = 6.79) are also viewed as fairly important IS issues. The results on "competitive advantage" reinforce earlier suggestions that information systems are critical to the long-term survival of IFFs. However, the IFFs recognize that their IS strategies must complement, and be compatible with, overall corporate strategies.

The results in Table 4 also show that "IS human resources" (mean = 5.62) and "information architecture" (mean = 5.77) are the two least important IS issues. With respect to the former, IFFs do not believe that current or future shortages of qualified IS personnel will be overly detrimental to their organization. The

TABLE 4

EVALUATION OF KEY INFORMATION SYSTEM (IS) ISSUES

Issue[a]	Average Score[b]
Organizational learning	7.26
Telecommunications	7.06
Competitive advantage	6.89
Strategic planning	6.79
Data resource	6.65
Software development	6.59
IS organizational alignment	6.45
IS role and contribution	6.19
Information architecture	5.77
IS human resources	5.62

[a]Complete descriptions in the Appendix.
[b]1 = very unimportant; 10 = very important

respondents are also guarded in their assessment about the necessity of corporate information architecture.

Significant relationships involving the use/nonuse of EDI, firm size, and whether the forwarder provides "one stop" shopping. The EDI and IS issues were analyzed to learn if there were statistically significant differences between (a) users and nonusers of EDI, (b) smaller, medium, and larger firms, and (c) firms providing "one-stop" shopping versus those not providing such service.

Users and nonusers of EDI. Respondents were divided into two groups—whether they use or do not use EDI—and t-tests of mean equality were performed across the various EDI and IS issues discussed in this paper. Statistically significant

differences (at the .05 level or better) from the t-tests, presented in Table 5, show that EDI users place greater importance on EDI than nonusers.

In addition, one EDI benefit, "staying ahead of competitors," was statistically significant between users and nonusers; users view staying ahead of competitors as more of a benefit than do nonusers. Finally, there are significant differences for eight of the ten IS issues, with current EDI users assigning higher importance than nonusers to each of the eight issues.

Smaller, medium, and larger firms. Information was collected for two measures of firm size, namely, annual revenues and number of employees. For whatever reasons, respondents were more reluctant, or less able, to provide revenue figures (69 responses) than employee information (93 responses).

As a result, employee figures were used as the measure of firm size. Employees were divided into three groups—<10, 10-99, >99—for the purposes of performing one-way analysis of variance across the EDI and IS issues discussed throughout this paper. Previous research used these size categories to represent smaller, medium, and larger IFFs.[25]

Information from statistically significant (at the .05 level or better) EDI and IS issues is presented in Table 6, and shows strongly significant results for both the use and importance of EDI, with smaller firms (a) being less likely to use EDI, and (b) placing less importance on EDI, than their larger counterparts. Moreover, five of the ten IS issues are statistically significant; for all five issues, the lowest importance was assigned by the largest ones.

Duncan multiple range tests were conducted to learn about significant differences among the three size groups for each of the significant one-way analyses. The Duncan results, also presented in Table 6, reveal that the largest number of significant differences (7) involve the smallest (<10 employees) and largest (> 99 employees) firms. The fewest significant differences (2) are between the medium (10-99 employees) and largest firms.

Firms providing "one-stop" shopping versus those not providing such service. Ozsomer, Mitri, and Cavusgil suggest that many IFFs are becoming "one stop" service providers to their customers, through the addition of such services as packaging, warehousing, and export marketing consulting.[26] And, as pointed out earlier, many forwarders are also providing services as customshouse brokers and nonvessel operating common carriers.

TABLE 5

STATISTICALLY SIGNIFICANT RELATIONSHIPS INVOLVING USE OF EDI

Variable	Mean Score		
	Use	Nonuse	t-test
Importance of EDI	1.50[a]	2.26	-4.13*[b]
EDI Benefits			
Staying ahead of competitors	.20[c]	.02	2.80*
IS Issues			
Telecommunications	7.86[d]	6.31	2.87*
Strategic planning	7.57	6.05	2.67*
IS role and contribution	6.93	5.50	2.48**
Data resource	7.26	6.05	2.09**
Organizational learning	8.34	6.25	3.95*
IS human resources	6.61	4.67	3.66*
Competitive advantage	8.05	5.87	3.82*
IS organizational alignment	7.10	5.81	2.35*

[a] 1 = very important; 2 = important; 3 = neutral; 4 = unimportant; 5 = very unimportant

[b] *significant at .01; **significant at .05

[c] 0 = no; 1 = yes

[d] 1 = very important; 10 = very unimportant

TABLE 6

STATISTICALLY SIGNIFICANT RELATIONSHIPS INVOLVING FIRM SIZE

Variable	Firm Size—Employees			
	< 10	10-99	> 99	F-ratio
Use of EDI	2.25[a]	1.57	1.22	16.28*[b]
Importance of EDI	2.64[c]	1.81	1.17	14.62*
IS Issues				
Software development	5.55[d]	6.61	7.67	3.24**
Telecommunications	5.76	7.29	7.94	3.92**
Data resource	5.50	6.73	7.94	4.05**
Organizational learning	5.80	7.67	8.22	5.23*
IS human resources	4.55	5.82	6.61	3.29**

[a]1 = currently use; 2 = plan to use; 3 = do not plan to use

[b]1 = very important; 2 = important; 3 = neutral; 4 = unimportant; 5 = very unimportant

[c]*significant at .01; **significant at .05

[d]1 = very unimportant; 10 = very important

TABLE 6 (Continued)

DUNCAN MULTIPLE RANGE RESULTS

Variable	Significant Groups
Use of EDI	< 10, 10-99
	< 10, > 99
	10-99, > 99
Importance of EDI	< 10, 10-99
	< 10, > 99
	10-99, > 99
IS Issues	
Software development	< 10, > 99
Telecommunications	< 10, 10-99
	< 10, > 99
Data resource	< 10, > 99
Organizational learning	< 10, 10-99
	< 10, > 99
IS human resources	< 10, > 99
Summary: < 10, 10-99 = 4	
10-99, > 99 = 2	
< 10, > 99 = 7	

In this paper, "one stop" forwarders will be defined as those offering both CHB and NVOCC services (n = 41). T-tests of mean equality were used to compare the responses of firms providing "one stop" shopping to those not providing such service. The results from these t-tests, presented in Table 7, show that "one stop"

TABLE 7

STATISTICALLY SIGNIFICANT RELATIONSHIPS INVOLVING "ONE STOP" FORWARDERS

Variable	Mean Value "One Stop"	Other	t-test
Use of EDI	1.31[a]	1.91	-4.86*[b]
Importance of EDI	1.51[c]	2.18	-3.67*
EDI Barriers			
Lack of awareness and benefits	.32[d]	.11	2.45**
EDI Benefits			
Tracing and expediting	.05[d]	.20	-2.38**
IS Issues			
Software development	7.70[e]	5.76	3.78*
Telecommunications	7.89	6.44	2.68*
Data resource	7.59	5.92	3.02*
IS technologies	8.00	6.71	2.34**
IS human resources	6.66	4.88	3.25*
Competitive advantage	7.83	6.24	2.71*
IS organizational alignment	7.34	5.79	2.98*

[a] 1 = currently use; 2 = plan to use; 3 = do not plan to use
[b] *significant at .01; **significant at .05
[c] 1 = very important; 2 = important; 3 = neutral; 4 = unimportant; 5 = very unimportant
[d] 0 = no; 1 = yes
[e] 1 = very unimportant; 10 = very important

forwarders are more likely to use EDI, and view EDI as more important, than their counterparts not providing "one stop" service.

The differences between the two groups are especially pronounced across the IS issues. As shown in Table 7, seven of the ten issues are statistically significant; in all seven cases, greater importance is assigned by the "one stop" forwarders. Particularly noteworthy is the finding that "one stop" forwarders recognize that using IS systems for competitive advantage is critical to their long-term survival. This result supports an earlier suggestion that IFFs who are slow to adopt information systems jeopardize their long-term viability.

CONCLUSIONS AND IMPLICATIONS

International freight forwarders (IFFs) are a common intermediary for facilitating cross-border shipments. Forwarders face an increasingly turbulent business environment, leading to a variety of adaptive behaviors, particularly with respect to information systems management. This paper reports information from a survey of U.S. based-IFFs designed to learn about selected electronic data interchange (EDI) and information systems (IS) management issues.

The results revealed that EDI is currently used by about 50% of IFFs, with another 40% planning to add EDI within three years. In addition, over 75% of the respondents indicated that EDI is an important tool for success as a forwarder. "Quick access to information" was the most frequently cited benefit to EDI implementation, followed by "better customer service." The most common barrier to EDI implementation among IFFs is "high setup costs," followed by "compatibility of hardware/software." Organizational learning" emerges as the most important information systems (IS) issue. Other important IS issues include "telecommunications," "competitive advantage," and "strategic planning."

A number of statistically significant relationships exist among select demographic variables. With respect to users and nonusers of EDI, significant differences were found on eight IS issues, with users assigning greater importance to each of them. Statistically significant differences were also discovered among smaller, medium, and larger IFFs. Smaller companies are least likely to use EDI, and also place least importance on it. Finally, a comparison of "one stop" forwarders revealed statistically significant differences on seven of the IS issues. Greater importance was assigned by the "one stop" forwarders to each case.

These results and others presented in the paper have a number of managerial, conceptual, and research implications. These implications will be discussed below.

Managerial implications. At a minimum, the study results offer a benchmark for IFFs to compare their information management practices to those of the industry in general. For example, the results indicate that more than 85% of the respondents will be using EDI within the next few years. Quick access to information emerges as the most important benefit to EDI, while high setup costs are the major obstacle. In short, EDI is a necessary—but not sufficient—capability for the contemporary forwarder.

Moreover, forwarders interested in either adding, or refining, EDI systems must insure that these systems allow for speedy information retrieval. Forwarders should also recognize that the addition, or redesign, of EDI systems is likely to be an expensive undertaking.

The survey results also suggest that "organizational learning" is the most important IS issue facing IFFs. Under "organizational learning," organizations that prosper will be those that make use of appropriate new IS technologies in their entire operation. This finding reinforces the importance of forwarders adopting IS technologies such as EDI. Failure to do so may jeopardize the existence of recalcitrant forwarders.

The survey findings also highlight noticeable tension between larger and smaller forwarders concerning the importance and usage of EDI. Larger forwarders view EDI as more important than do smaller forwarders, and larger forwarders are more likely to use EDI. Indeed, a number of smaller forwarders do not currently use, and have no future plans to use, EDI systems.

On the surface, these differences between larger and smaller forwarders would appear to have minimal managerial significance. Previous research, however, suggested that larger forwarders may enjoy economies of size over their smaller counterparts.[27] The combination of cost diseconomies and lower levels of EDI usage suggests that smaller forwarders must develop distinctive competencies, such as specialization in particular commodities or particular countries,[28] to survive.

Conceptual implications. As pointed out previously, there have been relatively few empirical studies dealing with EDI issues among transportation companies. As a result, the present paper's analysis of EDI systems among IFFs represents an important addition to the academic literature. For example, the results suggest

that IFFs have different perceptions than do motor carriers of the benefits of, and obstacles to, EDI systems.

However, comparison of this study's findings to those involving motor carriers was made difficult by the fact that particular constructs being investigated often differ across studies. Conceptual development concerning EDI usage by transportation companies will require future studies employing the exact constructs (e.g., this study's "staying ahead of competitors" as an EDI benefit) used in previous EDI studies.

The results from the current study also present an interesting conceptual complement to Williams' recent work on EDI adoption in logistics channels, which found that shippers are often the driving force behind carriers' adoption of EDI.[29] Unfortunately, Williams' investigation of the logistical channel included only shippers and carriers. What role do trading partners, such as shippers and carriers, play in the adoption of EDI by logistical intermediaries?[30]

Furthermore, Williams did not find demand uncertainty explaining the adoption of EDI by either shippers or carriers in the logistical channel. However, one manifestation of demand uncertainty, a turbulent market environment, was cited by Ozsomer and colleagues as a primary reason for EDI adoption by IFFs.[31] The results from the present study appear to support this latter proposition, and thus stand in direct contrast to Williams' results on demand uncertainty. What could explain the fact that IFFs, a logistical intermediary, appear to have adopted EDI to cope with demand uncertainties, while such uncertainties play a minimal role in EDI adoption by shippers and carriers?

With respect to information systems issues, recent work by Bardi and colleagues suggested that logistics information systems help companies improve their operating performance.[32] The present study identified "organizational learning" and "telecommunications" as the two most important IS issues. Will forwarders with the best operating performance be those who emphasize "organizational learning" and "telecommunications" in the management of their information systems?

Research implications. While the previous section has identified several promising areas for additional research, much remains to be learned about EDI and IS issues in the forwarding industry. Indeed, future research opportunities are limited only by the researcher's imagination.

Topics for research include the types of transactions (e.g., shipment status, freight bill payment, customs clearance) to which EDI is applied. Are standard formats (e.g., EDIFACT) or proprietary (firm-specific) formats being used? And, if forwarders are using EDI for customs clearance, what are the benefits and obstacles to so doing?

In addition, the current study did not investigate the degree to which EDI is being used by IFFs. For example, what percentage of revenues come from EDI-related transactions? Will this percentage increase in the future? If so, by how much? Similarly, do IFFs use EDI with all customers, or just select customers? Will more customers be using EDI in the future?

Moreover, the present study has suggested that proactive management of EDI and IS issues may provide IFFs with competitive advantages that are critical to their survival. Are there performance differences (e.g., higher profitability, higher customer satisfaction) between proactive and nonproactive IFFs? Alternatively, are there forwarders who continue to be successful with a more reactive approach to EDI and IS issues? If so, what factors account for their success?

Finally, researchers might investigate the strategies being used by forwarders to manage EDI and IS issues. What types of strategies exist? What variables are effective for distinguishing among the strategies? Are there differences in performance across these strategies?

In conclusion, while many questions remain, information management will play an increasingly significant role in the critical operations of IFFs. The importance of IFFs to the success of U.S. businesses in the global marketplace will be affected by the IFFs' ability to implement management information systems strategically, particularly with respect to EDI.

APPENDIX

INFORMATION SYSTEMS ISSUES AND RATIONALES

Improving the Quality of Software Development (Software Development). The application development backlog remains at unacceptably high levels. Users are getting impatient.

Developing an Information Architecture (Information Architecture). A corporate/global information architecture is needed to identify the major information categories used within an enterprise and their relationships to business processes.

Planning and Implementing a Telecommunications System (Telecommunications). Communication is the lifeblood of the organization. Using IS for competitive advantage often depends heavily on telecommunications.

Improving IS Strategic Planning (Strategic Planning). It is increasingly critical to an organization's success that it align its long-range IS plan with its strategic business plan.

Increasing Understanding of the Role and Contribution of IS (IS Role and Contribution). IS is sometimes viewed as an overhead expense with little appreciation of its contribution to the organization.

Making Effective Use of the Data Resource (Data Resource). The organization's data resource is growing in size, complexity, and value. Despite this, it remains largely unrecognized, inaccessible, and underutilized.

Facilitating Organizational Learning and Use of IS Technologies (Organizational Learning). Organizations that prosper will be those that make use of appropriate new IS technologies in their entire operation.

Specifying, Recruiting, and Developing Human Resources for IS (IS Human Resources). Current and future shortages of qualified information systems personnel threaten the IS department's ability to keep up with the information needs of the parent organization.

Using Information Systems for Competitive Advantage (Competitive Advantage). In many businesses, long-term survival is dependent on using information systems to gain competitive advantage. The business can be lost without it.

Aligning the IS Organization With That of the Enterprise (IS Organizational Alignment). The effectiveness with which IS can support the enterprise's information needs is dependent on the IS department's position within the enterprise.

Source: Derived from F. Neiderman, J. C. Brancheau, and J. C. Wetherbe, "Information Systems Management Issues for the 1990s," *MIS Quarterly* 20 (December 1991): 474-500.

NOTES

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[7]Same reference as Note 2.

[8]R. A. Millen, "Utilization of EDI by Motor Carrier Firms: A Status Report," *Transportation Journal* 32 (Winter 1992): 5-13.

[9]Same reference as Note 1.

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