

Obstacles and Benefits of Electronic Data Interchange: Hong Kong Experience

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ABSTRACT

EDI is an important inter-organizational information system which is said to provide competitive advantage for the companies using it. However, in the early stage of EDI implementation, there are some obstacles which may slow down or even deter its adoption. This study identifies obstacles and reasons for using EDI in Hong Kong. Because Hong Kong is in an early stage of adopting EDI, the problems faced may be quite different from other countries, like the USA, where organizations have been using EDI for quite some time. Based upon a review of the literature and a Delphi survey, we constructed a questionnaire and sent it to 300 companies, asking respondents to rank the importance of the identified obstacles and to rate the benefits of using EDI. Forty eight completed questionnaires were returned. Data from them and from the Delphi survey were analyzed and compared. The results show that lack of knowledge of EDI is the top obstacle to EDI implementation; communication-related factors are the top reasons why companies adopt EDI.

Key word : Electronic Data Interchange, Delphi Method, Inter-organizational Systems

1. INTRODUCTION

Inter-organizational systems (IOS) have been identified as one of the most influential applications of strategic information systems [4]. Electronic Data Interchange (EDI) is one form of IOS and it is the direct computer-to-computer exchange of business transaction documents in standard format between two organizations [8]. As such, EDI avoids the rekeying of business information to be used by the applications in the other location. Therefore, EDI can connect two value chains together which greatly expands the role of information technology as a value added tool. In addition, EDI can be used as an enabler of major organizational restructuring and business reengineering [22]. Some see EDI as a necessary way of doing business [2].

Due to its nature, EDI provides a number of benefits to its users [1,3,5,10,17,19,20]. They include fast response time, better communication, accuracy of data, better customer

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They include fast response time, better communication, accuracy of data, better customer service, a competitive advantage, and cost savings.

For many companies, especially small companies, EDI is a radical step forward as it can involve not only an investment in computer hardware, software and development costs, but perhaps more significantly, a re-thinking of the relationships with customers and suppliers, an adjustment in working practices, and a dramatic alteration to the trading cycle. Also it provides unique opportunities for business process reengineering [9,12,22]. These dramatic changes create a number of difficulties for companies which use or intend to use EDI.

Previous studies [5,6,14,19-21] have identified a number of major obstacles of implementing EDI. They are high set-up cost, hardware/software compatibility problems, lack of standard formats, lack of awareness of benefits, training and customer education, lack of management commitment, and lack of trading partner using EDI. Banerjee and Golhar [1] identified 23 factors that may influence the EDI implementation decision. They categorized the factors into 5 groups, namely, customer, communication, peer pressure, cost, and productivity. They compared the responses for user and nonuser and found that the lack of data integrity and lack of control are the two most influential factors for nonusers in their decision not to use EDI.

In Hong Kong, EDI has been discussed for over 10 years. However, not until September 1988 was Tradelink formed. Tradelink is a commercial consortium of private companies, trade associations, and the Hong Kong Government; it was created to study the feasibility of setting up a community-wide EDI service. In November 1990, the consortium recommended that the Hong Kong Government set up a community-wide EDI service. The Government endorsed the recommendation and established the Community Electronic Trading Service (CETS). However, two private EDI networks have been put to use in 1995 before the CETS provides its first service. Hong Kong Numbering Association launched its EZ-Trade service targeting the manufacturing, distribution and retail industries, and a freight-forwarding and transport oriented EDI service called CargoNet was also launched [11].

Most studies that have investigated the obstacles and benefits of using EDI have been carried out in USA or Europe, where organizations have used EDI for quite some time. The obstacles and benefits faced by companies in countries in which the technology is less developed may be quite different from the developed countries. Hong Kong is now in the process of introducing and promoting EDI. Hong Kong's experience may provide a valuable reference for other countries.

Many books and articles on EDI emphasize the benefits of using EDI for trading but rarely discuss the problems encountered in the process of implementation. It cannot be denied that understanding the benefits a technology offers is very helpful in making the adoption decision. However, without the understanding of the other side of the coin -- obstacles to implementation -- the decision may be somewhat bias. Knowing and understanding the difficulties that companies may encounter can help in designing programs to tackle those difficulties directly. With this in mind, we undertook a study to investigate the reasons current users have adopted EDI, the benefits they realized, and the problems encountered.

2. METHODOLOGY

Our approach was a two-stage study. In the first stage, we used the Delphi method to find out the most important obstacles in EDI implementation. Millar [15] explains the Delphi method as a research design which solicits and aggregates through written media (a series of questionnaires) the judgments of a number of individuals. Through this process, the investigator can arrive at a consensus without having face-to-face interaction. The process starts with an open-ended questionnaire which asks the respondents to give their opinions on the researched topic (EDI obstacles and benefits in this case), succeeding questionnaires feed back to the group their responses on the preceding questionnaire and asks for further information. The investigator terminates the process stops consensus among the individuals has been reached or when sufficient information has been obtained.

In our study, we asked eight experts and professionals in EDI and telecommunication to participate. The eight individuals consisted of providers of EDI technology, managers responsible for the implementation or evaluation of EDI, and academia who specialize in EDI or telecommunication. We modified the Delphi method by listing in the first questionnaire a number of obstacles identified from the literature. The participants were requested to add or delete obstacles based on their experience and to rank the relative importance of the obstacles. We aggregated the ranking in the first round and sent the consolidated questionnaire with the aggregated ranking of each obstacle to the participants. They were requested to rank the obstacles again in light of the previous ranking, which was indicated beside each item. We stopped the Delphi survey after the second round since no more obstacles were identified by the participants. The participants arrived at nine obstacles, which are shown in Table 1.

In the second stage of our study, we compiled a questionnaire based on the list of obstacles identified in the Delphi study and the benefits of using EDI drawn from existing literature. The questionnaire was mailed to 300 companies. The names of the companies were obtained from an EDI promotional organization which had collected the names during an EDI conferences in Hong Kong. We therefore assumed that the companies the questionnaires were sent to have an interest in evaluating and using EDI. The respondents were asked to rank and rate the relative importance of the obstacles and benefits in using EDI. Forty-eight completed questionnaires were received, yielding a response rate of 16 percent.

3. FINDINGS AND DISCUSSIONS

Responses on the completed questionnaires were analyzed and compared with the data from the Delphi survey. The relative rankings of the obstacles are shown in Table 1.

Table 1: Ranking of relative importance of obstacles Delphi Study and Survey Research

Obstacles	Delphi	Survey
Understanding and knowledge of EDI are insufficient in the commercial communities	1	2
Lack of understanding at the top level of management	2	3
There are few suitable electronic trading partners	3	1
Government's intention to use/support EDI is vague	5.5	4
No standard format for exchanging data has been adopted	5.5	5
No appropriate legal framework exists	7	7
No Hong Kong-wide EDI network is in place	9	6
EDI software and hardware is to often incompatible	8	8
EDI involves high set up cost	4	9

3.1 Obstacles of EDI Implementation

The experts and professionals identified nine obstacles. We grouped the obstacles into four categories: Lack of knowledge of EDI, Business related issues, Government and legal support, and Standard and technical issues.

3.1.1 Lack of knowledge of EDI

This category includes the obstacles "Understanding and knowledge of EDI are insufficient in the commercial communities", and "Lack of understanding at the top level of management". As indicated by the Delphi survey and the questionnaire respondents, both of these obstacles are among the top-ranked obstacles to EDI adoption.

Picot et. al. [18] pointed out a number of organizational consequences of EDI systems, such as "new patterns of vertical integration" and "emergence of new ideas, strategies, and business opportunities". The implication is that adoption of EDI is not simply a technical decision, but a very important business decision [7,23]. As for all other important business decisions, the objectives of an EDI program should be decided by top level of management. Understanding the issues involved in using EDI facilitates the decision making process and helps in making well-informed decisions. As the investment in EDI is substantial, the decision maker, i.e., top management, should have a basic understanding of EDI technology and how it can be employed to gain competitive advantage.

Unfortunately, as perceived by the participants of this study, the understanding of

EDI of the business communities in general, and of top management in particular, is not sufficient. This becomes a serious hindrance to the adoption and diffusion of EDI. They seem to lack a fundamental understanding of EDI from a business perspective.

To speed up the adoption of EDI, education through various means should be provided to top level management. Seminars, conferences, and trade publications are examples of such media. The promotions should be directed to management, and should not be limited to the technical staff. As suggested by Griffith [7], "For too long, EDI has been seen by many people as nothing more than a technology. ... However, they sometimes miss the real point of EDI, which is that it is first and foremost a business practice". Top management should try to understand the strategic implications of EDI systems; this technology can be an effective weapon for them to win the competitive battle in the marketplace.

3.1.2 Business Related Factors

The second category of obstacles relates to the bottom line of the business and the availability of trading partners.

Not all trading partners are ready to commit to the use of EDI. However, unlike other information system applications, such as accounting and production control systems, that are basically internal, EDI requires that the internal and external partners connect and work together in order to realize the benefits of exchanging business documents electronically.

Survey respondents ranked "Lack of trading partners" among the top three obstacles. It is not surprising to see this since Hong Kong is in the early stages of EDI implementation. Some firms may have trading partners outside Hong Kong, but without enough trading partners, the investment in EDI may not be cost effective and other benefits cannot materialize. As more and more companies adopt EDI, this limiting factor should disappear. Companies should consider rather to start implementing EDI now or wait until more partners are available. Large companies may use their influence to initiate the use of EDI and request their suppliers and customers to adopt the technology. This way, they can realize the benefits of using EDI, while smaller competitors are not able to do this. This gives larger companies an edge.

Another obstacle included in this category is the "High set up cost of EDI". The opinions of the experts and the corporate respondents are quite different in this category. The experts in the Delphi survey ranked this obstacle fourth, whereas the company participants ranked it the ninth, in other words, the least important.

There may be several explanation. First, the companies may not fully realize the real cost of setting up and operating EDI applications. The cost of setting up an EDI application not only includes the cost of setting up the links between trading partners, it also includes the cost of developing enabling software which integrates the EDI data into the existing application systems. The cost of this software is quite substantial. However, the corporate respondents may not fully recognize these costs and take them into account when deciding whether to use EDI.

Another explanation of this discrepancy is that although the companies know that the set up cost will be large, they consider this investment worthwhile. This explanation is supported by the survey of the reasons why they use EDI. Cost saving ranks very low. As Metzgen [13] has pointed out, companies adopt EDI "as part of their business justification and ignore the fact that, initially, EDI will cost money, not save it". In due course, the key issue not whether EDI will save money, but whether the business can still remain competitive without it. The productivity and time gained by using EDI may be the most important considerations of the companies.

3.1.3 Government and Legal Supports

One of the obstacles in this category is "Government's intention to use/support EDI is vague". This obstacle is quite important. It is ranked fifth and fourth by the Delphi and company participants respectively.

Government support provides a direction for the business communities and gives them more confidence in using EDI. Since a large number of documents, such as custom declarations and license applications, are exchanged between the Government and businesses, it is important to see what kind of standard the Government intends to adopt. The Government's role in promoting and adopting EDI is unclear in Hong Kong thus far. Although a consortium of businesses and the Government was formed to implement the Hong Kong community-wide EDI network, progress has not been very satisfactory. Companies, especially smaller ones, may hesitate to develop their own EDI applications without the commitment of the government.

Another government related obstacle identified in this research is "No appropriate legal framework exists". EDI is a totally new way of doing business. Current laws, which were written for paper-based business transactions, may have to be updated to face the challenge of this new form of business activity. One example is the status of a contract transmitted in electronic form without a signature. How does it differ from a written contract? How can an electronically transmitted contract establish its authentication and how can it be enforced? All of these legal issues need to be resolved before the opportunities for improved productivity can be realized.

As discussed in the previous paragraph, administrative support alone from the Government is not enough. Laws need to be modified or enacted. Currently, no legislation in Hong Kong deals with the legal validity of an electronic signature. The process of establishing laws regulating electronic trading is also very slow. Without a proper legal framework, companies are slow to adopt EDI because of above mentioned problems.

To speed up the adoption of EDI so that businesses will not be at a competitive disadvantage, the Government should play a leading role to support openly the use of EDI, such as is the case of the government of Singapore [16]. The legislation process of establishing laws for electronic trading should also be speeded up.

3.1.4 Standard and Technical Issues

One of the obstacles in this category is "No standard format for exchanging data has been adopted". This obstacle is ranked fifth by both type of participants. Picot et. al. [18] pointed out that eliminating specialized standards and replacing them with a comprehensive world standard is a "precondition for worldwide, open interorganizational communication". However, today a number of widely adopted standards still exist. Without a clear indication of a single standard, companies adopting EDI have to come up with their own standard, like K-Mart, or they have to adopt a standard that seems to be ever changing. Both situations are unsatisfactory. This not only adds to the cost of EDI implementation, but also increases the complexity of negotiating standards with trading partner individually. It may end up that one company has to use several standards for different trading partners, which makes the system costly to develop and difficult to maintain.

Another "standard" issue is the "Incompatibility of hardware and software". But this seems not be a great concern. As computer systems become more "open" and telecommunication networks more standardized, the compatibility should not be a problem. One possible headache is in the area of network connection. Because a lot of vendors provide value added networks (VANs) for connecting trading partners and the VANs cannot talk to each other, a company may have to contract with several VAN vendors in order to have connections with all its trading partners.

This brings us to the last obstacle in this category, which is "No Hong Kong community-wide EDI infrastructure exists". This obstacle is ranked sixth by the survey participants. No Hong Kong community-wide EDI network means that companies have to establish their own links using VAN services. As mentioned in the previous paragraph, using VANs has its problems. For a small company beginning to use EDI, accessing multiple VANs will add to their cost. The availability of a nationwide EDI network will greatly simplify and reduce the cost of implementation. This will help speed up EDI adoption.

3.2 Reasons for EDI Adoption

As mentioned in the previous discussion, whether to adopt EDI is more of a business decision than a technical one. EDI provides a number of benefits and opportunities and we wanted to identify those as perceived in the Hong Kong business community. Therefore, the second part of our survey asked the participants to rate the reasons they want to use EDI. The results of the survey is shown in Table 2.

Table 2: Reason for adopting EDI

	Reasons for adopting EDI	Mean Rating ^a
1	EDI speed the flow of information between organization	2.19
2	EDI improve productivity in labor intensive duties like collecting, sending, and receiving information	2.33
3	EDI improve the accuracy of information	2.42
4	EDI reduce paper flow between organization	2.77
5	EDI lead to competitive advantage	2.79
6	EDI standardized programs and working procedure	2.85
7	EDI result in cost saving	3.02
8	EDI allows for the reduction in personnel	3.17
9	EDI enhances our relationship with customers and suppliers	3.29
10	Our customers/suppliers request us to use EDI for information transmission	3.60

^a1=extremely important, 4=neither important nor unimportant, 7=extremely unimportant

The most important reasons companies adopt EDI are the speed and accuracy of the information exchanged. In today's information age, quick and accurate information greatly enhances a company's responsiveness to the changing market. The business processes can be carried out more smoothly and quickly, not being slowed by inefficiencies caused by data or processing errors arising from human intervention. This can increase customer's satisfaction significantly.

The next group of reasons relate to improvement of the bottom line and the competitive position of the companies. Reduction in paper flow between organizations not only speeds up business processes, it also eliminates or reduces the cost of handling huge amounts of paper. For example, one such cost that can be saved is mailing cost.

When the business is able to response to its customers' requests more quickly and accurately than its competitors, it has certainly gained edge over them. EDI provides many opportunities for vertical integration and tools to enhance service delivery at the boundary of two value chains. EDI application may also lock-in customers by increasing their switching cost to other suppliers.

In the process of implementing EDI systems, companies have to analyze their work procedures in order to integrate the data into existing work flows. To reap the benefits of using EDI, many of the work procedures may have to be encoded into the computer systems. This encoding process will make the work procedures become more standard thus reducing the chance of making mistakes or handling the same event in different ways by different employees. The objective is to enter data only once into the system.

In our survey, the cost factors, "cost saving" and "reduction in personnel", are not regarded as very important reasons that lead to the adoption of EDI. Because of the large initial investment and operating cost, using EDI may not be able to save money in the short run. However, other intangible benefits such as more speedy and accurate information justify the investment. Although there may be some cost savings in using EDI, it should not be put in a very important consideration when making the adoption decision.

The same is true for "reduction of personnel": Using EDI may not reduce the number of employees; however, EDI systems can eliminate some tedious jobs such as data entry, so that employee can have time to work on more important tasks. EDI may free up sales people from excess paperwork, giving them more time for marketing and sales activities.

Participants in our study ranked "Enhance relationship with customer and supplier" and "customer/supplier request the use of EDI" last. It seems that the pressure from customers and suppliers is not very great here. The companies will consider whether the use of EDI will benefit them before they comply with the requests of their customers.

4. CONCLUSION

This research investigated the obstacles and the reasons of the adoption of EDI in Hong Kong which is in the early stage of EDI adoption. From our questionnaire and Delphi surveys, we conclude that the most important reason that leads a company to adopt EDI is not "cost saving", which is a major factor when making the decision to implement some information systems. Instead, speed and accuracy information are the primary motives for using EDI. EDI's ability to provide companies with competitive advantage is also important. Therefore, the decision of whether to use EDI is not simply a technical decision, it is more of a business decision. Unfortunately, top management and the business communities still lack the fundamental understanding of EDI technology and its applications. EDI promotional organizations need to put more effort into educating business communities in general and top management in particular in order to speed up the adoption process.

References

- [1] Banerjee, S. and Golhar, D.Y. "Electronic Data Interchange: Characteristics of Users and Nonusers," *Information and Management*, Vol. 26, 1994, pp. 65-74.
- [2] Benjamin, R.I., De Long, D.W., and Scott-Morton, M.C. "Electronic Data Interchange: How Much Competitive Advantage?" *Long Range Planning*, Vol. 23, No. 1, 1990, pp. 29-40.
- [3] Bergeron, F. and Raymond, L. "The Advantages of Electronic Data Interchange," *Database*, 1992 Fall, pp. 19-30.
- [4] Cash, J. "Interorganizational Systems: An Information Society Opportunity or Threat?" *Information Society*, Vol. 3, No. 3, 1985, pp. 199-228.
- [5] Cox, B. and Ghoneim, S. "Drivers and Barriers to Adopting EDI: a Sector

- Analysis of UK Industry," *European Journal of Information Systems*, Vol. 5, 1996, pp. 24-33.
- [6] Ferguson, D.M. and Hill, N.C. "Missing the Boat," *Business Credit*, December 1988, pp. 21-24,
 - [7] Griffith, G. "Electronic Data Interchange: Challenges for the Future," *Hong Kong Computer Journal*, 1993 September, pp. 13-16.
 - [8] Laudon, K. and Laudon, J. *Management Information Systems: Organization and Technology*, New York: Macmillan Publishing Company, 1994.
 - [9] Layne, C.R. "Reengineering the Payment Process Using EDI, ERS, and Imaging Technology," *Journal of Cash Management*, Vol. 13, No. 5, 1993, pp. 10-19.
 - [10] Mackay, D.R. "The Impact of EDI in the Components Sector of the Australian Automotive Industry," *Journal of Strategic Information Systems*, Vol. 2, No. 3, 1993, pp. 243-263.
 - [11] Mailloux, J. and Trinkle, V. "A Review of EDI Progress in Hong Kong in 1995," *Business & Technology Information Quarterly*, Vol. 1, No. 4, 1995, pp. 31-33.
 - [12] Martinsons, M.G. "Global Success with Electronic Banking: the HongKong Bank and Hexagon," *Journal of Strategic Information Systems*, Vol. 1, No. 4, 1992, pp. 290-296.
 - [13] Metzgen, F. *Killing the Paper Dragon: Electronic Data Interchange in Business*, Ellesmere Port: Heinemann Newnes, 1990.
 - [14] Milburn, R. "Obstacles to Private Enterprise EDI," *Hong Kong Computer Journal*, 1991 May, pp. 12-17.
 - [15] Millar, V.E. "The Delphi Technique," *Information Strategy: The Executive's Journal*, Vol. 1, 1984 Fall, pp. 33.
 - [16] Neo, B.S. "Managing New Information Technologies: Lessons from Singapore's Experience with EDI," *Information and Management*, Vol. 26, 1994, pp. 317-326.
 - [17] Over, D.V. and Kavan, C.B. "Adopting EDI: When and Why," *Information Strategy: The Executive Journal*, Vol. 9, No. 4, 1993, pp. 50-52.
 - [18] Picot, A., Neuburger, R., and Niggel, J. "Management Perspectives of Electronic Data Interchange Systems," *International Journal of Information Management*, Vol. 13, 1993, pp. 243-248.
 - [19] Raney, M.A. and Walter, C.K. "Electronic Data Interchange: The Warehouse and Supplier Interface," *International Journal of Physical Distribution and Logistics Management*, Vol. 22, No. 8, 1992, pp. 21-26.
 - [20] Scala, S. and McGrath, J.R. "Advantages and Disadvantages of Electronic Data Interchange: An Industry Perspective," *Information and Management*, Vol. 25, 1993, pp. 85-91.
 - [21] Senn, J.A. "Electronic Data Interchange: The Elements of Implementation," *Information System Management*, 1992 Winter, pp. 45-53.
 - [22] Swatman, P. and Fowler, D. "A Model of EDI Integration and Strategic Business Reengineering," *Journal of Strategic Information Systems*, Vol. 3, No. 1, 1994, pp. 41-60.
 - [23] Tang, M. "No Company is Trading Alone: Association Join Forces on EDI Pilot Study," *Hong Kong Computer Journal*, 1993 October, pp. 6-8.