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Shimada, Tomoaki

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Tomoaki Shimada

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ABSTRACT

We examine the evolution of an electronic trading community over the Internet on the basis of the case study of two B2B (business-to-business) exchange operators for direct materials in the electrical and electronics industry of Southeast Asia. We identify three distinguishable stages in the transformation of the third party electronic trading community. We also observe that there are two types of online trading community formation at different stages of the third party community evolution: Buyer-driven community formation and supplier-driven community formation. In the end, however, some buyers left the third party community to build their own private electronic trading communities by developing their own in-house systems. In this study, we explain the evolution of the third party community and propose a framework of buyers' community movement. The buyer's decision whether to move to the private community or to remain in the third party community should be made based on what the company expects from the B2B exchange system.

Keywords:
Electronic trading community, e-procurement system, B2B exchange operator, electrical and electronics industry, Southeast Asia

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Introduction

A large number of IS (information systems) researchers examined the IOS (inter-organizational system) adoption in the last two decades. Some of these studies are summarized in Table 2 in Appendix. Most studies on the IOS adoption investigated the private trading community via an EDI VAN (electronic data interchange value-added network). In this study, we analyze how a third party electronic trading community evolves over the Internet. The study is based on an exploratory case study of two B2B (business-to-business) exchange/e-procurement[1] operators for direct materials[2] in the electrical and electronics industry of Southeast Asia.

The two operators are CrimsonLogic and ECnet. Each of the two companies is an ASP (application service provider) for e-procurement, and forms a third party online trading community (independent e-marketplace) through its own system. CrimsonLogic has approximately 10 buyers and 250 suppliers, most of which are sharing the demand forecast data. On the other hand, ECnet has approximately 45 buyers and 1200 suppliers, half of which are sharing the demand forecast data. The former is a government-linked company in Singapore, while the latter is a Singapore-based private company. Further information concerning CrimsonLogic and ECnet are available from teaching case studies of (De Meyer & Shimada, 2004) and (Soh & Singh, 2003), respectively.

In this study, we use the term "third party" for a community whose members are electronically linked through a third party's (a B2B exchange operator's) system in order to distinguish it from an online community through the buyer's "private" proprietary system.

[1] B2B exchange and B2B e-procurement are interchangeable in this study.

[2] There are two types of products to be traded online: Direct and indirect materials. Direct materials form part of the buyer's products, while indirect materials do not. A typical example of indirect materials is office supplies, air tickets, or MRO (maintenance, repair and operations) products. In contrast, one example of direct materials for PC (personal computer) manufacturers is PC components. The focus in this study is on direct materials purchasing done online.

Besides third party exchange and private exchange, consortium-based exchange is another form of B2B exchange. The third party exchange is an electronic marketplace established by an independent third party, whereas the private exchange is set up by an individual company such as a powerful buyer or supplier. The consortium-based exchange is initiated by a small group of companies in the same industry. An example of consortium-based exchange in the electrical and electronics industry is E2open[3].

Research Methodology

We used a case study approach for this research, as it is suitable for new topic areas (Eisenhardt, 1989), such as online B2B e-procurement. Our case study is the outcome of exploratory study rather than that of formally structured interviews. We conducted face-to-face interviews in Singapore with the two B2B e-procurement operators. We interviewed three senior/junior managers of each participating organization. The primary role of these managers is business development in Southeast Asia. We met each manager individually or together one to five times in total. We also interviewed managers in three electronic component manufacturers to obtain buyer users' views on the B2B procurement systems. These companies are using other B2B e-procurement systems in addition to one of the two B2B e-procurement operators' systems.

As an ASP, each of the two B2B e-procurement operators provides their users with an online application which the community members use remotely for data exchange with their trading partners via the Web. Purchase orders, purchase order acknowledgements, delivery orders (notices) and invoices are typical examples of the data exchanged for procurement as part

[3] E2open investors and strategic members include leading electronics companies, such as Acer, Hitachi, IBM, LG Electronics, Lucent Technologies, Matsushita Electronic (Panasonic), Nortel Networks, Seagate Technology, Solectron, Toshiba, Mitsubishi Electronic, Omron, Ricoh, Sanyo, and Sharp. Another example of consortium-based exchange is Covisint.

of SCM (supply chain management) activities. In addition to the data exchange services between buyers and their suppliers, these B2B e-procurement operators offer system customization services of their standard B2B procurement systems to meet the specific needs of each user. However, they do not offer sourcing services such as auctions or matching of buyers and suppliers. The B2B e-procurement operators normally convince a buyer to become a member of the third party online community. Then, on the buyer's behalf they send a letter endorsed by the buyer to invite its suppliers to join the community. Thus, the managers we interviewed in the operators are familiar with suppliers' activities in B2B e-procurement as well as buyers'.

Our research procedure of the exploratory case study is as follows. First, we interviewed the managers in one of the B2B e-procurement operators in Singapore. We asked them how the user community had been evolving. Although we had very broad research questions about the third party trading community evolution, we had not developed any specific theory for this study before we conducted interviews. Then, we can avoid having any bias toward theory to be built and retain theoretical flexibility (Eisenhardt, 1989). The managers explained the community transformation by providing us with several events as examples. Second, we structured these events and built some possible theories about the third party trading community evolution based on the interviews. Third, we interviewed the same managers to obtain their feedback about our theories. Subsequently, we conducted interviews with its users as well as the other system operator that is a competitor of this operator. There are several repetitions of this process to exchange their ideas and ours. Then, we evaluated and confirmed some theories within the two B2B e-procurement operators in the electrical and electronics industry of Southeast Asia.

The Evolution of an Electronic Trading Community

The third party electronic trading community by each of the two B2B e-procurement operators consists of several buyers and multiple suppliers. In the electrical and electronics industry[4], typical buyers are manufacturers of electrical and electronics products including electrical appliances and computer peripherals, while their suppliers are normally manufacturers of raw materials or components. The buyers and their suppliers are often called "hubs and spokes" respectively because the data exchange among them forms a trading community whose structure looks like a wheel as illustrated in Figure 1.

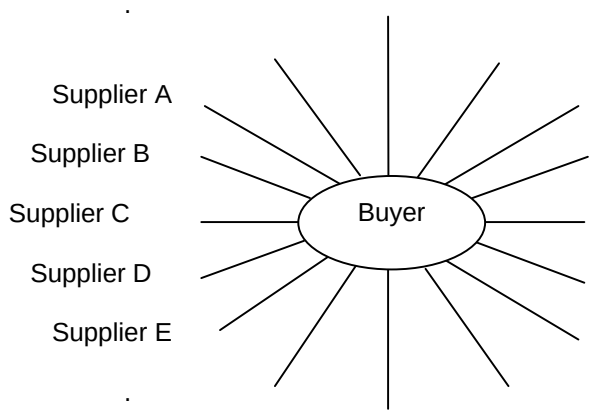


Figure 1: A Hub (Buyer) and Spokes (Suppliers) Structure

Figure 2 illustrates the third party trading community transformation. A trading community is normally created on the initiative of a large buyer, which explains why hubs and spokes are respectively referred to as initiators and followers. The buyer proposes adoption of the application for data communication with each of its suppliers. A small electronic trading community is thus formed between the buyer and some of its suppliers. This few-to-one-to-one[5] structure is the first step in the trading community's formation as shown in Figure 2. The number

[4] On the whole we include the computer, electronics, and electrical industry in the electrical and electronics industry, as the components such as condensers and connectors are often used across these industries.
[5] (a number of suppliers) – to – (B2B e-commerce hub, normally one) – to – (a number of buyers).

of suppliers in the community gradually increases over time as the buyer's request for the system to be adopted is taken up. At the same time, a few other buyers start to initiate B2B procurement. The trading community is thus transformed into a many-to-one-to-few structure in the second stage. Until this point, the community's formation is buyer-driven (buyer-initiated). In other words, a buyer initiates the system adoption and some of its suppliers follow it up to this stage.

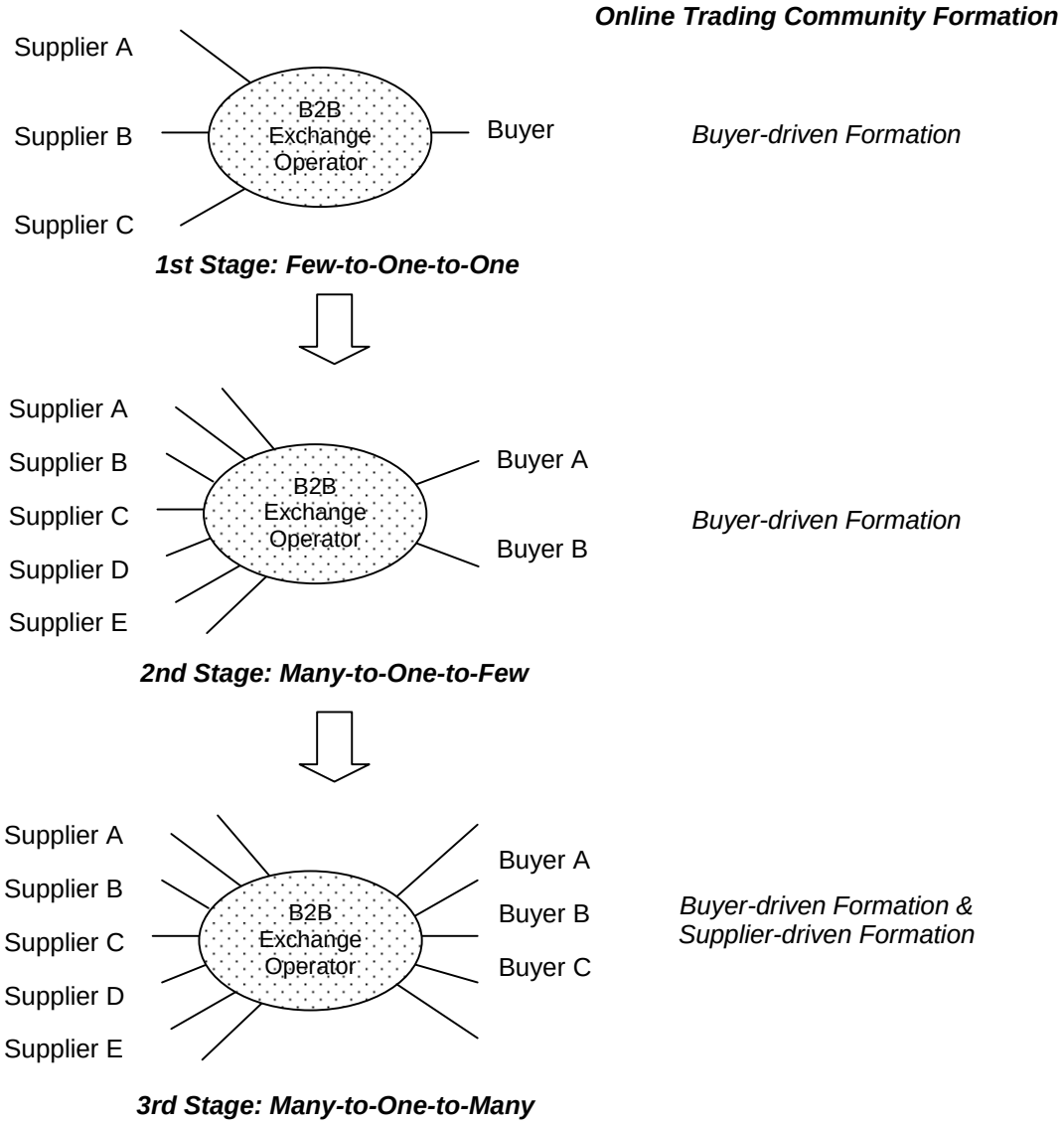


Figure 2: Third Party Online Trading Community Evolution

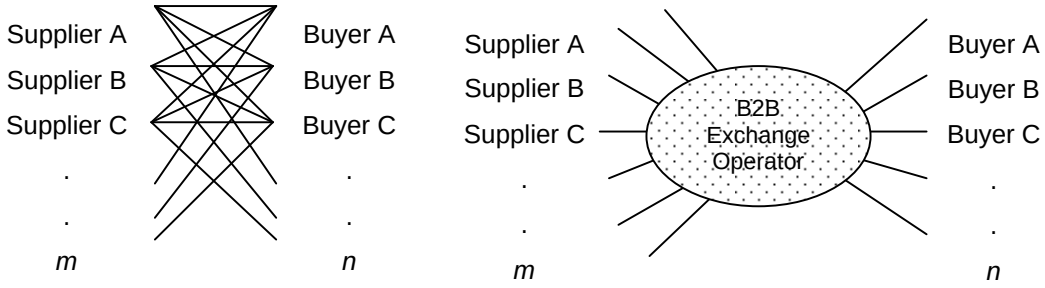
As the community grows, more buyers and their suppliers join the community. Generally, in the next phase in the evolution of the trading community, suppliers will suggest that additional buyers join the online trading community so that they can enhance operational efficiency from economies of scale. Thus, a supplier-driven (or supplier-initiated) community formation emerges. If a supplier has some buyers who use a different electronic trading community or a proprietary system, it will be obliged to use a different system for each buyer, rendering the supplier's operation both redundant and inefficient. One electronic component supplier observed:

> "When our buyer places a purchase order with us, we receive an e-mail notification which is automatically generated by the application. Then, we need to log on to the application on the Web to receive the purchase order. After we confirm with our warehouse staff that we can deliver the order items on time, we need to log on to the system again to acknowledge the order. However, many of our buyers are using different systems. Even the same company which has several operations is using a different system in each facility. And we also need to check the fax machine for manual purchase orders. It is really troublesome, especially if the order is urgent."

If a number of small and medium-sized buyers are willing to join a community in which there are many suppliers, then due to positive network externality the network structure will change over time from a few buyers with many suppliers to many buyers with many suppliers via the portal (many-to-one-to-many), as shown in the third step of Figure 2. Until Step 2, the community formation is completely buyer-driven. In Stage 3, however, a supplier-driven community formation emerges alongside the buyer-driven community formation, though the supplier-driven formation is less strong. In the supplier-driven community formation, a buyer is a

new user and all the suppliers are normally existing users.

In theory, operational efficiency in data exchange through a B2B e-commerce hub can be explained using the number of contacts in the transactions as depicted in Figure 3. The number of contacts in the transactions among *m* suppliers and *n* buyers is reduced from ($m \times n$) to ($m + n$). As *m* and *n* increase, the difference between ($m \times n$) and ($m + n$) becomes larger and each community member can benefit from further economies of scale. In practice, however, this may not always work well because the buyer sometimes prefers a proprietary system, as illustrated in Figure 4. The proprietary system fits into the buyer's operations and can be integrated with its back-end system. In addition, the proprietary system allows the buyer to monitor and control data without worrying about data confidentiality and system security being handled by a third party.



Private Data Exchange ***Data Exchange via an e-Procurement Operator***

Figure 3: Efficiency of Data Exchange

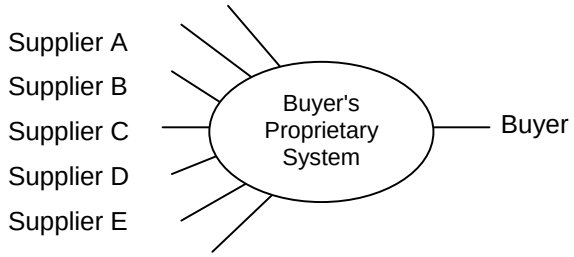


Figure 4: Buyer's Private Trading Community

In the end, some buyers have left the third party online trading community to build a

many-to-one structure without an e-commerce operator by developing an in-house system, as indicated in Figure 4. Subsequently, their suppliers will follow suit unless their other buyers are in the community. The reasons for leaving the community vary. For example, one buyer joined the community because the company wanted to test how the electronic data exchange worked in its operations. Having seen how it worked, it decided to develop its own in-house system to form a private trading community. In another example, where each facility of the buyer was using a different online trading community, the company decided to standardize the system worldwide by forming a private trading community. The company also cited a desire to avoid dependency of its information systems on the ASP, a trend that increased when the B2B e-commerce bubble burst. Acknowledging this general movement from the third party online trading community to the private community, one of the e-procurement operators explained what the company was doing to counteract the trend:

> "To prevent buyers from ceasing to use our services, we help them form their own private online trading community by offering new services such as dedicated server outsourcing services or licensing services. In our dedicated server outsourcing services, one server in our data center is physically dedicated to the use of a buyer and its suppliers only, and the system maintenance is outsourced to us. On the other hand, in our licensing services we don't play the role of an ASP any longer and allow the buyers to use our solution package on their premises by licensing the software."

On the other hand, some buyers prefer to continue to outsource procurement systems to ASPs. One MIS (management information system) manager of a semi-conductor manufacturer explained:

"We focus on developing and manufacturing semi-conductors worldwide. So we outsource any functions which are not relevant to our core business. For example, we use distributors to sell our products. Likewise, we outsource IS functions to an e-procurement operator. We will not have any plan to increase our resources for managing IS unless the headquarters change their outsourcing strategy."

Another MIS manager of another semi-conductor manufacturer agreed with this view and added:

"Most of large semi-conductor manufacturers in the world are using RosettaNet standards.[6] As RosettaNet is not simple or flexible, it is better to outsource development and maintenance of procurement systems to a specialist in this area. The e-procurement operator's 24-hour technical support is also an advantage because we are dealing with many companies in different time zones."

Proposed Framework

In the previous section, we show that there are two types of buyers: One is moving to private exchange, and the other is staying in the third party exchange. Although the buyers can use both the private system and the third party system in parallel, they will select one of these two options in the end. Otherwise, the company operations are not efficient. The buyers are likely to choose the option based on their expectations from e-procurement systems. Table 1 proposes the framework of buyers' community movement.

Operational efficiency refers to benefits of a company's operations, most of which are immediate benefits of internal operations. Typical examples of operational efficiency are

[6] RosettaNet defines a common set of standards for e-business in terms of communication languages and processes among the supply chain members in the IT (information technology) industry.

administrative cost reduction, inventory level decrease, real-time information exchange, clerical error elimination, and trading procedure simplification. Relational advantage consists of benefits pertaining to relationships with trading partners, such as loyalty enhancement, better cooperation, trust development, long-term relationship building, and customer satisfaction. In fact, some companies adopt B2B e-procurement systems in order to utilize them as facilitating tools to build solid relationships with their trading partners.

In the private exchange, the close relationships between the buyer and their suppliers play a key role in its success because the system is specific to the buyer. The buyer's proprietary system makes it difficult for new suppliers to join the buyer's online trading community due to lock-in effects of incumbent suppliers. However, some manufacturers prefer this model because they wish to develop new products with their reliable existing suppliers by keeping collaborative relationships with them. Thus, if the buyer expects both operational efficiency and relational advantage from the e-procurement system, the company is likely to build its own proprietary e-procurement system which matches with its business procedures (*e.g.*, those for purchase order placement/cancellation) and can easily be integrated with its back-end system.

Community Movement / Buyer's Expected Benefits	**Move to "Private" Community**	**Stay in "Third Party" Community**
Operational Efficiency and Relational Advantage	Buyers who wish to keep collaborative relationships with their suppliers. *(The e-procurement system is a competitive weapon.)*	Buyers who wish to avoid risk from e-procurement systems. *(The e-procurement system is a competitive necessity.)*
Operational Efficiency Only	Inappropriate	Buyers who wish to be at arm's length with their suppliers. *(The e-procurement system just facilitates transactions.)*

Table 1: Proposed Framework of Buyers' Community Movement

The following comments are not from an electrical and electronics manufacturer using a third party system but from a carmaker who decided not to use a consortium-based system. However, the manager's comments reflect the very similar situations. An e-BT (business transformation) manager of Nissan explained why they were not using Covisint[7]:

> "Although we invested in Covisint, we are not currently using its system. The Covisint system was originally created for Big Three automakers (*i.e.*, General Motors, Ford Motor, and DaimlerChrysler), and hence, the system is suitable for their business procedures. Unfortunately, we have different business procedures from them. To use the Covisint system, we have three options. The first option is that we change our business procedures so that we can use the Covisint system comfortably. The second option is that we customize the Covisint system so that we do not need to change our operations. The third option is that we do not use Covisint system and implement our own proprietary system. Then, we decided to choose the third option."

However, some buyers are concerned about the technology change or want to avoid any risk relevant to the e-procurement system, as the technology of e-procurement systems is always evolving. This type of buyers expects both operational efficiency and relational advantage from the e-procurement system, but they hesitate to implement the private e-procurement system. These buyers are likely to stay in the third party online trading community. The buyers are aware of competitive necessity of e-procurement system, but they do not intend to invest in the system at this point. Thus, the buyers who belong to the upper-right-hand corner of the two-by-two matrix in Table 1 will stay in the third party community.

[7] Covisint was finally sold to Compuware in February 2004 after the company sold its auction-services business to FreeMarkets, which is being acquired by Ariba.

Other buyers like to stay in the third party online trading community for different reasons. They are concerned with transaction (operation) efficiency which the e-procurement system surely bring, but wish to keep supplier switching costs or supplier searching costs low. The third party exchange is suitable for this type of buyer, as many suppliers are in the online trading community. Thus, if the buyers expect operational efficiency but not relational advantage due to their preference for arm's length relationships with their suppliers, they are likely to stay in the third party community.

Finally, the buyers who fall into the lower-left-hand cell of the matrix may be problematic. These buyers who expect only operational efficiency but intend to move to private community are pursuing an inappropriate goal because the private system entails close ties between the buyer and suppliers. Thus, their movement does not match with their expectation.

Discussions and Conclusions

There are no clear-cut boundaries between the three stages in the online trading community transformation. Specifically, the boundary between the second stage and the third stage may not be obvious, but we can expect the emergence of the supplier-driven community formation only in the third stage. It is practical to distinguish "early adopters" in Stage 2 from "late adopters" in Stage 3 because they are likely to have distinct characteristics. The suppliers adopting the systems in Stage 3 are fence-sitters who take a wait-and-see approach and then decide whether to adopt the system. Unlike "early adopter" suppliers, "late adopter" suppliers have more time to assess the impact of e-procurement systems in aspects of both operations and relationships, though they are more under pressure to adopt the systems.

In this study, we show how the third party electronic community evolves over the

Internet. We identify three distinguishable stages in the transformation of the online trading community, as illustrated in Figure 2. We also observe that there are two types of online trading community formation at different stages of the third party community evolution (*i.e.*, buyer-driven community formation and supplier-driven community formation). Some buyers left the third party community to build their own private electronic trading communities. The buyer's decision whether to move to the private community or to remain in the third party community should be made based on what the company expects from the B2B exchange system (*i.e.*, operational efficiency and/or relational advantage).

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Appendix

	Authors	Research Methods	Major Contributions/Findings
1	(Ahmad & Schroeder, 2001)	Mail survey	The extent of EDI use lead to better deliver performance after controlling for non-managerial context (product diversity, product customization, production instability, and organizational size) and managerial context (just-in-time and quality management).
2	(Arunachalam, 1995)	Mail survey	Customer's request was by far the most supported reason for the EDI adoption. On the other hand, the improvement of customer service was the most realized benefits from EDI.
3	(Bamfield, 1994)	Longitudinal case study based on interviews	The precipitating factors for EDI were EDI innovation networks, cost and performance improvements, and management learning.
4	(Banerjee & Golhar, 1994)	Mail survey	Customer and peer pressure, and the desire for speedier and better communications were primary motivations for the EDI adoption.
5	(Benjamin, de Long, & Morton, 1990)	Case study based on interviews	Buyers would be the dominant force behind the growth of EDI, while suppliers would push it only when they saw some way of differentiating themselves.
6	(Bensaou, 1997)	Mail survey	The scope of EDI use had positive influence on buyer-supplier cooperation in Japan and U.S.A., though not significant in U.S.A.
7	(Bergeron & Raymond, 1992)	Mail survey	Companies which had to adopt EDI under pressure from trading partner(s) provided a significantly worse implementation and usage context for EDI in terms of organizational support, implementation process, and control procedures.
8	(Bergeron & Raymond, 1997)	Two mail surveys (longitudinal approach) (partially the same data as (Bergeron & Raymond, 1992))	The imposition of EDI by business partners was negatively related to the attainment of EDI advantages. In contrast, the organizational context (organizational support, implementation process, and control procedures) and the integration of EDI were positively associated with the EDI advantages. Three years later, the implementation process and the imposition of EDI lost their importance for EDI advantages.
9	(Bouchard, 1993)	Mail survey and case study based on interviews	Organizations' decisions to adopt EDI depended on whether their major business partners were using EDI, and not on the characteristics of EDI.
10	(Carter & Fredendall, 1990)	Mail survey	The majority of companies implemented EDI to obtain cost savings, but the cost savings did not accrue primarily from personnel reductions or new hire avoidance.
11	(Chatfield & Yetton, 2000)	Case study based on interviews	High EDI embeddedness, which was influenced by existing inter-organizational relationships, motivated adopter's strategic use of EDI, whereas low embeddedness deterred such use.
12	(Chwelos, Benbasat, & Dexter, 2001)	Mail survey	The conceptual model based on Iacovou *et al.*'s was empirically tested. It was confirmed that intent to adopt EDI was influenced by perceived benefits, external pressure, and organizational readiness.
13	(Clark & Lee, 1997)	Case study based on interviews, and mail survey	The implementation of EDI without CRP adoption did not result in significant improvements in performance on inventory turns or stock-outs.
14	(Cox & Ghoneim, 1996)	Mail survey, interviews, and case study	The drivers, benefits, barriers and implementation difficulties to adopting EDI varied among the seven UK industry sectors. The benefits were most significantly perceived in the retail, manufacturing, and distribution industries.
15	(Crook & Kumar, 1998)	Grounded theory approach	Increased use of EDI was often organization-initiated and not customer-initiated, but success in increasing the volume of EDI transactions was likely to be impacted by environmental factors (the nature of customers and suppliers, and industry experience with EDI) and organizational factors pertaining to customers and suppliers.
16	(Crum, Johnson, & Allen, 1998)	Two mail surveys (longitudinal approach)	Most of the reasons why companies had implemented or continued to use EDI were not significantly different between the 1990 and 1996 in the same motor carrier companies. However, three non-marketing benefits increased significantly in importance: Increased office/clerical efficiency, improved integration of information, and improved planning.
17	(Davila, Gupta, & Palmer, 2003)	Mail survey	Companies were approaching e-procurement technologies with very different strategies. The majority were taking a wait-and-see approach, and were either aware of the developments but were not committing resources, or investing selectively until the best e-procurement model could be identified.
18	(Deeter-Schmelz et al., 2001)	Mail survey	By offering encouragement, guidance, and incentives and also by stressing convenience of use, suppliers could increase the likelihood that buyers would adopt and use e-procurement.
19	(Drury & Farhoomand, 1996)	Mail survey	Compared to early adopters, late adopters were less satisfied with the output information of the EDI systems in terms of reliability, relevancy, accuracy, and completeness. Users' participation and understanding of the EDI systems in late adopters were also significantly lower than those in early adopters.
20	(Ellram, Londe, & Weber, 1989)	Mail survey	The most important customer service elements were "orders are filled completely", "order cycle time is short", "order cycle time is reliable", "accurate and timely information", and "quick correction of mistakes". EDI could support retailers in their effort to increase customer service.

21	(Emmelhainz, 1987)	Case study based on interviews	EDI use seemed to improve vendor relationships and to increase purchasing productivity without changing the basic nature of the purchasing process.
22	(Fearon & Philip, 1998)	Case study based on interviews and questionnaire	EDI benefit success could be regarded as a synergistic measure of (a) the actual strategic and operational benefits a company had achieved, and (b) the extent of the planning gap between pre-implementation benefit expectations and post-implementation perceptions of realized benefits.
23	(Ferguson, 1998)	Interviewer-administered questionnaire survey	The hub companies that drove EDI achieved the 40% cycle-time improvements, 30% error reductions, and US$5 per document cost savings.
24	(Ghobadian, Liu, & Stainer, 1994)	Case study based on interviews	One of the major benefits of EDI use was that vendor and purchasers were able to make decisions which affected both parties with knowledge of how the other party transacted.
25	(Grover, 1993)	Mail survey	A proactive technological orientation such as strategic IS planning, and an internal push such as top management support were the two most significant sets of facilitators for the adoption decision of a customer-based inter-organizational system.
26	(Hansen & Hill, 1989)	Telephone survey	EDI systems changed the control and audit environment. The survey indicated that the most popular reason for EDI use was quick response and access to information, followed by cost efficiency, customer's request, effect of EDI on paperwork, and accuracy.
27	(Hart & Saunders, 1998)	Mail survey with telephone interviews	Trust was related to increases in diversity of EDI use (the number of transaction sets), while power was negatively related to diversity.
28	(Hill & Scudder, 2002)	Mail survey	Many manufacturers viewed EDI as a tool for gaining coordination with suppliers, but not necessarily so with customers.
29	(Hsiao, 2001)	Case study based on interviews and on-site observations	Four key factors of the adoption difficulty in B2B exchange were lack of familiarity, risk aversion, lack of trust, and incongruent cultural practice.
30	(Hwang et al., 1993)	Mail survey	Customer organizations listed their important motivations behind EDI use as reduction of paperwork, lowered inventory cost, and competitive advantage improvement, while supplier organizations specified improvement of customer service as the primary reason.
31	(Iacovou, Benbasat, & Dexter, 1995)	Case study based on interviews	Three major factors of EDI adoption were identified: Perceived benefits, external pressure, and organizational readiness. The relationship of each factor with the EDI adoption was moderate, strong, and weak, respectively.
32	(Iskandar, Kurokawa, & LeBlanc, 2001a)	Mail survey	"Buyer-push" was the most significant reason for EDI adoption. The resource-dependency approach appeared to be more suitable than the transaction-cost approach for explaining EDI adoption.
33	(Iskandar, Kurokawa, & LeBlanc, 2001b)	Mail survey (the same data as (Iskandar, Kurokawa, & LeBlanc, 2001a))	Companies that adopted EDI with its own initiative perceived EDI as having significant competitive advantages, while reactive companies considered EDI to be only a necessity.
34	(Jelassi & Figon, 1994)	In-depth case study	EDI allowed customers to eliminate paper work, improve data accuracy and timeliness, as well as reduce inventory, resulting in significant savings. It also helped the company gain market share by winning new customers or becoming the single provider of office supplies to several large companies.
35	(Jones & Beatty, 1998)	Mail survey	The adequate constructs to be used for EDI adoption were direct perceived benefits, indirect perceived benefits, and operational compatibility. Technological compatibility was not adequately captured.
36	(Kekre & Mukhopadhyay, 1992)	Archival data analysis at a customer	Companies using routine EDI transactions achieved synchronized manufacturing for JIT environments, whereas those with exception EDI transactions (proxies for uncertainties and processes out of control) were able to mitigate the negative impacts of process uncertainties as a result of timely information.
37	(La Londe & Emmelhainz, 1985)	Mail survey	Expected EDI benefits cited by purchasing managers seemed to be consistent with benefits actually realized.
38	(Lee, Clark, & Tam, 1999)	Archival data analysis at a supplier	The EDI adopters of grocery retail chains increased their inventory turns while simultaneously reducing stock-outs as a result of CRP implementation.
39	(Mackay, 1993)	Mail survey	The most popular reason to adopt EDI was customers' (large car companies') request in the component sector of the Australian automotive industry. Around 25 to 37 percent indicated either marginal or significantly improved trading relationships with their customers. Once EDI was fully integrated into internal systems, significant benefits were achievable.
40	(Maingot & Quon, 2001)	Mail survey	The primary reasons for EDI adoption were improved customer service, improved supplier relationship, reduced clerical error, and competitive advantage. The first three items were also viewed as important impacts of EDI after implementation.
41	(Marcussen, 1996)	Case study based on interviews	Buyers were more positive than suppliers in their evaluation of the effects of EDI on buyer-supplier relationships. In addition, buyers achieved greater financial benefits from EDI use than suppliers.
42	(Mukhopadhyay, Kekre, & Kalathur, 1995)	Archival data analysis at a buyer	EDI with its suppliers enabled Chrysler to significantly reduce operating costs associated with carrying inventories, obsolescence, and transportation. In addition, premium freight savings and information-handling cost savings were realized.

43	(Mukhopadhyay & Kekre, 2002)	Archival data analysis at a supplier	The supplier derived large strategic benefits over time when the customer initiated the EDI system and the supplier enhanced the system's capabilities.
44	(Nakayama, 2000)	Mail survey	Automated information exchange via EDI links might lower wholesalers' perceived bargaining power over their suppliers in the grocery industry.
45	(Nakayama, 2003)	Mail survey	For retailers, EDI use enhanced partner knowledge of operational personnel but it reduced cooperation. On the other hand, for suppliers, EDI use did not enhance partner knowledge but it reduced conflict.
46	(Neo, Khoo, & Ang, 1994)	Mail survey	The opportunity to experiment and learn by using, and adoption behaviors of peers and competitors provided added impetus for the rapid diffusion of EDI (Tradenet) adoption.
47	(O'Callaghan, Kaufmann, & Konsynski, 1992)	Mail survey	Independent agents expanded the share of their business devoted to the insurance carriers with whom they had established EDI linkages. In addition, expected efficiency gains, expected service gains, and expected system compatibility were related to EDI adoption.
48	(Parker & Swatman, 1996)	Mail survey	Regardless of the current EDI knowledge, a lack of know-how concerning EDI in the company was a major inhibitor to the adoption of EDI.
49	(Pfeiffer, 1992)	Preliminary interview-based field study and mail survey	31 different hypotheses about EDI were tested. One of the interesting findings was that EDI use was perceived by early adopters as providing competitive advantage.
50	(Philip & Pedersen, 1997)	Mail survey	The initial reasons most frequently cited for EDI adoption were also those most frequently cited as major benefits obtained through EDI implementation in the organizations.
51	(Premkumar, Ramamurthy, & Nilakanta, 1994)	Mail survey	The relationship between innovation characteristics (complexity, compatibility, costs, relative advantage, and communicability) and diffusion attributes (adaptation, internal diffusion, external diffusion, and implementation success) of EDI in organizations were examined.
52	(Premkumar & Ramamurthy, 1995)	Mail survey (the same data as (Premkumar, Ramamurthy, & Nilakanta, 1994))	EDI users with proactive adoption decision had less competitive pressure, greater exercised power over their trading partners, more internal need, and more top management support than reactive EDI users.
53	(Premkumar, Ramamurthy, & Crum, 1997)	Mail survey	Four factors were important to discriminate adopters from non-adopters of EDI in the motor carrier industry: Company size, competitive pressure, customer support, and top management support.
54	(Ramaseshan, 1997)	Mail survey	There was a growing preference among companies to deal with a supplier/customer who had EDI facilities.
55	(Rassameethes, Kurokawa, & LeBlanc, 2000)	Mail survey	It was not large companies but companies with high corporate performance that had a high level of EDI integration.
56	(Raymond & Bergeron, 1996)	Mail survey	The quality of organizational context (organizational support, implementation process, and control procedures) was higher when the SME implemented EDI voluntarily rather than having it imposed by a major client or supplier.
57	(Raymond & Blili, 1997)	Case study based on interviews	The contracting SMEs were characterized in terms of external influences, predisposition of the organizational context, perception of EDI, and business processes, and classified into "committed", "involuntary", and "belated" adopters. Successful EDI implementation was linked to strategic/network planning, required resources, knowledge and know-how, and project planning.
58	(Reekers, 1994)	Mail survey	The typical findings were high levels of forced EDI adoption by large organizations and only limited achievement of high level benefits of EDI.
59	(Reekers & Smithson, 1994)	Mail survey (partially the same data as (Reekers, 1994))	Compared to operational benefits, strategic benefits were more likely to be found in the later stages of EDI usage.
60	(Saunders & Clark, 1992)	Mail survey	Perceived costs were negatively related to EDI adoption, but perceived benefits, trust in trading partners, and net dependency did not affect EDI adoption.
61	(Scala & McGrath, 1993)	Delphi method	The manager's concerns about EDI adoption were that EDI required high initial capital expenses and high volumes before benefits were attained.
62	(Sriram & Banerjee, 1994)	Mail survey	The impact of EDI was moderated by the volume of EDI transactions. Its adoption required computer skills and training for buyers.
63	(Sriram, Arunachalam, & Ivancevich, 2000)	Mail survey	Organizations experienced both operational and strategic benefits from EDI, and customer-initiated EDI users recognized slightly greater EDI strategic benefits than voluntary EDI users.
64	(Stern & Kaufmann, 1985)	Case study based on interviews	Most distributors believed that EDI systems had not changed buyers' basic relationships with vendors.
65	(Subramani, 2004)	Mail survey	SCMS (Supply Chain Management Systems) use for transaction processing was not significantly associated with operational benefits. In contrast, SCMS use for learning and knowledge creation resulted in both operational and strategic benefits.
66	(Suzuki & Williams, 1998)	Mail survey	Companies tended to show stronger resistance to EDI when they perceived a high level of technological uncertainties (hardware and software), low diffusion rate of industry-wide EDI formats, and little benefit of using EDI for reducing processing time.

67	(Teo et al., 1995)	Mail survey	EDI (Tradenet) users that had planned ahead, participated early, or integrated EDI with their internal IS, benefited more in terms of increased organizational effectiveness (international competitiveness, inventory control, and customer quantity). In addition, all, irrespective of organizational characteristics, attained enhanced organizational efficiency (preparation cost, exchange cost, and flow).
68	(van Heck & Ribbers, 1999)	Interviewer-administered questionnaire survey	The conceptual model based on Iacovou *et al*.'s was tested. It was basically confirmed that intent to adopt EDI was influenced by perceived benefits, external pressure, and organizational readiness, especially the first two factors. In addition, there was no significant relationship between the level of integration of EDI (internally and externally) with the actual benefits adopters received from EDI use.
69	(Vijayasarathy & Robey, 1997)	Mail survey	EDI use was positively associated with channel information intensity and formalization but not on channel information quality. Moreover, intensity and formalization were positively related to channel cooperation but not to conflict. Channel performance was positively associated with channel cooperation and negatively related to channel conflict.
70	(Walton & Marucheck, 1997)	Mail survey	The quality of delivered products as well as the delivery of the correct item/mix was significantly related to the buyer's experience using EDI as a tool in supplier management, willingness of both the buyer and supplier to share sensitive production and capacity information, acquisition of the EDI system, and the level of EDI integration with other computer applications.
71	(Weber & Kantamneni, 2002)	Mail survey	Retailers perceived similar levels of benefits from all levels of EDI use.
72	(Williams, 1994)	Preliminary interviews and mail survey	Marketing channels (suppliers and customers) typically viewed EDI as a means of reducing demand uncertainty in the environment. In contrast, logistical channels (shippers and carriers) were characterized as having significantly powerful shippers that forcefully persuaded carriers to adopt EDI.
73	(Williams, Magee, & Suzuki, 1998)	Mail survey (the same data as (Suzuki & Williams, 1998))	Longer use of EDI or higher degrees of partner selectivity had a significant positive effect on EDI range (the percentage of partners with whom a company shares information via EDI), EDI width (the extent to which a company uses EDI for multiple purposes), and EDI depth (the volume of EDI use for each of the possible EDI transactions).

Table 2: Empirical Studies on the Adoption/Use of EDI or e-Procurement Systems