

# MRO 시장에서의 공급자의 전용마켓 참여에 관한 연구

## A Study of Suppliers' Participation in Private Exchanges: Focusing on MRO Markets

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### 초 록

성장 잠재력에도 불구하고 많은 B2B 시장은 참여업체 수의 부족으로 운영의 어려움을 겪고 있다. 따라서 어떠한 방법을 통해 충분한 숫자의 기업들을 시장에 참여하도록 유도할 것인가가 B2B 시장의 성공을 위한 주요 요인 중의 하나로 인식되고 있다. 본 논문은 MRO 시장을 대상으로 공급업체들을 구매자 중심의 전용시장 (Private Exchanges) 에 참여하게 만드는 요인들이 어떤 것인지를 규명해 보는 것을 주요 목적으로 하고 있다. 이를 위해 EDI 채택에 관한 선행연구와 실무자들과의 면담에 기초하여 실험대상 요인들을 추출하였다. 불완전한 계약 이론(Incomplete contract theory)에 기초하여 가설의 설정과 검증을 하였으며, 분석 결과 시장에 참여할 것으로 기대되는 공급업자들의 수와 시장 참여의 대가로 주어질 보상의 유무가 B2B시장의 참여에 긍정적인 영향을 주는 요인으로 나타났다. 한편 구매업자에 대한 신뢰는 유의한 요인으로 드러나지 않아 공급업자들은 기존의 구매업자와의 신뢰관계가 B2B 시장에서는 중요하지 않는 것으로 조사되었다.

### ABSTRACT

Many B2B electronic markets (EMs) are struggling to survive because they failed to attract enough participants. Thus reaching critical mass of participants is one of the key success factors for various types of EMs. The main purpose of this study is to investigate factors that lead MRO (maintenance, repair, and operating) suppliers to participate in private exchanges (PE), the buy-side EM. This paper introduces the characteristics of the PE according to the classification schemes introduced in previous studies about EM types. Literature is reviewed on suppliers' adoption of inter-organizational information systems focusing on EDI adoptions issues. Data analysis based on incomplete contract theory and the social exchange theory is then presented. The results of this study show that the number of suppliers and subsidy are factors that influence suppliers' participation in PEs. Nonsignificant results relating to trust imply that suppliers who are invited to participate in a PE do not expect their off-line relationships with the buyer to be transferred to the PE.

키워드 : 전용시장, EDI, B2B, 불완전한 계약이론

Private Exchanges, EDI, B2B, Incomplete Contract Theory

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## I. INTRODUCTION

In spite of the recent slowdown of the world economy along with organizational and technical challenges, an explosive growth in B2B (business to business) electronic markets (EMs) has become a global trend. For example, the B2B market is quickly growing into a major market [26] and is expected to account for 88 percent of online sales in 2006 [8].

Despite their potential for extensive growth, many B2B EMs are struggling to survive because they have failed to attract enough participants [28]. Even one of the most ambitious EMs, Covisint, had attracted fewer than 100 of the 30,000 suppliers of Daimler-Chrysler, Ford, and General Motors fourteen months after it announced its plan to launch a single global B2B supplier exchange [16].

While studies have suggested that it is imperative to understand what makes potential participants join EMs, they have provided only anecdotal rather than empirical results. Thus the main purpose of this study is to investigate factors that lead suppliers in horizontal MRO (maintenance, repair, and operating) markets to participate in web-based private exchanges (PEs), the buy-side EM. This study focuses on PEs for MRO purchases since the PE is currently the fastest-growing types of B2B EM [15] and is expected to be a major B2B EM [28].

A PE is privately built by a single buyer

who attracts many suppliers into the buyer's electronic market. The main benefit of this model is that if it is successfully implemented, the market helps both buyers and sellers since it not only keeps the advantage of close off-line relationships but also gives the benefit of on-line transactions.

Using many existing studies on EDI adoption (e.g. [10]; [12]; [21]; [22]; [27]), this research compared factors relating to EDI and the PE. The researchers assume that there are many common aspects between EDI adoption and PE adoption since both of them deal with suppliers participating in the buyers' network; however, many differences exist. The huge asset specific investment required in EDI, for instance, is not a major issue in a PE. Also the price mechanism of the PE, which is based on the reverse auction, is different from the negotiated price mechanism adopted by the EDI environment. Therefore, this paper begins its analysis based on factors related to EDI adoption. However, the primary focus is on how those factors that are thought to be major influences in EDI adoption can be applied differently in the context of the web-based PE.

This paper first introduces the characteristics of the PE, the focus of this study, according to the classification schemes introduced in previous studies about the types of EMs. Secondly, literature is introduced about suppliers' adoption of inter-organizational information systems focusing on EDI adoption issues.

Thirdly, the paper develops hypotheses based on the incomplete contract theory and the social exchange theory. Finally, the results of data analyses and implications are presented.

## II. LITERATURE REVIEW

### II.1 Characteristics of Private Exchanges

Although various market classification schemes have been introduced in previous studies to characterize different types of EMs ([5]; [14]; [26]), it is not easy to find a universal scheme which successfully covers the more than 700 internet-based exchange markets [5].

Kaplan and Sawhney [14] pointed out the need to develop a classification scheme for the many types of B2B EMs and introduced their own classification scheme by focusing on two distinctions. The first distinction was classification by product. By this criterion they introduced products as manufacturing inputs and MRO goods. The second distinction was based on how products are bought. Based on this criterion,

firms can be engaged in either systematic sourcing or spot sourcing. According to these two distinctions, Kaplan and Sawhney developed four categories of EMs, as seen in Figure 1.

Jones [13] introduced three kinds of EMs according to the way the markets save money and create new revenue as follows:

- Inventory squeezers: Provide buyers with the price, availability, and guaranteed arrival date of things they need from their suppliers to make their products in an accurate and timely way.
- Value creators: Create sales that would never have taken place without the Internet.
- Product creators: Net markets that create products that would never have existed without the Internet.

Crimson Consulting Group [5] suggested a holistic classification scheme with four dimensions as follows:

- Industry Focus: Vertical, Horizontal, Mega-Exchange.
- Type of Product: Direct, Operating Inputs, Both.
- Ownership Structure: Third-Party, Private, Consortia.

Spot Source	Yield Managers	Exchange
System Source	MRO Hubs	Catalog Hubs

(Figure 1) Classification of E-hubs (Source: Kaplan S., and Sawhney M., 2000)

〈Table 1〉 Characteristics of Private Exchange

Classification schemes	Type
Parties to transactions	Direct : seller to buyer
Types of product	MROs
Form of participation	Many to one (buy-side)
Industry focus	Horizontal
Types of transaction	Reverse auction (bidding)
Degree of openness	Only for invited suppliers
Ownership structure	Private
Value creation method	Inventory squeezers

- Types of Transaction: Spot, Systematic, Both.

Turban et al. [26] introduced an integrated classification scheme including parties to transactions, types of material sold, number and form of participation, types of transaction, direction of trade, and degree of openness.

Thus the type of EM can be classified according to different schemes. Based on the classification schemes in the literature, PEs can be characterized as shown in Table 1.

## II.2 EDI Adoption

EDI is an exclusive on-line channel between a supplier and a buyer and refers to the electronic exchange of standardized business documents [10]. It provides up-to-date information and allows the supplier and buyer to conduct transactions such as billing, ordering, and invoicing through secure telephone lines or a

VPN (virtual private network) using standardized electronic documents. EDI provides companies with many distinct advantages in terms of faster order processing speed with fewer errors, improved information sharing, and fewer mistakes as well as cost reduction in inventory, labor, and paperwork ([17]: [27]). Thus buyers have a strong motivation to persuade their suppliers to adopt the EDI system to maintain the integration of their supply chains.

However, suppliers have to incur a large asset specific investment to implement EDI. The typical cost of EDI implementation is too expensive for small-to-medium sized suppliers. Additionally, the investment is specific to a single buyer, since most EDI system lack a standard. EDI is customized only for one specific buyer and supplier relationship, and its value is dramatically reduced if it is used for another relationship [29]. Although many

suppliers hesitate to adopt EDI because of aforementioned reasons, their decision should be based on the comparison of the risk of asset specific investment with incentives from it [25].

Another major factor that is frequently studied in EDI adoption is each party's bargaining power. Bargaining power refers to the outcome of the relationship between a supplier and a buyer, which is often represented by power balance and trust. According to previous studies on the impact of power in the EDI adoption process ([10]: [22]), open communication between a buyer and a supplier occurred when a buyer used persuasive power. The exercising of such power results in a long-term partnership and trust, which encourage both parties to expand EDI use. One study that clearly pointed out the power relationship in the EDI adoption is [22], where he convincingly argues that the issue of adopting EDI is no longer related to reliability of technology but to the reliability of the trading parties. Hart and Saunders [10] view power as a function of dependence on the other party and the use of dependence to leverage change in accord with the intention of the less dependent firm. They argue that while the coercive approach reflects a short-term strategy, the persuasive approach is a long-term strategy for building inter-organizational relationships with trading partners through EDI implementations.

Trust encourages firms to make investments necessary for electronic information exchange

and discourages opportunistic behavior, which would clearly reduce the opportunity for greater information sharing over time [10]. Hart and Saunders [10] note that trust increases a firm's willingness to improve information sharing through EDI and explores mutually beneficial arrangements related to EDI that improves inter-firm coordination. Parkhe [19] discusses two kinds of uncertainty: uncertainty regarding unknown future events and uncertainty regarding trading partners' response to the future events. Parkhe argues that trust through uncertainty is related to suppliers' adoption decision regarding EDI. According to his research, these uncertainties result in reduced confidence not only in reliability of business-to-business transactions transmitted electronically but also in other trading parties with whom they are dealing.

Another important factor, which has been identified as one of the factors which strongly increase suppliers' intention of joining EDI, is subsidy from the buyer as an initiator of inter-organizational systems. Wang and Seidmann [27] showed that it is important for buyers to provide price premiums to suppliers who are trying to adopt EDI because adopting EDI gives negative externalities. They also showed that when the benefit of EDI for a buyer is substantial, the buyer's best interest is to subsidize the suppliers to motivate them to adopt EDI.

Finally, Iacovou et al. [12] hypothesized that there are factors influencing EDI adoption

such as perceived benefits, organizational readiness, and external pressure. They also suggested that competitive pressure and imposition by trading partners are two main sources of external pressure to adopt EDI. They concluded that there are positive relationships between perceived benefit and EDI adoption and external pressure and EDI adoption but there is no relationship between readiness and EDI adoption. This study adopted suppliers' perception about the number of suppliers expected to join a PE as an independent variable representing perceived benefit of joining the PE.

### II.3 Private Exchange as a Different Marketplace for Suppliers

As seen in the previous research, EDI adoption accompanies an asset specific investment to suppliers ([1]; [2]; [25]). The assumption of huge asset specificity, however, is not the major concern in PE that it is in EDI for potential

suppliers since the development of Internet technology has dramatically reduced the cost of implementing and maintaining EMs [4]. For example, if a company uses a web server with XML (Extensible Markup Language) through public network infrastructure as a substitute for traditional EDI through VANs (Value Added Networks), the company only has to spend \$5,000 for a Web server, whereas a traditional EDI server once cost \$10,000 to \$100,000 [23]. In addition, the high compatibility of Internet technology hedges the risk of an asset specific investment. For example, suppliers can switch an EM in which they are involved with another EM for minimum switching cost by virtue of Internet technology. Therefore, a new approach based on the context of the Internet infrastructure is necessary to analyze the relationship between a buyer and a supplier when the risk of "asset specific investment" is split into small pieces due to the high compatibility of Internet technology.

Price mechanism is another important

<Table 2> Types of Price Mechanism

Type	Sub classes
Set price mechanism	Prices updated periodically
	Prices updated continually
Negotiated price mechanism	Specified starting points for negotiation
	No specified starting points for negotiation
Competition across buyers and sellers	The seller provides an item without specifying a price (classic auction)
	The customer taking the lead in organizing pricing process (reverse buying)
	Multiple buyers and multiple sellers (exchange)

difference between EDI and PE. According to Dolan and Moon's [6] classification scheme, the price mechanism can be classified into three types as seen in Table 2.

Among the three types, the negotiated price mechanism without specified price is close to the price mechanism for EDI. Thus not only price but also other important factors including quality, delivery, flexibility, and trust have played important roles for suppliers to make a good deal with buyers. Trust especially has been regarded as a very important factor in this mechanism.

On the other hand, the price mechanism of the PE is closer to reverse buying, where competition among sellers leads to a price. Under this mechanism the buyer sends a Request for Quotation (RFQ), which specifies what is to be purchased, to qualified sellers. Then the sellers submit secret bids for sealed bidding or real time bids for open bidding. Since the overall result of the reverse auction is downward pressure on prices [6], it has been regarded as a biased market for customers.

### III. HYPOTHESES DEVELOPMENT AND RESEARCH METHODS

#### III.1 Hypotheses Development

The purpose of this study is to identify

factors which influence suppliers' adoption of the PE and to compare them with factors that influence the EDI adoption process. To investigate whether factors having influenced suppliers' EDI adoption are still applicable to the PE adoption domain, this study developed customized hypotheses for the PE based on factors which were identified from EDI research. To develop hypotheses, we used the social exchange theory and the incomplete contract theory, which have been adopted to analyze the relationship between a buyer and suppliers ([1]; [2]; [25]; [30]).

According to the incomplete contract theory, the main reason that suppliers do not want to join EMs is that EMs force suppliers into price-based competition. Once an EM is established, suppliers have to provide their price information, and suppliers' ex post values decrease in terms of the market bargaining power. Therefore, to motivate suppliers to join EMs, buyers should provide some incentives in exchange for taking away ex post bargaining power from suppliers [25]. Although the promised incentives should be accompanied by some contingences left out of the partner's agreement due to the nature of the incomplete contract [9], promising some incentives to suppliers could mitigate the barriers against getting participants.

Previous studies have suggested that two incentives are useful to the buyer. First, the promised limitation of the number of suppliers

in the market by the buyer will increase suppliers' confidence that their ex post bargaining power will not be decreased. Second, the promised subsidy to suppliers for the investment reduces the suppliers' ex post dependency on the buyer by reducing the asset specific investment from suppliers ([4]: [11]: [25]).

Following these two strategies, the current research investigated factors that might affect suppliers' participation in a PE. First, a suppliers' perception of the number of suppliers who will participate in the PE will influence suppliers' decision to join the PE since the number of suppliers will indirectly affect the bargaining power of a supplier. If suppliers think that they can maintain their bargaining power in relation to the buyer, they will join the market. Second, the subsidy might not influence suppliers' intention to join a PE, although it was an important factor in EDI adoption. Since the asset specificity is not a major concern in EMs due to the flexibility and low cost of Internet technologies, the researchers expected that the subsidy offer from a buyer would not be a strong incentive for suppliers in their decision to join a PE.

**H1.** The smaller the number of suppliers who are expected to join the PE, the higher will be the intention of suppliers to join the PE.

**H2.** The greater the level of subsidy expected from the buyer, the higher is the intention

of the supplier to join the PE.

According to Blau's [3] social exchange theory, power structure is the product of unequal exchange relations. For instance, if an individual becomes increasingly dependant on another for services required in achieving their goals, the former should subordinate himself to the latter. Similarly when a supplier is dependant on a buyer, the buyer has the power in the relationship [30]. Previous studies have also approached suppliers' EDI adoption issues from the same perspective by focusing on the effect of buyer's superior power on suppliers' decision making ([10]: [12]: [18]: [22]). Thus, this paper developed a third hypothesis to test the influence of the buyer's superior power on suppliers' PE adoption. From the perspective of Hart and Saunders, this study assumes power as a function of dependence on the other party. Based on the assumption that the buyer's superior power still has influence on suppliers' decisions, the following hypothesis was developed:

**H3.** The greater the level of suppliers' dependency on the buyer, the higher is the intention of suppliers to join the PE.

Previous studies have also identified the role of trust in the relationship between buyers and suppliers and its effect on EDI adoption ([10]: [19]). According to the social exchange theory, trust is the result of past experiences and current

interactions [30]. Thus the researchers assumed that trust, which is built from the off-line relationship, could be transferred to an on-line relationship of PE. Social exchange refers to voluntary actions of individuals that are motivated by the return they are expected to bring [3]. In other words, an individual can obligate another by supplying rewarding services to him. Thus based on trust, suppliers obligate a buyer by joining a PE; to discharge its obligation to the suppliers, the buyer is expected to compensate for the suppliers' loss of bargaining power.

Based on this theory, the researchers hypothesized that there is a significant relationship between the supplier's trust in a buyer and the supplier's adoption of the PE as follows:

**H4.** The greater the level of supplier's trust in the buyer, the greater is the intention of suppliers to join the PE.

### III.2 Research Methods

Since this study focused on suppliers' intention of joining a PE, data were collected from MRO suppliers of a single buyer operating in Seoul or Keyng-ki area in Korea, a food processor for such products as noodles, mineral water, and dairy products. Responding organizations were supplying the parts for repair and maintenance of production lines of the buyer. The buyer had decided to transfer off-line

procurement processes with its suppliers to on-line B2B transactions in the near future. They had 150 active suppliers. A questionnaire was distributed to senior managers of all active suppliers: 62 usable questionnaires were returned, for a response rate of 41.3 percent.

To measure the effect of factors identified through literature review and hypothesis development, an instrument was developed including questions about the supplier's trust in a buyer based on previous studies ([7]; [24]). To check the uni-scale of the construct, reliability analysis was employed, resulting in a Cronbach value of 0.7395, which is sufficient to guarantee uni-scale (see the Appendix 1).

Other independent variables, such as the number of suppliers expected to join the EM, the level of subsidy expected from a buyer, and the level of supplier's dependency on a buyer, were measured. One item asking suppliers' intention of joining the PE was used for the dependent variable. Finally, two control variables were used: the size of suppliers and the number of years for which the relationship with the buyer had existed.

## IV. RESULTS AND IMPLICATIONS

### IV.1 Results of Data Analyses

As shown in Table 3, the average number

of employees in the sample firms is 14, and the average length of partnership between a supplier and a buyer is 3.5 years. The sample group has an average of 9.25 buyers. To test which factors influence the suppliers' intention of joining the EM, multiple regression analysis was conducted on the following variables and with the control variables: (1) expected number of suppliers, (2) level of subsidy, (3) level of dependency, and (4) level of trust. The extracted

model explains 25.0 percent of total variance. A P value of 0.003 in the ANOVA statistics of Table 4 shows that the model is significant at the level of 0.05, and all tolerance scores are higher than the minimum tolerance limit of 0.1, suggesting that multi-linearity is not a problem. Coefficient scores in Table 5 show that only (1) the level of subsidy from the buyer and (2) the number of suppliers expected to join the PE are variables which significantly

<Table 3> Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Number of employees	39	3.00	86.00	14.00	16.34
Length of partnership (years)	44	1.00	20.00	3.50	3.39
Number of main buyers	39	2.00	25.00	9.25	7.40

<Table 4> ANOVA Test

Mode		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	7.781	2	3.891	6.682	.003
	Residual	23.289	40	.582		
	Total	31.070	42			

<Table 5> Coefficient Scores

Model		Std. Error	Standardized Coefficients Beta
1	(Constant)	.539	
	Subsidy	.154	.267*
	Number of Suppliers	.143	.343**

\* Significant at the  $\alpha$  level of 0.1

\*\* Significant at the  $\alpha$  level of 0.05

〈Table 6〉 Summary of Data Analysis

Hypothesis Number	Hypothesis	Result
I	The smaller the number of suppliers who are expected to join the e-Marketplace, the higher is the intention of suppliers to join the PE	Accept
II	The greater the level of subsidy expected from the buyer, the higher is the intention of suppliers to join the PE	Accept
III	The greater the level of suppliers' dependency on the buyer, the higher is the intention of suppliers to join the PE	Reject
IV	The greater the level of supplier's trust in the buyer, the greater is the intention of suppliers to join the PE	Reject

influence suppliers' intention of joining a PE.

The results of data analysis are summarized in Table 6. The number of suppliers, which research has shown to be an important factor for EDI adoption, is still a significant predictor of the supplier's intention to join PE. But contrary expectation, the level of subsidy still plays an important role in affecting a supplier's decision to join a PE. The positive relationship indicates that the greater the subsidy from the buyer, the stronger the intention of a supplier to join the market.

The results indicate that buyer's superior power on suppliers does not influence suppliers' intention to join a PE. Finally, unlike the case in EDI, trust between the buyer and suppliers does not explain suppliers' intention to join the PE.

## IV.2 Implications

The results of the study indicate that suppliers

will look for somewhat different factors when they make decisions about joining PEs from when they adopt EDI. Contrary to the case in EDI, the results indicate that a power relationship between buyers and suppliers does not play an important role. The results imply that using superior market power over suppliers may not be a very effective way for buyers to develop their own PEs. Thus the current struggling status of the consortium PE, which is created as a way to align several buyers to increase their market power over suppliers, can be explained from this perspective.

The nonsignificant effect of trust indicates that as the industry moves into the Internet-based transaction, suppliers perceive that the previous traditional relationship between buyers and sellers might be threatened. Given low switching costs combined with flexibility of systems and price mechanism based on reverse auction, one should expect to see more transaction-based rather than trust-based

relationships. However, the very fact that suppliers do not think that trust will play a role in their decision implies that the digression of an existing relationship is a great concern to the suppliers. Buyers need to further nurture the trust relationship since they have to convince their suppliers that a PE is not just a price-based marketplace where suppliers have to slash their prices but it is instead a marketplace where mutual benefit can be achieved by building a competitive supply chain based on existing trust relationship with selected suppliers for lower transaction cost and higher transparency of business.

On the other hand, the expected number of suppliers to a PE is a factor influencing suppliers' intention. Since the number of suppliers to the market determines the extent to which a supplier competes in EDI adoption, some buyers have to restrict the number of suppliers to attract necessary suppliers into their EDI system. Likewise, the results of this study also suggest that the competition in PEs is a major concern to suppliers. This result implies that suppliers believe they might lose their bargaining power to the buyer as a result of an increased number of suppliers joining the PE. Thus buyers need to emphasize the fact that only a limited number of suppliers with qualification will be invited into their PEs to attract more suppliers to their markets.

Contrary to the expectation of the researchers, the subsidy from a buyer turns out to be the

strongest predictor in determining the adoption of a PE by suppliers. However this result could be explained by the fact that subsidy could still have a significant effect on the adoption decision of suppliers who in the past enjoyed getting financial rewards for adopting new inter-organizational technologies. For example, the low adoption rate of XML resulted from the fact that no financial reward could be delivered to any specific supplier since it is a standard technology with low implementation cost [20]. Furthermore, considering the relatively small size of suppliers in this study, the support from a buyer can be a great help for small-sized suppliers.

## V. CONCLUSIONS

This research began with an analysis of the factors related to EDI adoption and evaluated how factors that are thought to be a major influence in EDI adoption can be applied differently in the contexts of PE. The results of this study show, however, that only number of suppliers and subsidy are factors that influence the participating suppliers in a PE. These results indicate that many suppliers do not recognize the potential benefits a PE could offer, and they do not believe their off-line relationships with a buyer could be transferred to on-line relationships in a PE. Therefore, buyers have to convince their suppliers that

the PE is not just a price-based marketplace like a spot purchasing market where many suppliers have to slash their prices. Instead it is a marketplace where mutual benefit can be achieved based on an existing trust relationship between a buyer and a limited number of qualified suppliers.

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