

## **Integration of electronic data interchange: a review**

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### **Abstract**

The implementation of electronic data interchange (EDI) has been claimed to be vital for the success of international trade, as it requires bundle of data exchanges between many parties across geographical boundaries. Numerous literatures have argued that EDI could yield enormous benefits provided that there is integration into other business applications as well as with company's trading partners. Nevertheless, due to many barriers during the implementation process, EDI often stagnant with a single set of transactions without further integration. On the other hand, literatures revealed further that most of the companies that were imposed by government or larger trading partners to implement EDI are reluctant to integrate it into other business applications. This paper discusses EDI integration by referring to its benefits, inhibitors and determinants based on the literatures and findings of the preliminary works. Accordingly, a research model has been built where the effectiveness of the model is demonstrated by the development of thirteen propositions that could be tested in practice.

### **Introduction**

Electronic Data Interchange (EDI) can be defined as an electronic transmission of standardized business documents between trading partners with little or without human intervention (Ngai and Gunasekaran, 2004; Chau and Jim, 2002). The present EDI market growth rate is 45% per annum, where there are more than 300,000 EDI users worldwide and it is forecasted that EDI market will rise considerably at the growth rate of 200% per annum in near future (Bergeron and Raymond, 1997; Ngai and Gunasekaran, 2004). EDI could result in enormous benefits when there is a closer integration of EDI with other business applications as well as with company's trading partners (as claimed by Sanchez and Perez, 2003; Kurokawa and Manabe, 2002; Jun et al., 2000; Holmes and Srivastava, 1999; Tuunainen, 1998; Vega et al., 1996). Pertinent to EDI integration and its benefits, Angeles et al. (1998) found a company would lose 70% of potential benefits of EDI if not integrated. Thus, it is wise to assume that EDI implementation would not be successful without its full integration.

Nevertheless, due to potential barriers or difficulties in the implementation process, EDI often stagnant at the initial stage with a single set of transactions without integration (Kurokawa and Manabe, 2002; Jun et al. 2000; Holmes and Srivastava, 1999; Vega et al., 1996). Findings by Fawcett (2005) could be used to illustrate the scenario of EDI stallness. According to Fawcett, many of the surveyed respondents admitted that they receive 100% of purchasing orders via EDI and transmit more than 80% of their orders to suppliers using fax or phone; this indicates that EDI integration did not take place in these companies while they remain with traditional methods for transmissions of such documents.

The major motivation behind the EDI implementation among Malaysian companies particularly for small and medium-sized enterprises (SMEs) is merely due to the imposition by their large trading partners or government enforcement instead of their own initiatives (Leng

Ang et al., 2003); thus, these companies often stagnant with a single EDI transaction (e.g. customs declarations) without the integration (Leng Ang et al., 2003; Jun and Chai, 2003; Chau, 2001). It has been claimed that resistance to the full EDI implementation in Malaysia is in accordance with the pessimistic thoughts of Malaysian towards efficiency and effectiveness of EDI. It is just one of the examples where Malaysians prove to be reluctant to change from their old values (Straits Shipper, 1995 March 27; Business Times, 2003 November 26). Nonetheless, there appears to be interest on EDI system among Malaysian companies but little commitment or lesser urgency among trading partners (MIDA Annual Media Conference, 2004). In addition, lack of financial and technical resources as well as lack of top management support have become significant barriers for successful EDI implementation and integration (Bergeron and Raymond, 1997; Elbaz, 1998; Tuunainen, 1998).

Pertaining to the above-described EDI issues, a research on EDI integration is *required* to be a guide for EDI practitioners in Malaysia. Thus, the objective of this paper is to examine the determinants, benefits and inhibitors of EDI integration. This paper focuses on the development of the research model. The next section reviews relevant past literatures that provide the basis for the model. The research model and hypotheses are developed and discussed in the later section.

### **Literature review**

EDI system was initiated in the United States by Berlin Airlift United States in late 1940s to coordinate consignment airfreights by devising a standard manifest to be filled by aircraft before unloading (Emmelhainz, 1994). This concept had been extended by the rail and road transport industries in 1960s when they begun to standardize documents and replace paper-based communication methods with the electronic system (McNurlin, 1987).

Swatman and Swatman (1991) claimed that an integrated EDI system with internal application systems and organizational functions can be distinguished as a truly strategic application from other forms of electronic telecommunications. Knoppers (1992) pointed out that EDI includes an enormous variety of applications, ranging from the more common standard business documents, such as purchasing order, to generic documents such as funds transfer. Many past researches have argued that enormous benefits of EDI could be gained from its integration into other business applications that ultimately will change the entire structure of the affected organization via business process reengineering (Vega et al., 1996; Emmelhainz, 1994; Angeles et al., 1998; Bergeron and Raymond, 1997; Kurokawa and Manabe, 2002).

There are many examples of companies that enjoy greater benefits from EDI implementation and its integration. In Malaysia, benefits of EDI integration could be assessed by referring to Royal Malaysian Customs (RMC) SMK DagangNet system at Port Klang (known as Port Klang Community System - PKCS) which begun with the submission of declaration forms and then has expanded with electronic payment system to support RMC's duty payments. Since its inception, turnaround time between submission and clearance had been reduced to about 70% in addition to the improved information accuracy with the automated data entry validation and the elimination of rekeying data at every RMC's station (Mahfuzah Kamsah and Wood-Harper, 1997).

In the global context, benefits of EDI integration could be seen in the General Electronic (GE) Company. Chief Executive Officer of GE admitted that EDI integration has brought enormous benefits to the company's performance as depicted in the following statement, "*By integrated system, General Electric (GE) has reduced its backlog at a plant from two months*

to two days. Productions have increased by 20% and costs are down by 30%. Return on investment is currently running at 20%. The product is delivered in three days not three weeks and quality is markedly higher. On top of all these, GE is gaining market share in a market that has been flat for years. Although integration is not the only factor of this turnaround, it has been deemed as the primary factor and a contributor to the success of other important factors” (Swatman and Swatman, 1991). These two examples have portrayed the significance of EDI integration in order to enjoy its greater benefits where without integration, EDI would act as merely little better than an electronic mail (Swatman and Swatman, 1991).

In general, there are two dimensions in EDI integration i.e. internal and external (Iacovou et al., 1995; Elbaz, 1998; Bergeron and Raymond, 1997). Internal integration refers to the variety of applications interconnected through EDI such as order entry, invoicing, billing and payment transfer meanwhile external integration refers to the number of trading partners such as suppliers, customers, government agencies etc. On the other hand, Jun et al. (2000) identified four key dimensions of EDI usage as regards to its integration. The identified dimensions are volume (extent of company’s documents are handled through EDI connections), diversity (number of distinct document types that a company handles), depth (degree of business process electronic consolidation that has been established between two or more trading partners) and breadth (extent of company’s EDI connections with external organizations). Morell et al. (1995) categorized EDI integration into three levels: in high level, there is little or no manual intervention in EDI transactions; in moderate level, there is some manual intervention; and in poor level, there is more manual intervention. As for this research, the typology of internal and external integration has been emulated.

### Research model and hypotheses

By looking through numerous EDI literatures, a research model has been built in relation to the EDI integration. This model identifies a set of determinants, benefits and barriers variables that have impact on EDI integration (see Figure 1).

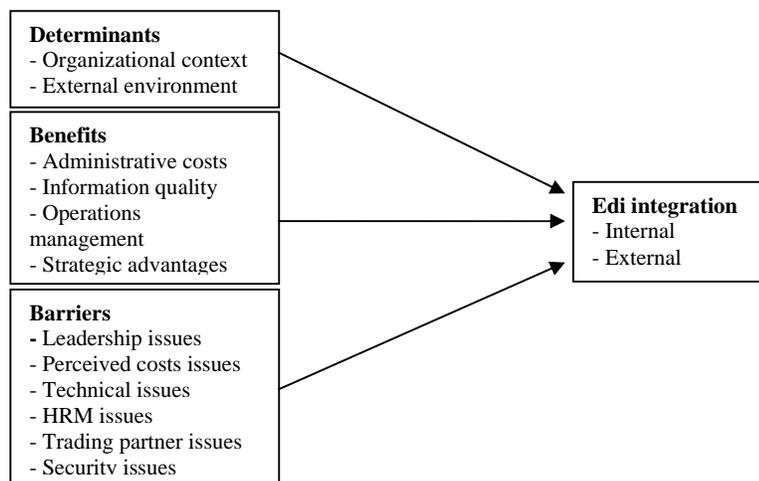


Figure 1: Research model

### ***Determinants***

To date, there are dozen of researches that have focused on the factors of EDI adoption and integration. The most prevalent two studies on EDI implementation factors are studies done by Iacovou et al. (1995) and Angeles et al. (1998). Iacovou et al. classified EDI determinants into three categories i.e. organizational readiness, perceived benefits and external pressures while Angeles et al. identified 13 individual determinants without any particular classification, where these two findings are alike. For this paper, EDI integration determinants are grouped into two i.e. organizational context and external environment. Organizational variables refer to IT maturity, top management support, technological and financial resources while external variables refer to imposition by large trading partners, enforcement by government and competitive pressures. Thus, the following hypotheses are proposed:

- H1a: The organizational factors will be positively related to both internal and external integration of EDI
- H1b: The external factors will be negatively related to both internal and external integration of EDI

### ***Benefits***

Numerous past researche have discussed in details about EDI enormous benefits. The common EDI benefits are improved trading partners relationship, improved customers service, reductions in transaction cost and time, error-free transactions, high access to information, increased overall competitiveness and others. Bergeron and Raymond (1997) categorized 22 EDI benefits, which were found from literatures, into five group namely administrative costs, information quality, operations management, strategic advantages and transaction speed. Their study found EDI advantages tend to be more in operational level (administrative costs and transaction speed) and the managerial level (information quality and operations management) than the strategic level (strategic advantage).

- H2a: The benefits that result from reduced administrative costs will be positively related to both internal and external EDI integration
- H2b: The benefits that resulted from increased information quality will be positively related to both internal and external EDI integration
- H2c: The benefits that resulted from improved operation management will be positively related to both internal and external integration EDI
- H2d: The strategic advantages of EDI will be positively related to both internal and external EDI integration
- H2e: The benefits that resulted from increased transaction speed will be positively related to both internal and external integration

### ***Barriers***

Despite the enormous benefits of EDI, there are some barriers that often inhibit EDI integration process. The common EDI barriers are lack of top management support, technological resources, financial resources and EDI-capable trading partners as well as incompatibility of existing system with EDI. Jun and Chai (2003) classified various EDI barriers which were found from past literatures into six categories namely managerial leadership issues (e.g. lack of managerial leadership), perceived costs and benefits issues (e.g. substantial financial resources and requirement for the high volume of transactions before obtaining the benefits), technical issues (e.g. incompatibilities of EDI with existing system,

proliferation of EDI standards and risk of system instability), human resource management issues (e.g. insufficient education and training for the company's EDI personnel), trading partner relationship issues (e.g. difficulty in getting EDI capable trading partners) and security issues (e.g. disclosure of messages, repudiation of message origin and modification of message contents).

- H3a: The barriers that arise from leadership will be negatively related to both internal and external EDI integration
- H3b: The barriers that arise from perceived costs will be negatively related to both internal and external EDI integration
- H3c: The barriers that arise from technical aspects will be negatively related to both internal and external EDI integration
- H3d: The barriers that arise from human resource management will be negatively related to both internal and external EDI integration
- H3e: The barriers that arise from trading partner relationship will be negatively related to both internal and external EDI integration
- H3f: The barriers that arise from security aspects will be negatively related to both internal and external EDI integration

### **Proposed sampling**

This section discusses and proposes the key aspects of methodology for the research. Most of the past researches have employed descriptive research methods e.g. Ngai & Gunasekaran (2004), Chau & Jim (2002) and Kurokawa & Manabe (2002); thus, this research will employ descriptive research methods based on the cross-sectional design. In Malaysia, all companies that engage with export and import activities are mandated to use EDI (SMK DagangNet) for customs declarations where most of these companies are manufacturers. It is suggested that all manufacturers that are located at three major industrial states, namely Johor, Penang and Selangor will be the target population. The list of manufacturers will be obtained from Malaysian Manufacturers Directory and Trade Portal (<http://www.e-directory.com.my/>). The sample of this research will be selected randomly on the basis of simple random sampling. Accordingly, the questionnaires will be distributed through mail where the response rate can be increased by doing a proper follow-up. The thirteen propositions that have been established in this paper, will be tested by statistical tool such as t-test, Anova, Pearson correlation and multivariate to produce reliable results.

### **Conclusion**

In summary, this paper examines the integration of EDI in terms of its determinants, barriers and benefits. This model comprised concept, variables and measures derived from the theoretical and empirical approaches. The application of this model is likely to be useful to study the relationship of determinants, barriers and benefits on EDI integration. Thirteen propositions have been established to show the applicability of the model. It is recommendable to study the outcomes of EDI integration in addition to the other three variables that have been introduced in this paper.

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