





6

AN EMPIRICAL INVESTIGATION ON EDI DETERMINANTS AND OUTCOMES IN THE MALAYSIAN INDUSTRY

**ABU BAKAR ABDUL HAMID
GENGESWARI A/P KRISHNAPILLAI
MELATI AHMAD ANUAR**

INTRODUCTION

Government involvement is the main cause for the EDI acceptance in Southeast Asian countries (United Nation of Economic and Social Commission for Asia and Pacific - UNESCAP, 1996). This is significantly different from the EDI developments in the western countries in which private sector involvement in EDI is substantial (UNESCAP, 1996). As an initial step to spur EDI implementation in private sector, the Malaysian Government has imposed all companies that engage in international trade to implement EDI by doing electronic customs declarations through CIS (Customs Information System) DagangNet. For this, the Government also spent over RM 300 million to fully implement EDI nationwide (Star, 2003 December 3). Nevertheless, such implementation is not successful and it has been claimed that *“EDI is not yet fully implemented even though it had been initiated since late 1990s, besides electronic data is also still not recognized for legal customs declaration purposes even if it was meant for paperless and electronic customs declarations”* (Star, 2003 December 3). To date, there are dual customs declarations, both electronic and manual, in practices where the sole typical electronic transaction is registration of the customs form (Jimmy, 2005; Star, 2005 July 11). This is in contrast with electronic customs declarations

by other countries such as Hong Kong, Korea and Singapore where there is a full electronic declaration including electronic payment for declarations charges (Jimmy, 2005; Star, 2005 July 11; Chau, 2001).

The expectations for EDI began to mount since its initiation where many analysts made predictions of unprecedented growth, that the number of users would double annually and that no one could afford to be without EDI, yet the sad truth was that only 1% of potential users had ever implemented EDI where many factors were claimed to be the reasons that inhibit its growth (Chan, 2000; Iskandar, 2000; Chau, 2001; Angeles et al., 2001). The most often cited reason was attributed to the considerable initial investment, misperception by users on EDI as a very complicated tool and EDI benefits were hardly quantified.

Recent studies found that there are more mandated EDI users than self-initiated users in Malaysian manufacturing and shipping industry (Leng Ang et al., 2003; Gengeswari and Abu Bakar, 2006b). A positive association was identified between firm size and type of users where mandated users tend to be small and medium-sized enterprises (SMEs) who have no capabilities to implement on their own or have no necessity to implement EDI due to low transactions, for instant (Chau, 2001; Chau and Jim, 2002; Leng Ang et al., 2003; Jun and Chai, 2003). Many of these mandated users tend to appoint third parties to implement EDI on behalf themselves instead of implementing directly or at their own (Yassin, 2005). These companies often stall EDI implementation with little transactions i.e. customs declarations or transmission of purchase orders instead of integrating it into other business functions (Leng Ang et al. 2003; Gengeswari et al., 2006a).

With regards to importance of EDI integration, Angeles et al. (1998) claimed that a company would lose 70% of potential benefits if it did not integrate EDI with other applications. Substantial EDI benefits can be enjoyed only when there is a closer integration (Sanchez and Perez, 2003; Kurokawa and Manabe, 20012; Jun et al., 2000; Tuunainen, 1998a; Vega et al., 1996) where EDI proponents

have convinced that “EDI does not make sense unless it is integrated into business cycle and therefore into business application systems” (Swatman and Swatman, 1991). Thus, mandated users, SMEs or companies that implement indirect EDI would not be able to enjoy enormous benefits of EDI due to not integrating it in which, ultimately their EDI implementation would fail.

Despite substantial investment on and utilization of IT, the manufacturing sector is still facing the challenges of technological advancements and continuing needs to move towards higher added value (Musalmah, 2006; Mak Loh Abdullah et al., 2003). Utilization of IT can help this sector to improve overall productivity in different ways. With EDI, a competitive and cooperative IT tool, they are able to gain competitive advantages as claimed by (Porter, 1998 in Ashby, 2002). However, in general, EDI implementation and integration among Malaysian manufacturers is just average (Gengeswari and Abu Bakar, 2006b). There appears to be an interest on EDI system but little commitment among trading partners, potential EDI barriers, pessimistic thoughts towards effectiveness of EDI and reluctance to change from using conventional trade communication methods have slow down EDI implementation (Straits Shipper, 1995 March 27; Rafidah Aziz, 2004).

In conclusion, in Malaysia, EDI has been implemented by all companies that are required to declare their goods for the purpose of customs clearance but most of the companies stall EDI implementation with few transactions such as customs declarations and transmission of purchase orders. Thus, EDI implementation level among Malaysian companies has not reached the predicted level (Business Times, 2003 November 26). Yet, this conclusion can be too hasty as in so far very less relevant empirical studies have been undertaken in Malaysia (Gengeswari et al., 2006a; Gengeswari and Abu Bakar, 2006b; Leng Ang et al., 2003; Mahfuzah Kamsah and Wood-Harper, 1997). Thus, an empirical investigation is required to empirically examine the EDI implementation at Malaysia focusing on manufacturers.

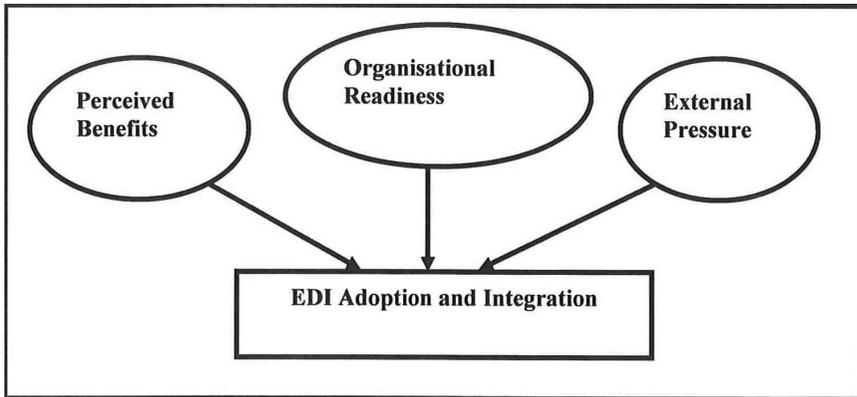
LITERATURE REVIEW

EDI Determinants

EDI adoption can be viewed as an innovation adoption; as a collaboration tool; and from organisational behavior perspective. Paradigm of innovation adoption assumes that users perceive EDI as an external innovation developed by a third party. Consistent with Roger's diffusion of innovation theory, EDI technical characteristics such as relative advantage, compatibility and complexity determine its adoption process. Yet, EDI implementation should be viewed in more managerial and business rather than technical terms where EDI community has claimed that "EDI is 90% business and just 10% technology" (Swatman and Swatman, 1992; Emmelhainz, 1994; Chan and Swatman, 1998). This is because EDI is not merely another telecommunication advances but is rather a tool to enhance cooperation within and between organisations. Consistently, paradigm of organisational behavior assumes that certain aspects or characteristics of the adopting organisations considerably influence EDI adoption process. Adequate financial and technological resources were claimed to be key facilitators for the adoption of any technologies including EDI (Rogers, 1995; Tornazky and Klein, 1982). It explains why a large organisation, which is seen to have sufficient resources, is likely to adopt EDI a small or medium-sized enterprise (Iacovou et al., 1995; Tuunainen, 1999b; Lin, 2002). Besides that, EDI, as a cooperative system, requires at least two parties to commit the transactions thus EDI adoption depends on the collaboration among potential adopters, as claimed by paradigm of critical mass.

Organisational readiness refers to the company's level of financial and technological resources. Technological readiness is concerned with the high level of IT usage and it is predicted that companies with computerized process would be more likely to adopt and integrate EDI. In terms of financial readiness, companies with substantial financial resources are more likely to adopt and integrate EDI. Iacovou et al. (1995) defined external pressure as influences

from the organisational environment where it consists of competitive pressure and imposition by trading partners. Companies are claimed to initiate EDI when their trading partners become EDI-capable in order to maintain competitive position. Imposition by trading partners is expected to be the most critical factors of EDI adoption. Iacovou et al. (1995) defined perceived benefits as the level of awareness on EDI potential advantages where it consists of direct and indirect benefits. Direct benefits are mostly operational savings related to the company's internal efficiency while indirect benefits refer to the impact of EDI on company's business processes and relationships. Great care on all these factors is vital in order to adopt and integrate EDI successfully where it was claimed that adoption and integration lead to positive impacts for EDI users (Iacovou et al., 1995).



Source: Iacovou et al. (1995)

Figure 1: Factors of EDI Adoption and Integration

Elbaz (1998) has revised and used typology of Iacovou et al. (1995). Elbaz's model consists of five factors namely perceived benefit, external pressure, financial strength, technology used and awareness. The third and fifth variables are the subset of

“organisational readiness” category in Iacovou et al.’s typology. The fifth factor has been introduced in this study to measure the roles of users’ awareness on EDI adoption and integration. According to Elbaz, the lack of EDI knowledge could be an obstacle for EDI adoption and thus, awareness and understanding of new technology is a prerequisite to the adoption process. His study found EDI adoption had significant positive relationships with awareness, financial strength, external pressure and technology used. Accordingly, Elbaz suggested the inclusion of “awareness” factor into Iacovou et al.’s findings.

Heck and Ribbers (1999) examined EDI determinants based on Iacovou et al. (1995) where they also introduced “availability of an EDI standards” factor. According to Heck and Ribbers, the use of commercially available standard reduces the EDI development costs and time besides decreasing the risks associated with the new EDI application. Thus, the availability of widespread EDI standard was predicted to increase the likelihood of EDI adoption. However, this new factor did not include in the test, as the measuring instrument of this variable was not reliable. Their study found that there was significant relationship between EDI adoption and the other three (organisational readiness, external pressures and perceived benefits) factors in which external pressure seems to be a dominant factor.

Chau and Jim (2002) built a research model consisting of seven factors namely perceived direct benefits, perceived indirect benefits, perceived cost, IT knowledge, top management attitude and trading partner’s influence as well as government incentives and enforcement. This model was the modification of Iacovou et al. (1995)’s typology in which perceived costs, top management attitude as well as government incentives and pressures were the additional factors. Their study found only perceived indirect benefits and top management factors did not have significant positive influence towards EDI adoption. This finding against the findings of many past literature in which top management role was perceived as an important element in EDI adoption and implementation (Emmelhainz, 1994; Laage-Hellman and Gadde, 1996; Jun and Chai, 2003; Ngai

and Gunasekaran, 2004).

Compared to Iacovou et al. (1995), Gengeswari and Abu Bakar (2006b) did not include factor of perceived benefits under category of influencing factors. In this case, Gengeswari and Abu Bakar emulated ideas of Bergeron and Raymond (1997) in examining roles of EDI benefits separately. They categorized EDI influencing factors into two namely readiness and external influences. Readiness factors were found to be more influencing than external influences.

EDI Benefits

Inherently, businesses are prepared to undertake changes that result from implementation of new technologies providing they can attain competitive advantages. Same scenario is applicable for EDI implementation where many companies are reluctant to implement EDI unless they are convinced with the potential benefits of EDI implementation.

Emmelhainz (1994) recognized EDI implementation could lead positive significant impacts into five key business areas i.e. customer service, supply chain relationship, internal production, international business and operational cost. EDI provides accurate and timely information required for high levels of customer service. Several past researches showed many companies are adopting this technology as imposed or 'requested' by their major trading partners i.e., customers and suppliers. In other words, implementation of EDI can be perceived as a definite way to respond company's customer requirements, which ultimately can improve the present customer service. It provides a way of enhancing a company's supply chain relationships and the majority of users feel that its implementation has strengthened relationships within the channel (Sanchez and Perez, 2003; Kurokawa and Manabe, 2001). Linkages created by EDI are seen as a strong level of commitment between the trading partners as well as it also reduces the number of company's vendors. Thus, EDI implementation results in the improved supply chain with fewer but stronger relationships. EDI has also proved its ability in improving

company's internal productions. Apart from improving company's present documentation system, EDI is seen as necessary for the implementation of other management techniques. For instant, the full implementation of Just in Time (JIT) system is not possible without EDI in automotive industry (Mackay and Rosier, 1996; Kurokawa and Manabe, 2001). Nowadays, business in general and logistic operations in particularly becomes global in nature. EDI helps firms to compete internationally by speeding up the design and production process in order to allow firms to market new products more quickly besides reducing the costs and time in international documentation (Mackay and Rosier, 1996). Company's operational costs in terms of document processing, labor, inventory and error consequences can be also reduced through the EDI implementation. Paper processing costs are directly associated with the volume of documents where through EDI, this cost can be reduced considerably as with EDI there is no necessity to reproduce, distribute and store the business documents manually. Further, EDI can be used to reduce labor costs as almost all manual procedures, which were done by personnel, can be replaced by EDI system such as re-keying the similar transactions for the different departments within the company. EDI can significantly reduce inventory by lowering the length of order cycle as well as variability in demand in which EDI can change the impact of demand uncertainty by quickly providing accurate information on inventory and sales level. Finally, the use of EDI also can cut the costs associated with errors; as EDI lessen or eliminates the data entry duplication, the number of errors can be reduced which leads to significant savings.

Meanwhile, Bergeron and Raymond (1997) categorized 22 benefits, which found from literatures, into five groups namely administrative costs, information quality, operations management, strategic advantages and transaction speed. The first category of benefits relates to cost reductions in terms of transactions, paperwork, forms manipulation and filling, office costs and inventory level. The second category relates to reductions in transaction errors, improvement in the customer service quality as well as accessibility and accuracy of transactions information. The third category refers

to reductions in the length of the operations and decision-making cycle besides reductions in the price of offered goods and services. The fourth category relates to the creation of barriers for newcomers in the industry and difficulties for the present competitors as well as the tightened relationships with trading partners. The last category concerns reductions in the time required to transmit and process a transaction. Their study found EDI advantages tend to be more at the operational level (administrative costs and transaction speed) and the managerial level (information quality and operations management) than strategic level (strategic advantage). The finding of this study on “reduction in processing time” benefit, which were perceived as the least benefits by the respondents, against the findings of Ngai and Gunasekaran (2004) and many other past researches where in many researches, reductions in processing time were identified as key benefit.

Gengeswari et al. (2006a) closely emulated findings of Elbaz (1998) and Bergeron and Raymond (1997) to examine EDI benefits. They categorized EDI benefits into two groups namely direct benefits and indirect benefits. They found direct EDI benefits were most received than indirect benefits.

EDI Barriers

Despite the many potential benefits from EDI implementation, many companies are reluctant to adopt EDI. There seem to be a number of barriers and problems which slow down EDI adoption rate (Ngai and Gunasekaran, 2004; Parsa and Popa, 2003; Chau, 2001). In order to achieve the full benefits of EDI, major barriers of EDI implementation must be addressed in order to have deeper understanding of the actual scenario and to take the improvement steps, accordingly.

In common, costs of EDI could be a major consideration for many companies and these costs can be classified into four categories. The costs for software and hardware had been recognized as one of the potential significant barriers by Jun and Chai (2003). Software and hardware cost for EDI vary significantly depending on the approach

taken. Full EDI integration with other business applications could cause high costs for the associated software in contrast to a PC-based EDI system, which is intended for a smaller number of transactions. As EDI can be run on nearly any computer platform, hardware costs are not varying for the different approach. Second category of costs is related to expenses for communication; such cost is involved in the actual transmission of an electronic message between trading partners. A onetime start-up cost and monthly service and transmission charges are required too when a third-party network is used. Third category of costs is the costs for training to both internal personnel and trading partners. The training costs relate to the lost work time to participate in training as well as the actual cost of the training. The last category of costs is for involved personnel and these costs are difficult to track, as they are reallocations of existing resources (Lummus and Duclos, 1995; Swatman and Swatman, 1992).

Laage-Hellman and Gadde (1996) categorized barriers of successful EDI implementation into five basic groups. Table 1 shows the summary of Laage-Hellman and Gadde findings. Four potential barriers lie in different technical or organisational aspects that are distinctive at the company level and industry level while the fifth group of potential barriers is related to the way companies are doing business with each other. This study found the most inhibitors of EDI implementation relate with organisational aspects than technical aspects.

Aspects	Level	
	Company	Industry
Technical	Inhibitors from the company itself and its trading partners	Lack of EDI standards and modern computer applications
Organisational	Problems with the internal EDI system, its functions and company's EDI competence	Limited number of users

Source: Laage-Hellman and Gadde (1996)

Table 1: Basic Groups of Potential Barriers in EDI Implementation

Gengeswari et al. (2006a) adapted findings of Jun and Chai (2003) to examine EDI barriers. According to them, there are two groups of barriers namely barriers concerned on organisational aspects and barriers related with security and EDI system itself. They found that barriers of system and security were most significant where incompatibility with existing system and system instability were identified as the major barriers.

EDI Integration

EDI can be distinguished from other similar IOS or IT tools by its nature of “cooperative” as attributed by McNurlin (1987) as *“with all the talk about strategic systems aimed at achieving competitive advantage ... we have come across an interesting countervailing trend ... the growth of developing systems in cooperation with others ... cooperative systems require at least two parties with different objectives to collaborate the development and operation of a ‘join’ computer-based system”*. The main advantage of a cooperative system, or it is often referred as an integrated system, is to provide solution for problems such as multiple connectivity, multiple set of standards, multiple hardware requirements and maintenance (McNurlin, 1987; Swatman and Swatman, 1991). Pertaining to EDI’s integrated or cooperative nature, Knoppers (1992) pointed out that EDI includes an enormous variety of applications, ranging from the more common standard business documents, such as PO, 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 organisation via business process reengineering (Vega et. el., 1966; Bergeron and Raymond, 1997; Kurokawa and Manabe, 2001). Angeles et al. (1998) further validated that a company would loose 70% of potential EDI benefits

if it did not integrate it with other business applications.

Besides, Emmelhainz (1994) also has contributed to the EDI integration scope by investigating the levels of EDI implementation and attainable benefits from each level; there are 3 levels of EDI implementation. In Level 1, a simple data is exchanged without integration into any of the firm's internal processes; few business documents are handled electronically and others are handled manually; companies receive merely minimal benefits such as faster response time, standardized information as well as reductions in paperwork and errors. In Level 2, the data exchange take places between the applications of two companies; both external and internal integration take places that could yield enhanced benefits such as improvement in lead-time, improved customer relations and reductions in inventory. In Level 3, EDI could change the way of doing business through business process reengineering; companies could expect cost benefits due to reduction in personnel and efficient business operation in addition to strategic time-based competitive advantages as EDI is interlinked with all the business functions. Morell et al. (1995) classified EDI integration into three levels – high, moderate and poor. They assessed the extent of integration based on manual intervention during data transmission, for instant high level of integration comprises little or no manual intervention vice versa to poor integration.

There are many examples of companies that enjoy greater benefits from EDI implementation and its integration. For example, in Malaysia, CIS DagangNet reduces the number of data entry clerks from 70 to 30 at each Customs station (Yassin, 2005). EDI at Port Klang, which is known as Port Klang Community System (PKCS), reduces about 70% of turnaround time between submission of declaration forms and goods clearance (Mahfuzah Kamsah and Wood-Harper, 1997). EDI at nation's automobile manufacturer – PROTON, reduced about 50% of supply chain costs after the vehicles leaves the factory (Tengku Ariff, 2001 in Chong et al., 2005). In the context of global, EDI implementation by General Electric (GE) Company can be a good example. These examples have portrayed the significance of EDI integration for providing greater benefits where

without integration, EDI would act as merely little better than an electronic mail (Swatman and Swatman, 1991).

METHODOLOGY

A quantitative methodology is used to provide precise measurement or quantification information pertaining to the research problems (Aaker et al., 2001). Most of the past EDI studies that are quantitative in nature have employed descriptive research method, for instant, Seyal and Rahim (2006); Ngai and Gunasekaran (2004); Chau and Jim (2002); and Bergeron and Raymond (1997). The data collected will be analysed based on statistical methods i.e., descriptive and inferential.

Descriptive research can be further classified into cross-sectional and longitudinal research (Malhotra, 2002). In brief, cross-sectional design is a type of research design that involves the one-time collection of information from any given sample of population elements. This research employed descriptive method with cross-sectional design by considering its comparative advantages.

The target population consisted of all Malaysian manufacturers located at three major industrial states of Malaysia namely Selangor, Johor and Penang. These manufacturers should be involved in international trade (export/import activities) despite their demographic aspects consisting of firm size, way of EDI implementation and type of users, in order to be considered as a target population of this research. This is because, in Malaysia, all companies that are involved in international trade are required to implement EDI at least for customs declarations (Yassin, 2005). The list of population for this research was obtained from Malaysia Manufacturers Directory amounting to 633.

There are two approaches to obtain the desired sample namely probability and non probability sampling (Zikmund, 1998). For descriptive research, the sample was selected based on the probability

sampling technique. In this case, the sample was randomly chosen on the basis of simple random sampling that assures each element in the population have an equal chance of being included in the sample (Zikmund, 1998). Table of random numbers was used to simplify the sample selection procedure and code numbers was assigned to each company in the target population to avoid wrong selection of sample (Aaker et al., 2001).

Table Isaac was referred to determine the sample size for descriptive research. According to Isaac et al. (1981), population size (n) that contains 633 companies (approximate to 650), needs 242 companies as a sample size (s) to acquire 95% level of confidence. It was then decided to determine a higher sample size amounting to 300 in order to ensure substantial return rate besides it is unlikely to get inaccurate results when the sample is larger (Aaker et al, 1998).

The respondents of this research consisted of the personnel who are in charge of the company's EDI system instead of personnel who are doing EDI tasks routinely. In other words, only heads of purchasing, logistic, shipping or information system department were the respondents in order to ensure validity of the information given. All potential respondents were contacted earlier over telephone to get their consent. In addition, few respondents, who were contacted, to participate due to their tight schedules or for not having much knowledge on EDI system. A questionnaire was e-mailed to all respondents who agreed to participate. According to Malhotra (2002) and Zikmund (1998), the proper follow-up for such survey can increase the response rate up to 80%. Thus, four rounds of follow-up were executed over e-mail and phone to remind the non-respond respondents to complete and return questionnaire, only 113 questionnaires were returned and it represents 47% of return rate. For this research, questionnaire was primarily used and was built based on reviews on past literatures in addition to feedbacks from preliminary works, pre-test and pilot test.

ANALYSIS AND RESULTS

Respondents' Profile

This section attempts to provide general insights of respondents of this research. Table 2 summarizes characteristics of respondents according to few categories namely nature of business operation, type of industry, number of full time employees, firm size, type of users, way of implementation and number of EDI transactions.

The majority of respondents have business operations outside Malaysia to some extent whereby 16.67% of them have operations only for foreign market, followed by 30.56% of them who have been involved more in foreign businesses and 37.96% of them who have been involved more in domestic and less in overseas businesses. Only 14.81% of them have involved in domestic businesses, entirely. This is consistent with the pre-requisite set earlier in this research whereby involvement in international trade has been the main aspect to consider a company as the potential respondent. Such aspects have been prioritized as it was informed that, in Malaysia, companies involved in export or import activities (international trade) were required to implement EDI at least for customs declarations (Yassin, 2005). Thus, as expected, findings indicate that majority of respondents have engaged in some sort of international trade.

Characteristics	Frequency	%=100
Business nature		
More than 50% local	41	37.96
More than 50% foreign	33	30.56
100% foreign	18	16.67
100% local	16	14.81
Type of industry		
Electric and electronic	19	17.59

Supporting products and services	16	14.81
Foods and beverages	14	12.96
Plastic	11	10.19
Iron and steel	9	8.33
Machinery	9	8.33
Chemical and petrochemical	7	6.48
Transport equipments	7	6.48
Non-ferrous metals	5	4.63
Photographic and cinematographic	3	2.78
Building hardware and supplies	2	1.85
Furniture	2	1.85
Clay and non-metallic minerals	1	0.93
Medical, scientific and measuring	1	0.93
Rubber	1	0.93
Textile	1	0.93

Table 2: Respondents' Profile

However, respondents of this research are not from six particular industries namely (i) agricultural; (ii) pulp and paper; (iii) souvenirs, gifts and handcrafts; (iv) sport equipments; (v) toys; and (vi) wood. Majority of respondents have been involved in the industry of electric and electronic (17.59%) followed by supporting products and services (14.81%); foods and beverages (12.96%); and plastic (10.19%). The least respondents are from the industry of (i) clay and non-metallic minerals; (ii) medical, scientific and measuring; (iii) rubber; and (iv) textile whereby each of this industry has comprised 0.93% of respondents.

Characteristics	Frequency	%=100
No. full time employees		
Above 151	68	62.96
51-150	33	30.56
Below 50	7	6.48
Firm size		
Large	68	62.96
SMEs	40	37.04
Type of users		
Mandated	58	53.70
Self-initiated	50	46.30
Way of implementation		
Indirect	70	64.81
Direct	38	35.19
Number of EDI transactions	n=38	
Small: Below 2000	19	50.00
Medium: 2001- 5000	13	34.21
Large: Above 5000	6	15.79

Table 2: Respondents' Profile (continued)

The number of full time employees (FTEs), in fact, has been used to categorize respondents based on their firm size. In brief, SMIDEC stated that there are four groups of companies who are micro-sized organisation (<5 FTEs), small-sized (5-50 FTEs), medium-sized (50-150 FTEs) and large organisation (>150 FTEs). Referring to this classification, initially there are 3 groups of respondents who are large-sized organisations (62.96%) followed by medium-sized (30.56%) and small-sized organisations (6.48%) while none of respondents are micro-sized organisations. As there are no micro-sized and few small-sized respondents, the firm size was re-categorized into 2 groups

namely small and medium-sized organisations (SMEs) and large organisations. This is in order to facilitate the progress of further data analysis. Based on this re-categorization, there are 62.96% of respondents who are large organisations and 37.04% of respondents who are SMEs.

In the context of users' type, as predicted, there are more mandated users (53.70%) than self-initiated users (46.30%). This is consistent with findings of Leng Ang et al. (2003) and Gengeswari and Abu Bakar (2006b) which claimed that Malaysian EDI users comprised of more mandated users than users who implemented it on their own. Meanwhile, in the context of EDI implementation, a considerable number of respondents have implemented EDI indirectly (64.81%) by appointing third parties while very few of them have implemented it directly (35.19%) without depending on others. A plausible explanation for the higher number of mandated users and indirect implementation is that users who were mandated tend to take immediate actions to respond to the external requirements by appointing third-parties (Yassin, 2005; Gengeswari et al., 2006a) instead of implementing it at their own.

Table 3 indicates that sufficient financial resources was perceived as most influencing factor by respondents (mean=4.24 and STD=0.82). This was followed by acceptance of top management (mean=4.16 and STD=1.05) and compatibility with existing systems (mean=4 and STD=0.99). Meanwhile the least influencing factors were perceived assistances from EDI vendors (mean=2.53 and STD=0.95), promotion from them (mean=2.71 and STD=1.11) and imposition from headquarters- HQ (mean=2.92 and STD=1.40).

Determinants	Mean	STD
Sufficient financial resources	4.237	0.820
Top management acceptance	4.158	1.053
Compatibility with existing system	4.000	0.986
Availability of internal technical persons	3.789	1.044

Top management awareness	3.553	1.108
Staff awareness	3.105	0.894
Staff acceptance	3.105	0.894
Training and education for staffs	3.105	0.863
Influences from industry players	3.079	1.148
Enforcement by government	3.026	1.197
Imposition by trading partners	2.974	0.854
Imposition by HQ	2.921	1.402
Promotion from EDI vendors	2.711	1.113
Perceived assistances from EDI vendors	2.526	0.951

Table 3: Mean Value for Individual EDI Determinants

Accordingly, mean value is again computed for determinants based on factors generated from factor analysis (Table 4). From this, one can know that aspects of organisation namely financial and technological resources in addition to roles of top management had significantly influenced respondents to implement EDI. As not expected, external aspects consisting of imposition by government and trading partners in addition to influences from industry players were not highly significant. This is contrasted with findings of many past studies which claimed that external influences were more significant than other aspects in implementing EDI system (Chau, 2001; Jun and Chai, 2003). However, it is believed that these external influences do have their credits especially in influencing SMEs or companies that are reluctant to implement EDI. Besides that, roles of EDI vendors were not perceived as important by respondents and this is consistent with findings from factor analysis (Table 6) where vendor factor has the lowest percentage of variance which indicates its least importance.

Determinants	Mean	STD
Organisation	3.785	0.818
Staff	3.105	0.694
External	3.000	0.558
Vendors	2.618	0.866

Table 4: Mean Value for Factors of EDI Determinants

Views from all respondents were taken into consideration on the findings of EDI benefits. For respondents who have implemented indirect EDI, these are potential benefits while for those who implemented direct EDI these are actual benefits received from EDI. Table 5 indicates that benefits related on information timeliness (mean=3.80 and STD=0.83) as well as reductions in time for data transmission and processing (mean=3.79 and STD=0.63) were most significant for respondents. Meanwhile, benefits of EDI as an exit barrier tool for trading partners (mean=2.78 and STD=0.91) and as an entry barrier tool for new comers to the industry (mean=2.75 and STD=0.90) in addition to improvement in company's cash flow were least received and perceived (mean=2.69 and STD=0.59).

Benefits	Mean	STD
High information timeliness	3.796	0.829
Reduced time of data transmission	3.787	0.627
Reduced time of data processing	3.787	0.627
High accuracy of information	3.722	0.984
High accessibility of information	3.722	0.795
Reduced length of operations	3.565	0.714
Reduced costs of forms, form manipulation and storage	3.519	0.881

Reduced costs of postal and telecommunication	3.500	0.859
Reduced costs of labors	3.500	0.870
Reduced costs of transactions	3.491	0.848
Improved trading partners relationship	3.389	0.783
Improved customer service	3.250	0.810
Reduced length of decision making cycle	3.009	0.502
Improved inventory management	2.806	0.538
Exit barriers for trading partners	2.778	0.910
Entry barriers for new comer	2.750	0.898
Improved cash flow	2.694	0.587

Table 5: Mean Value for Individual EDI Benefits

In average, referring to Table 6, benefits related to reductions in time and costs in addition to improvement in quality of information were the most appealing benefits as received and perceived by respondents of this research. Findings of Table 7 are similar with findings of factor analysis especially which signaled that operational benefits were the least significant benefits as perceived by respondents.

Benefits	Mean	STD
Time	3.713	0.607
Costs and information	3.607	0.797
External	3.319	0.747
Strategic	2.846	0.666
Operational	2.750	0.495

Table 6: Mean Value for Factors of EDI Benefits

As with benefits, views from all respondents were taken into account in examining barriers that might or had inhibited EDI implementation. Findings of Table 7 indicates that lack of top management support (mean=4.50 and STD=0.65), considerable initial investment (mean=4.28 and STD=0.78) and security concerns (mean=3.94 and STD=1.06) were greatly faced or perceived by respondents meanwhile they also admitted that much emphasis was not put on acceptance of personnel (mean=2.20 and STD=0.51) and problems in reaching agreement on EDI issues with trading partners (mean=2.89 and STD=0.44). Further, respondents also did not view longer time in initiating EDI (mean=3.22 and STD=0.84) and inadequate trainings and educations for personnel (mean=3.25 and STD=0.71) as the key inhibitors. In overall, referring to Table 8, respondents viewed that significant investment for initiating EDI was main issue followed by security concerns and lack of top management roles.

Barriers	Mean	STD
Lack of top management support	4.500	0.649
Considerable initial investment	4.278	0.783
Security concerns	3.935	1.061
Lack of internal technical persons	3.750	0.750
Risks of system instability	3.509	0.502
Lack of EDI trading partners	3.500	0.743
Incompatibility with existing system	3.472	0.716
Lack of education and training for users	3.250	0.712
Longer start time	3.222	0.835
Problems in reaching agreement on EDI issues	2.889	0.439
Lack of personnel acceptance	2.204	0.507

Table 7: Mean Value for Individual EDI Barriers

Barriers	Mean	STD
Finance	4.278	0.783
Security and top management	3.708	0.477
Trading partner	3.500	0.743
Technology and training	3.424	0.648

Table 8: Mean Value for Factors of EDI Barriers

Mean value is computed for identifying the most common EDI integration level among 38 respondents who have implemented direct EDI system. As shown in Figure 2, majority of respondents have integrated EDI at poor level (39.5%) followed by respondents who have integrated it at moderate level (34.2%) and high level (26.3%). These findings can be justified with small number of transactions (50%) over EDI as shown in Table 2. It is wise to consider that small number of transactions indicates that respondents used more manual intervention rather than automation in the transmission of business data (Morell et al., 1995).

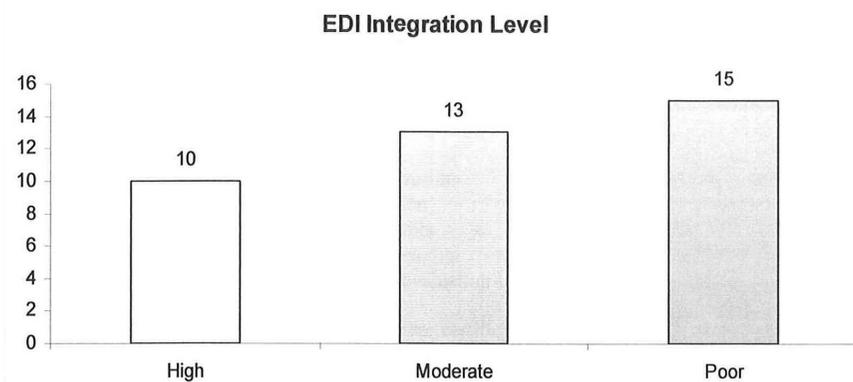


Figure 2: Level of EDI Integration

To sum, the key determinants that influenced respondents to implement EDI were organisational aspects consisting of technological resources, financial resources and top management support. Benefits of reductions in the length of data transmission, processing and operations were greatly received and perceived by respondents. Despite the numerous actual and potential benefits, EDI integration level among respondents was poor where many inhibitors has been discovered including aspects of inadequate financial resources in addition to lack of top management support and security concerns.

DISCUSSION AND CONCLUSION

Determinants

14 variables were identified as the key determinants from past literatures where factor analysis has categorized these variables into four. In order to assess the importance of these determinants, mean value was computed for each individual factor and categorized factor. Computation of mean value showed that organisational aspects were the most influencing factor where sufficient financial resources was identified as the most significant determinant followed by top management roles, compatibility with existing system and availability of internal technical persons. This is consistent with the findings of several past studies including Angeles et al. (2001); Leng Ang et al. (2003); Ngai and Gunasekaran (2004).

Given the fact that top management is the personnel who are ruling the company and have decisive power, their support is necessary in taking any actions pertaining to company's operations especially actions that involve monetary matters. Sensibly, without sufficient financial resources, a company is not able to do anything even to survive in the business operation. Thus, availability of financial resources is certainly important in implementing a new technology such as EDI which requires considerable initial investment. These

two variables, in fact, are interrelated, for instant, top management support by allocating sufficient financial resources to implement EDI would facilitate the entire process.

In contrast to many past literatures, this study found that staff-related factor was the next key determinant after organisational aspect. Staff that are directly engaging with EDI implementation, are playing important roles to ensure the system is functioning as per planned. Neglecting their responses would substantially harm the entire process. Staff that are resistant might not be fully committed in using EDI. Since they are not aware of the importance of EDI due to poor educations or trainings, they might do EDI transactions for granted which would lead to many negative consequences, for example, delays in data transmission and more errors in the information transmitted.

It was also found that external aspects, consisting of imposition by government and trading partners in addition to influences from industry players, were not highly critical in influencing users' decision to initiate EDI. This is in contrast with findings of many past studies which claimed that external influences were more significant than other aspects in implementing EDI system (Chau, 2001; Jun and Chai, 2003). EDI implementation has become compulsory for all who have engaged with international trade in Malaysia, thus, over time, it might be a norm for these companies where they are no more viewing such imposition as a major influencing factor. There are companies which have implemented EDI just to respond to the external requirements especially from larger trading partners as a way to sustain their business opportunities (Chwelos et al., 2001; Chau and Jim, 2002). Thus, it can be justified that external influences have considerable influences towards the initial decision to commence EDI, but these are seemed to be dominant merely for companies that are reluctant to adopt EDI.

Once EDI is being implemented, users would need assistances from vendors to be familiar with and maintain the system. However, prior to implementation, roles of vendors would not be a concern at all as they would only go for vendor when decision to initiate has been

made. In brief, there are many other factors, apart from influences from vendors, which are influencing a company's decision to initiate EDI.

EDI Benefits and Integration

As with determinants, mean value was computed for EDI benefits. There are five groups of EDI benefits namely costs and information; time; strategic; external; and operational. Categorization of these benefits is almost similar as Bergeron and Raymond (1997); and Gengswari et al. (2006b). Furthermore, the most significant individual benefits were high information timelines, reduced time of data transmission and reduced time of data processing meanwhile the three least significant individual benefits were exit barriers for trading partners, entry barriers for new comers and improved cash flow. In brief, time-based benefits were the most significant followed by cost and information benefits while strategic benefits were the least significant benefits followed by operational benefits. Furthering the inspection, time-based and costs and information benefits can be defined as direct or minimal benefits meanwhile external, strategic and operational benefits can be defined as indirect or enhanced benefits (Emmelhainz, 1994; Elbaz, 1998; Mukopadhyay and Kekre, 2002).

In order to explain empirically why the respondents had received or perceived more minimal benefits instead of enhanced benefits, level of EDI integration can be referred. Many past literatures found that EDI benefits are subject to the level of EDI integration; the higher the level of integration the greater benefits can be gained from EDI (Emmelhainz, 1994; Morell et al., 1995; Angeles et al., 1998; Jun et al., 2000). As showed only about 20% of respondents had integrated EDI at high level where the rest integrated EDI at poor and medium level. As such, the chances for respondents to receive or perceive more minimal benefits (time; costs and information) are higher than enhanced benefits. There are many reasons that inhibit users to further integrate or implement EDI, which are discussed in the following sub-section. Conversation with interviewed respondents discovered

that users who had implemented EDI due to external requirements tend to remain stagnant at the minimal level just to maintain such requirements. Or in one extreme, some respondents would have assigned the tasks to others, thus there is no implementation and integration, as well.

EDI Barriers

For barriers, factor analysis has generated four namely finance; security/top management; trading partner; and technology/training. Findings indicated that lack of top management support, considerable initial investment and security concerns were the most significant barriers meanwhile longer start time, problems in reaching agreement with EDI trading partner and lack of personnel acceptance were the least significant barriers.

Chau (2001) claimed that improper management of EDI determinants would be the inhibitors for EDI implementation. As such, it was identified that top management support and sufficient financial resources were the major determinants. Consistently, findings from Table 4.13 indicate that financial-associated barriers, especially considerable initial investment, and lack of top management support were the major barriers for respondents of this study. It signals that these two aspects are significantly perceived as vital for the EDI implementation by these respondents.

It was also revealed that the advent of Internet has significantly reduced costs involved in traditional EDI (Hsieh and Lin, 2004) where it allows more SMEs or companies with insufficient financial resources to participate in. On the other hand, the advent of Internet EDI has also caused users to think about the security aspects.

Top management support, sufficient financial and technical resources were perceived as the major EDI determinants. On the other hand, these aspects in addition to security element were admitted as the most critical barriers which have or would inhibit the implementation process. Instead of enhanced benefits, direct benefits were most received or perceived where such scenario could certainly

be related with the practices of poor EDI integration by respondents. However, most of the respondents viewed that EDI has brought positive impacts towards their overall firm performance. In addition to these, findings indicated that the extent of received or perceived EDI benefits was significantly influenced by determinants, barriers and integration level. The extent of EDI integration was found to be similar for all respondents in contrast to EDI determinants which were subjected to the firm size and type of users. Impacts of EDI benefits and barriers were found to be similar for both mandated and self initiated; in contrast, these impacts were found to be different for small and medium-sized and large-sized respondents.

REFERENCES

- Aaker, D.A., Kumar, V. and Day, G.S. (2001). *Marketing Research*. 7th Edition. USA: John Wiley & Sons, Inc.
- Angeles, R., Ravinder, N. and Hendon, W.D. (1998). An Empirical Investigation of the Level Electronic Data Interchange (EDI) Implementation and its Ability to Predict EDI System Success Measures and EDI Implementation Factors. *International Journal of Physical Distribution and Logistics*. 28(9): 773-793.
- Angeles, R., Corritore, C.L., Basu, S.C. and Ravinder, N. (2001). Success Factors for Domestic and International Electronic Data Interchange (EDI) Implementation for US Firms. *International Journal of Information Management*. 21: 329-347
- Ashby, T.M. (2002). *Organisational Culture Integration and Information Technology Integration: A Theoretical Model of the Perceived Linkage to Success of Mergers and Acquisitions*. Alliant International University: PhD Thesis.
- Bergeron, F. and Raymond, L. (1997). Managing EDI for Corporate

- Advantages: A Longitudinal Study. *Information and Management*. 31: 319-333
- Business Times. *Customs Electronic Clearing System Set to Go Nationwide by December*. 26/11/03.
- Chan, C. and Swatman, P.M.C. (1998). EDI Implementation: A Broader Perspective. "Bled'98"- 11th International Conference on Electronic Commerce. June 8-10. Bled, Slovenia: 90-108.
- Chan, Y.H. (2000). E-Commerce: Looking Back a Brief History. *Jaring Internet Magazine*.
- Chau, Y.K. (2001). Inhibitors to EDI Adoption in Small Businesses: An Empirical Investigation. *Journal of Electronic Commerce Research*. 2(2): 78-88.
- Chau, Y.K. and Jim, C.F. (2002). Adoption of Electronic Data Interchange in Small and Medium Enterprises. *Journal of Global Information Management*. 10(4): 61-85.
- Chong, S.C., Hoon, T.H. and Wan Aznida, W.A. (2005). *The Impact of Electronic Data Interchange (EDI): A Case Study on At Panasonic AVC Networks Johor Malaysia Sdn Bhd*. Universiti Teknologi Malaysia: Bachelor's Degree Project.
- Chwelos, P., Benbasat, I. and Dexter, A.S. (2001). *Empirical Test of an EDI Adoption Model*.
- Elbaz, D. (1998). *Electronic Data Interchange: An Assessment of the Factors Leading to EDI Adoption*. Concordia University: Master Thesis.
- Emmelhainz, M.A. (1994). Electronic Data Interchange in Logistics. In: Robeson, F.J. and Copacino C.W. (1994). *The Logistics Handbook*. New York: The Free Press. 737-766.
- Gengeswari, K., Abu Bakar, A.H., Zainab, K. & Melati, A. (2006a). EDI Implementation: Views from Malaysian Manufacturers. *Proceedings of BIZIT'06 International Business and IT Conference*. 8-10 August. Kuala Lumpur, Malaysia.
- Gengeswari, K. and Abu Bakar, A.H. (2006b). Impacts of EDI Benefits on Firm Performance: Evidence from Malaysian

- Manufacturers. *Proceeding of Regional Postgraduate Conference on Engineering and Sciences*. 26-27 July. Johor, Malaysia
- Heck, E.V and Ribbers, P.M (1999). The adoption and impact of EDI in Dutch SMEs. *Proceedings of the 32nd Hawaii International Conference on System Sciences*.
- Iacovou, C.L., Benbasat, I. and Dexter, A.S. (1995). Electronic Data Interchange and Small Organisations. Adoption and Impact of Technology. *MIS Quarterly*. 19(4): 465-485.
- Iskandar, B.Y. (2000). *Electronic Data Interchange (EDI) Adoption in Automobile Suppliers*. Tennessee Vanderbilt University: PhD Theses.
- Jimmy, Y. (2005). *Customs Not Yet Fully Paperless*. Edge Daily. 12/9/05
- Jun, M. and Cai, S. (2003). Key Obstacles to EDI Success: from the US Small Manufacturing Companies' Perspective. *Industrial Management and Data Systems*. 103(3): 192-203.
- Jun, M., Cai, M. and Peterson, R.T. (2000). EDI Use and Participation Models: from the Interorganisational Relationship Perspective. *Industrial Management & Data Systems*. 100 (9): 412 – 420.
- Knoppers, J. (1992). *Results of the Work of the International Organisation for Standardization (ISO)/International Electrotechnical Commission (IEC) on the “Open-edi conceptual Model” and its Importance for EDI Developments*.
- Kurokawa, S. and Manabe, S. (2001). *Determinants of Electronic Data Interchange (EDI) Adoption and Integration in the US and Japanese Automobile Suppliers*.
- Laage-Hellman, J. and Gadde, L. (1996). Information Technology and the Efficiency of Materials Supply- the Implementation of EDI in the Swedish Construction Industry. *European Journal of Purchasing and Supply Chain Management*. 2(4): 221-228.

- Leng Ang, C., Razman, M.T. and Rusdi, M. (2003). An Empirical Study on Electronic Commerce Diffusion in the Malaysian Shipping Industry. *Electronic Journal on Information Systems in Developing Countries*. 14(1): 1-9
- Lin, C. (2002). Organisational Size, Multiple Audiences and Web Design. *Technical Communication*. 49 (1): 35-44.
- Lumms, R.R. and Duclos, L.K. (1995). Implementation of EDI Systems. *Journals of System Management*. 45(5): 4-10.
- Mackay, D. and Rosier, M. (1996). Measuring Organisational Benefits of EDI Diffusion - A Case of the Australian Automotive Industry. *International Journal of Physical Distribution and Logistics Management*. 26(10): 60-78.
- Mah Lok Abdullah; Seo, A.K.H., Yong, A.H. and Goh, S.S. (2003). Sustaining Competitiveness Of The Manufacturing Sector Through Productivity Enhancement. *Report of Roundtable*. August 18. Selangor.
- Mahfuzah Kamsah and Wood-Harper, A.T. (1997). A Multi-theoretical Framework for the Study of EDI Diffusion in Malaysia. *Management of Technology for Industrialization-Malaysian Science and Technology Congress' 97*. 16-17 October. Johor, Malaysia.
- Malhotra, N.K. (2002). *Basic marketing research- applications to contemporary issues*. New : Prentice Hall.
- McNurlin, B.C. (1987). The Rise of Co-operative Systems. *EDP Analyser*. 25(6): 1-16.
- Morell, J.A., Neal, W. and Fries, V. (1995). *Promoting Electronic Data Interchange: Building a Foundation for Support to Small Businesses*. Industrial Technology Institute.
- Mukhopadhyay, T. and Kekre, S. (2002). Strategic and Operational Benefits of Electronic Integration in B2B Procurement Processes. *Management Science*. 48(10). 1301-1313.
- Musalmah, J. (2006). *Rethinking Strategy for Manufacturing*. The Star dated 27/02/06.

- Ngai, E.W.T. and Gunasekaran, A. (2004). Implementation of EDI in Hong Kong: An Empirical Analysis. *Industrial Management and Data Systems*. 104(1): 88-100.
- Parsa, A. and Popa, S. (2003). *Analysis of EDI Success Implementation Factors and Their Interrelationship with the Level of EDI Implementation within Swedish Companies*. Goterborg University: Master Thesis.
- Rafidah Aziz (2004). The Performance of the Manufacturing Sector in 2003. *MIDA Annual Media Conference*.
- Rogers, E.M. (1995). *The Diffusion of Innovations*. 4th Edition. New York: The Free Press.
- Sanchez, A.M. and Perez, M.P. (2003). The Use of EDI for Interorganisational Co-operation and Co-ordination in the Supply Chain. *Integrated Manufacturing Systems*. 14(8): 642-651.
- Seyal, A.H. and Rahim, M.M. (2006). A Preliminary Investigation of Electronic Data Interchange Adoption in Bruneian Small Business Organisations. *Electronic Journal on Information Systems in Developing Countries*. 24(4): 1-21.
- Star. *All Ports, Airports to Use EDI System by April*. 3/12/03.
- Star. *FMM Objects Cost Recovery Fees Collected from July 1*. 11/7/05
- Strait Shipper. *Stop Fiddling Around, EDI Player Told*. 27/3/95.
- Swatman, P.M.C and Swatman, P.A (1991). Electronic Data Interchange: Organisational Opportunity, Not Technical Problem. "DBIS'91" 2nd Australian Conference on Database and Information Systems. February 2- 3. University of New South Wales.
- Swatman, P.M.C and Swatman, P.A. (1992). EDI System Integration: A Definition and Literature Survey. *The Information Society*.

8(3): 169-205.

- Tornazky, L.G. and Klein, K.J. (1982). Innovation Characteristics and Innovation Adoption Implementation-A Meta Analysis of Findings. *IEEE Transactions on Engineering Management*. 29(1): 28-45.
- Tuunainen, V.K. (1998a). *Different Models of Electronic Commerce-Integration of Value Chains and Processes*. Helsinki School of Economics and Business Administration: PhD Thesis
- Tuunainen, V.K. (1998b). Opportunities of Effective Integration of EDI for Small Businesses in the Automotive Industry. *Information & Management*. 36 (6): 361-375.
- UNESCAP - United Nation of Economic and Social Commission for Asia and Pacific (1996). *Electronic Data Interchange – A Management Overview*.
- Vega, L., Salvador, R. and Guerra, L. (1996). Vlachos, I.P. (2002). Paradigms of the Factors that Impinge upon Business-to-Business e-commerce Evaluation. *International Journal of Business and Economics*. 2 (1): 82-89.
- Yassin, C. (2005). Enforcement Officer of Royal Customs at Malaysia stationed in Larkin, Johor Bahru. September 2005.
- Zikmund, W.G. (1998). *Business Research Methods*. 5th Edition. USA: The Dryden Press.