

A LITERATURE REVIEW OF ELECTRONIC DATA INTERCHANGE AS ELECTRONIC BUSINESS COMMUNICATION FOR MANUFACTURING

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ABSTRACT

In the present dynamic environment, manufacture are required to reduce product development cycle time and enhance product quality. To meet such challenges many business are developing closer relationships with their business partner through application of interorganisational system. Electronic data interchange (EDI) providing a structured form of communication and has become very popular vehicle for electronic communication. Since the EDI concept was popularised in 1990, there is a growing recognition by practitioners and academics. The aim of this study is to perform an analysis of EDI research, give the current discussion regarding the trends and note the suggestions for the future directions of EDI research in the manufacture. In this paper, we provide a wide coverage of excessively citations on EDI from 1990 to 2017 from good references in this area. The papers are classified into EDI implementation strategy, EDI adoption, EDI integration, EDI in supply chain and EDI in small and medium enterprises (SMEs). The study results of this literature review are expected to assist development of EDI research especially the implementation of EDI on production outsourcing as one of supply chain activities.

KEYWORDS

electronic data interchange, communication, manufacture, business.

Introduction

In the last two decades there is a consensus that the implementation of electronic communication throughout the supply chain has changed profoundly the way businesses operate [1]. In order to compete effectively in today's global marketplace, a company must have a competitive supply chain. A competitive supply chain requires an ability to communicate rapidly and accurately with their business partner. Relationships between firms and their environment in the field of communication are various and manifold. EDI is one of method that world class organizations have successfully used to improve the communication [2, 3]. The use of EDI is growing rapidly, and

is expected to be the dominant form of business communication between companies in several markets.

EDI technology impacts inter and intra firm management and business practices which, in turn, influence such areas as economic value creation and strategic competitive advantage [4]. EDI system plays a key role in achieving competitive success [5, 6]. Indeed, research has shown that EDI use can help firms establish cooperative relationships and share vital information [7, 8]. EDI adds value to channel relationships through an increase in the efficiency of transaction processing, facilitation of related systems (manufacturing and marketing) and an improvement in coordination and communication systems [9]. As a form of lateral communication, EDI can facilitate

the coordination of activities and goals within and/or between organizations [10]. EDI also represents an attempt to manage the interdependency of organizations, creating closer and better relationships both within and between organizations [11].

Otherwise, the development of industry 4.0 is currently encouraging the use of various technologies in various aspects. Industry 4.0 is a connection that produce a synergistic combination that has existed today. The use of EDI technology in the manufacturing area is one example of industry 4.0. The electronic business document exchange technology is able to bridge organization communications with the external environment more efficiently and effectively, which is in line with the effect of industry 4.0 that can increased production efficiency and increased competitiveness.

However, although this interest in EDI communication and several years of industry wide development work, practical use is still very limited [12]. Despite the current pressure of the public sphere and all the benefits that the adoption of EDI provides, the expansion of this technology is still a minority [13]. The research related to EDI technology can be developed through the implementation of EDI on supply chain activities to achieve competitive advantage. One of the supply chain management activities is outsourcing [14] and there is still rarely research about EDI implementation in production outsourcing. Outsourcing is a contract or an operational arrangement between a firm/manufacturer and an external supplier under which the latter will deliver to the former an agreed range of goods or services that would otherwise have been conducted internally within the firm [15, 16]. The outsourcing of production activities or process to external supplier has had a significant effect on how manufacturing firms develop, produce, and deliver products to their customers [17]. Today's many companies increasingly used outsource production, especially when the activities are asset intensive or require process technologies characterized by rapid innovation. From the definition above, production outsourcing requires a good communication and relationship with external partner that called supplier. In order to improve coordination and communication with external business partners, the production outsourcing activities need EDI technology so they can communicate rapidly and accurately.

The main purpose of this paper is to classify the existing body of knowledge in the EDI topic and provide a direction for future research of EDI in the manufacture area. The remainder of this paper is organized as follows. In the next section the method

for papers selecting is introduced. Section 3 outlines each classification of EDI literature and brief review of several previous studies that have not discuss yet in the literature review above. Finally the conclusion is given in Sec. 4.

Method

This literature review was done by analyzing academic journal articles in the ScienceDirect, ProQuest scholarly journal, Emerald journal, Scopus and Google Scholar databases. The subject areas of industrial and manufacturing engineering, decision science, management and economics was used to define the scope of journals as the literature material. The journals search used keywords with the terms 'electronic data interchange' that appearing in the title, abstract and keywords from 1990 until 2017.

The first search process identified 150 yields that coverage journal articles and conference proceeding. Furthermore, each of the papers was screened to verify that its content was pertinent to EDI from the perspective of this paper purposes. The final screening resulted 100 articles that reviewed in the next section (Table 1).

Table 1

Summary of citation on electronic data interchange research.

Article source	Number of papers
Academy of Management Journal	2
Decision Science	2
European Journal of Purchasing and Supply Management	2
Industrial Management and Data Systems	2
Information and Management	5
Information System Management	2
Information Systems Research	2
International Journal of Information Management	4
International Journal of Technology Management	2
Journal of Management Information Systems	6
Journal of Marketing	4
Journal of Organizational Computing and Electronic Commerce	2
Journal of Strategic Information Systems	3
Logistics Information Management	6
Long Range Planning	2
Management Science	2
MIS Quarterly	6
Others (34 journal titles)	34
Proceeding	5
Book	7
Total	100

Classification of EDI literature

In this section, a classification of EDI literature is showed that based on the focus of contents which include category such as EDI implementation strategy, EDI adoption, EDI integration, research on EDI in supply chain, and research on EDI in small and medium enterprises (SMEs). The aim of this classification is to ease of understanding and to simplify of the research work on EDI.

EDI implementation strategy

In this classification, we attempt to make an overview of the existing EDI implementation strategy. EDI implementation is more desirable and will be one of the major determinants of company business successful [13]. EDI was examined in the context of implementation strategies based on case studies among home center buyer-wood products supplier channel. EDI implementation can impact all corporate functions and have significant impacts on relationships with exchange partners [4]. The most important factor in assuring successful implementation is clearly communicated support from upper management. EDI is more an organizational issue than a technological one: this means that full management support is required [18–20]. Meanwhile, EDI systems have to satisfy the needs of many constituents such as top management, internal users in the functional areas, external users (customers/suppliers), and IS personnel to gain successful implementation of EDI [21]. There are the key of EDI implementation factors including top management support; sense of ownership of cross-functional EDI team; use of widely accepted EDI standards; re-engineering business processes; information technology (IT) compatibility; trading partner relationships; cost-benefit analysis; use of value-added networks; conduct of pilot projects; use of security and auditing controls; conduct of training programs; availability of clear legal guidelines for such issues as the legality of contracts, electronic signatures, authorizations, etc.; and availability of clear guidelines on EDI trading partner interchange agreements [22].

Figure 1 propose a generic framework for the successful implementation of EDI. The model includes four major critical areas of EDI implementation: top management support; technical infrastructure; strategic planning for IT; and education and training (Fig. 1) [23].

Another research also perform study intends to classify the determinant factors of EDI implementation into organizational structural, technical, managerial and environmental characteristics (Fig. 2) [24].



Fig. 1. A generic framework for the implementation of EDI [23].

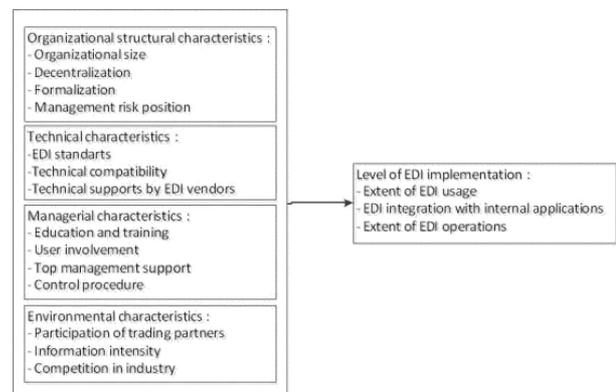


Fig. 2. Determinant factors of EDI implementation [24].

There are some activities required for implementing EDI, including analysis, testing and implementation, and approaches such as prototyping. These activities are helpful when introducing new systems or developing new applications for a company [25]. They define two major parts of EDI implementation process. The first part consists of a feasibility study to determine whether to proceed with EDI. The second part, the implementation itself, is performed only if the results of the feasibility study indicate EDI as beneficial for the company. The feasibility study can be conducted in six steps [26]:

1. List the business transactions currently performed.
2. Analyse the current “gateway” application.
3. Create a revised data flow.
4. Develop a list of potential EDI trading partners.
5. Perform a cost-benefit analysis.
6. Develop a business recommendation on whether to proceed or not.

The second phase in the EDI project is the implementation of EDI technology. Here also we can describe the process consisting of six steps [27]:

1. Completely understand about EDI.
2. Agree on standards with business partners.
3. Modify existing systems.

4. Translate data.
5. Prepare communications.
6. Management and audit of the whole process.

Meanwhile, there are several steps of implementing EDI [28]:

1. Enabling business applications to use EDI.
2. Translating transactions into EDI standard messages.
3. Forming a network connection to trading partners via value-added networks or directly.
4. Providing consistent management and auditing between application and trading link.
5. Performing service validation tests.

However, it has been observed that the higher the level of EDI implementation, the greater the benefits experienced by the network participants [25]. The identification of EDI implementation stages is important because of the relationship between implementation and benefits. Further benefits are limited, unless the company proceeds with linking EDI to its manufacturing planning system or other functions of the business, such as quality, product design, and product engineering and expands the implementation to more customers and to suppliers. However, most of literatures on EDI rarely analyse about linking EDI to its manufacturing planning system. Many companies implement EDI as part of their customer-supplier partnerships to gain operational and competitive benefits [29].

EDI adoption

The most EDI adoption research have focused on main reasons for EDI adoption that consists of three aspects, there are the perceived benefits of the technology, the perceived organizational resources and the influences of the environmental context in the organization. From several studies also explained that EDI adoption reasons were primarily the cost of introduction, competitive advantage, EDI compatibility with the existing system [9, 30], influence of business partner [31], competitive pressure [32, 33], EDI know-how, the company's IT savviness, market standing [34, 35], perceived benefits [36], etc. Previous studies in EDI adoption mostly examined environmental, organizational and technological factors [37]. This study examines behavioral dimensions of trading partner trust in EDI adoption via a qualitative interpretative case study conducted between an automotive manufacturer and their first tier supplier. The findings of this study suggests that trading partner trust is important for cooperative long term trading relationships and contributes to increased awareness on the importance of trading partner trust in EDI adoption. Organizations motivated

to adopt EDI must either find similarly motivated trading partners or persuade and/or coerce their existing trading partners to adopt EDI [38, 39]. One key barrier to this is the lack of trading partner trust derived from a lack in open communications and information sharing [40–43].

There is a research by asking to the suppliers, what motivated them to adopt EDI. They were presented with a list of 11 possibilities and asked to rank them in order according to the weight given to the particular issue for their organization. Two-thirds of suppliers adopting EDI did so, not primarily because of the perceived benefits of EDI to their business, but because they were 'instructed to' by their major customers. This result would seem to indicate the dominance of strategic factors over economic (cost/benefit) factors. The claimed economic benefits of EDI (reduction of: inventory, transaction costs, staff levels) all rated in the lowest three of the suppliers' ranking [44].

From a different perspective, the reasons to adopt EDI consist of 2 type, there are strategic (compresses business cycle and implements just-in-time practices) and operational reasons eliminates errors, detects errors quickly, reduces document costs) [45]. Organizations migrating to EDI are driven mostly by business needs. Improved productivity for the entire organization and the need to reduce the number of paper documents used are the broadest objectives.

There are several model of EDI adoption factors. This model has been selected because these drivers that may affect the decision to adopt EDI. A model formulating three aspects of EDI adoption influences, technological factor (perceived benefits), organizational factor (organizational readiness), and environmental factor (external pressure) [34] (Fig. 3).

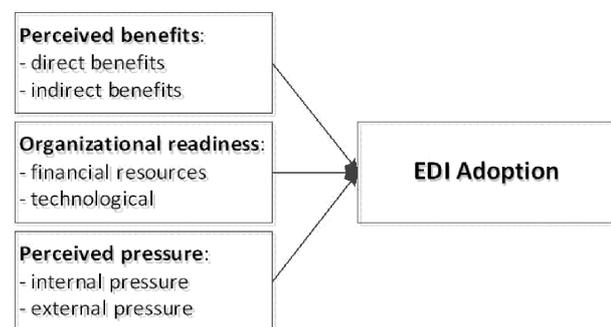


Fig. 3. Conceptual model of EDI adoption influences [34].

EDI adopters perceive more operational benefits, more external pressure, and mutual understanding, and fewer technical and organizational difficulties than do non-adopters of EDI [46]. Inter-organisational trust, external pressure, costs, and

size of adopting companies have significant impact on EDI adoption [47]. Iacovou models first studied how perceived benefits influence EDI adoption in small firms. This model has since been tested by other researchers and perceived benefits are shown to be positively related to EDI adoption [48]. EDI is a means to achieve business strategic goals, and can support implementation of business strategy such as cost strategy and differentiation strategy [49]. To implement a cost strategy or differentiation strategy, a firm can employ and resort to EDI. Therefore, the degree of business strategic thrust of a firm, as it was, the intensity or desire to implement particular strategy, may affect the use of EDI [50]. Prior research found that perceived benefits are important predictors of EDI adoption

EDI integration

In general, there are two dimensions in EDI integration i.e. internal and external [25, 34, 51]. 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, there are four key dimensions of EDI usage as regards to its integration [52]. 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). There are three level categorized of EDI integration [53]: 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. Strategic benefits attributable to EDI depend upon two forms of integration [54]:

- integration of information received from external sources with existing organizational systems and practices;
- integration of the internal organizational systems and practices themselves, which can change the entire structure of the organization.

The factor which had the greatest influence on progress through the stages of the model was an organizational perspective of EDI. While non-initiating participants in EDI schemes have the ability to gain long-term comparative advantage from system in-

tegration, they frequently fail to take a top-down, strategic view which incorporates EDI. 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 [55] (Fig. 4).

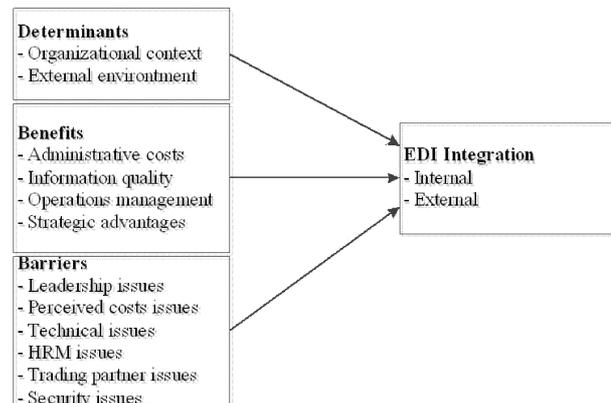


Fig. 4. Research model of EDI integration [55].

EDI adoption is the process during which a firm becomes capable of transacting via EDI, usually through a front-end, PC-based EDI server [34]. This is the first step of EDI integration. Although adoption and integration can be undertaken at the same time, EDI integration is the process during which a firm alters its business practices and applications so that they interface with its EDI applications. For the purposes of this study, integration is considered bi-dimensional. Internal integration refers to the variety of applications interconnected through EDI such as order-entry, invoicing, billing, and payment transfer, and external integration refers to the number of trading partners, such as suppliers, customers, governmental units, and financial institutions with which the firm can transact business through EDI [56].

Although the EDI adoption decision has been heavily researched, the number of studies related with EDI integration is a small set indeed. By integration we refer to the degree to which EDI technology is used in current internal and external business processes, applications, and transactions. The distinction between the two terms is important because our definition of EDI precludes manual intervention in transaction processing. Some framework suggests that EDI adoption may precede integration, but that integration benefits may be quite different from adoption benefits. Based on our analysis of the literature, we characterize two different second-order integration constructs. These are (i) internal integration intensity and (ii) external integration intensity.

The former refers to the integration among various applications internal to the firm so that both incoming and outgoing EDI data handling is automated. The latter refers to the diversity of transactions, connectivity to the diverse stakeholders of the firm, such as customer and supply chain partners, and the depth of process interconnectivity to suppliers. Internal integration intensity consists of three dimensions. First, the percentage of transactions processed using EDI is a proxy measure for the level of EDI usage within the company [59]. While this measure may be useful in comparing EDI use across different firms, it lacks specificity in measuring how and where the EDI system is integrated. A more targeted measure of internal integration is the degree to which an EDI transaction is integrated with the internal business systems of the firm, eliminating the need for manual processing and data entry redundancy [21, 32, 57, 58].

Many firms have integrated EDI with their order-processing and inventory management systems. More innovative integrations include electronic funds transfer where funds are electronically remitted to suppliers and electronic graphic interchange where visuals and drawings are electronically transmitted to support new product development and bidding processes [59–61]. Many of the antecedents of EDI adoption are also shared with EDI integration [21, 25, 62]. Anticipated benefits specific to the internal integration decision include cost efficiencies (through decreased paperwork and reduced staff requirements), increased quality (fewer errors and improved data accuracy), improved productivity by eliminating redundancy in processing, and better customer service (better planning of shipments, fewer stock-outs, and better planning of shipments and deliveries) [63–66].

External integration intensity also consists of three dimensions. One measure is the number of external partners connected to the firm's EDI system. A second dimension is the diversity of transaction sets converted into EDI [25, 67]. This measure is also referred to as EDI diversity by several authors [65, 68].

EDI in the supply chain

Firm within a supply chain routinely communicate with each other element of supply chain [46]. Coordinating between each members of supply chain about their production and logistics activities was required by the development of supply chain management. The coordination can be facilitated by information technologies, particularly when these technologies are used to span the traditional boundaries

of supply chain firms. EDI is one of these information technologies and an important application of business-to-business electronic commerce. EDI is the electronic transmission of information and documents such as invoices or purchase orders between computer system in different organizations. The use of EDI has the natural effect of increasing interorganizational coordination activities, as well as increasing the integration that occurs between supply chain members [69]. SCM places an emphasis on the flow of both information and material, synchronized to the customer's requirements, from raw materials to the end consumer. In effect, SCM removes the traditional boundaries that exist between supply chain entities through interfirm activities such as: sharing of research and development, the placing of employees with other firms, development of cost management systems across firms, collaborative inventory control and inventory placement decisions. SCM has an emphasis that goes well beyond the traditional function of materials management [70, 71].

Information sharing between the buyer and supplier is considered to be a major indicator of the use of SCM. When information flows seamlessly in both directions, the effect is to create a virtual supply chain. Information transfer is used, in effect, to integrate the entire value chain into one longer chain [72–75]. In the context of SCM, the term integration relates to how closely, particularly at their interfaces, supply chain entities operate as a single unit. Higher degrees of integration occur when supply chain members automatically coordinate some aspect of production. EDI is important since it facilitates frequent and automatic transfers of information required for high degrees of integration and coordination within the supply chain. Instead, the use of EDI, without the integration of supply chain activities, will simply speed up an existing process. This integration requires the reorganization and restructuring of the relationships between firms to achieve the full benefit from use of both EDI and SCM [76]. Coordination is an integral part of supply chain integration. Another research [77] focus on the coordination between firms, using it to measure integration. In particular, EDI is an enabling factor and the first step leading to integrated supply chains [78]. The degree of integration in SCM depends on the degree of EDI use within the firm [79].

Nowadays, the success of a firm increasingly depends on working efficiently and effectively with others in the supply chain [80]. Firms that simultaneously explore two ways of using IT in their supply chain management may face undesirable uncertainties. They may face a managerial challenge or a tech-

nical risk due to the limitation in their search activities [81]. This research uses two IT-based methods to show the mediating effect between environmental uncertainty, behavioral uncertainty and transaction costs as well as the moderating effect of using EDI on the effect of environmental uncertainty on transaction costs.

As such, supply chain management is considered to include activities such as supplier partnerships, outsourcing, cycle time compression, continuous process flow, and information sharing [14]. However, it is extremely difficult to enable and coordinate seamless data flows across organizational boundaries. An inter-organizational system (IOS) commonly refers to an electronic data interchange (EDI) that conducts interorganizational exchange of business documentation in a structured, machine-readable form [82]. The IOS is designed to reduce supply chain uncertainty and transaction costs, increase resource utilization, and diffuse products and services into new markets [83]. Therefore, firms that implement IOS facilitate collaboration and manage potential conflict through electronic integration [84]. Still, information systems greatly facilitate interfunctional exchange and promote a joint understanding [85].

Another research findings, EDI in the Supply Chain has had important implications for the EDI introduction in the retail supply chain [86]. On the one hand, the general decline in demand for common-user services, particularly in the grocery sector, has led some contractors to scale down their activities in this area and concentrate their attention on dedicated services for individual clients. Other firms have exhibited a stronger commitment to the common-user market and some have seen enhanced computer support not only as a means of maintaining or expanding their share of this market but also of upgrading the standard of service and hopefully improving margins.

Meanwhile, integrating EDI and SAP the supply chain management of firms with a high number of invoices is improved and the manpower is reduced, as many validations are performed automatically and mistakes/inconsistencies are detected easily [87]. In addition, the cost of maintenance of the different computer applications is reduced. As a consequence, the efficiency of the operation is increased and a higher capacity to adapt to changes is experienced. Moreover, it is important to know that SMEs are reluctant to use this technology, as the effort required to perform all the standardization is not covered by the revenues achieved, as typically the SMEs have many customers, and more effort is required to facilitate their inclusion into these initiatives. Electronic sup-

ply chains using electronic data interchange (EDI) are more successful than nonelectronic supply chains using manual (paper) purchase orders by analyzing the supplier-manufacturer link in the SC [88]. The EDI supply chain is more effective than the manual supply chain in terms of: shorter order cycles, greater availability, lower (purchase) price, and lower (transaction) cost. Electronically-enabled supply chains have the potential to improve organizational and supply chain-wide performance by increasing transaction efficiencies and coordination effectiveness [89]. The emergence of electronically-enabled supply chains (ESC) has changed both the quantity and the velocity of information flowing among supply chain partners. ESCs utilize information technologies, including electronic data interchange (EDI) and the internet, to enable and enhance supply chain processes, creating efficiencies in the flow of materials and goods [90, 91]. These information technologies offer the potential for reduced costs and increasing sales for all members of the supply chain. However, ESCs may also increase the risk to intermediaries, such as distributors, as ESCs can facilitate information flows directly between manufacturers and retailers [92].

EDI in small and medium enterprises (SMEs)

In the last twenty years, many small and medium-sized enterprises (SMEs) have turned to computer processing technology in order to minimize their operating costs and increase their performance. Now, the challenge is the necessity to increase their informational capability in order to maintain and expand their position in a more global market, by establishing privileged relationships with external partners. It thus becomes important to understand how SMEs can successfully make the transition from intra-firm computing to inter-firm computing, and manage in the new information age, more specifically in the case of EDI as the most prevalent form of electronic commerce. Information needs of small businesses are different from those of large firms, and become evolve along with the firm's growth [93]. Also, the adoption, implementation and utilization of any type of information technology is affected by the organizational, decisional, psycho-sociological and informational specificities of the small business context [94]. First off, the decision to implement EDI is not necessarily taken in a voluntary fashion by an SME's owner/managers. These firms often adopt this technology under pressure from their larger commercial partners [95]. Given the sharing of interorganizational IS between partners of different size and power, the benefits of EDI systems are not the same for all [96]. Un-

fortunately, SMEs tend to obtain fewer advantages because of their less favorable organizational context and their lower level of EDI integration [56].

Meanwhile, EDI has become one of the important tools in the development of new forms of organization [97]. One such form is the network enterprise, grouping a number of small and medium-sized enterprises (subcontractors, suppliers, distributors; SMEs) around a large enterprise (pivot firm). Based on research among fifteen subcontracting SMEs, they designed to validate an evaluation model of the potential for EDI in the context of a network enterprise. The firms are characterized in terms of external influences, predisposition of the organizational context, perception of EDI and business processes, and classified into three groups, namely the “committed” adopters, the “involuntary” adopters, and the “belated” adopters.

Although many issues related to the adoption of EDI technology were found similar but their contribution were entirely different to the SMEs and they reacted differently to these issues. It is therefore relevant that we investigate the issue of technology adoption from SMEs perspective. Unfortunately, few studies were conducted on EDI adoption within SMEs. Iacovou work is considered as pioneering effort [34]. They proposed a theoretical model consisting of three factors: perceived benefits, organizational readiness and external pressures that found determinants to EDI adoption in SMEs. Although Iacovou et al.’s study was based upon very small sample size of seven organizations investigated by case study methodology yet it provided an insight to formulate the hypotheses for further work.

Most of the EDI studies have addressed three factors influencing the EDI adoption among several small business context. These are: organizational, technological and environmental. These factors within their domain have added to the existing knowledge. However, most of the studies on EDI are based on case study method that is a good way of developing hypothesis but unfortunately this method makes it difficult to generalize the results to a large population. So there is a need of conducting more empirical studies to provide statistical validity and generalizability. Researchers across the globe selected different factors that might not be suitable to Asian context. Chwelos further extended Iacovou et al.’s study with increased sample size and by adopting a survey approach for 268 Canadian SMEs [36]. Their findings suggest that intent to adopt EDI was influenced by perceived benefits, external pressure and organizational readiness. Another study of 644 Hong Kong SMEs conclude that perceived direct benefits, per-

ceived cost, IT knowledge, trading partner’s influence and government incentive are significant factors for EDI adoption [98]. In summary, the EDI adoption has been studied within the context of SMEs using several approaches and operationalizations. From the review of the existing literature it is evident that there are number of overlapping divergent models that have been shown to potentially explain the EDI adoption decision by examining different factors. From a different perspective, a research [99] analyze that contrary to large companies, SMEs have always demonstrated enormous reluctance to invest on EDI probably based on excessive investment costs when compared to the perceived benefits [100].

Conclusions

EDI is one of electronic communication method that refers to a technology used to exchange information and data across organizations. EDI implementation can impact all corporate functions and have significant impacts on relationships with exchange partners. This literature review study showed that EDI is important to achieve business strategic goals, and can support implementation of business strategy such as cost strategy and differentiation strategy.

Furthermore, there is still need more research about EDI in other aspect that rarely discuss and analyze, especially EDI implementation on production outsourcing, where external supplier establish relationship with firm/manufacturer. Beside that in order to gain more benefit by implementing EDI technology, the manufacturer needs to linking EDI to its manufacturing planning system or other functions of the business, such as quality, product design, and product engineering and expands the implementation to more customers and to suppliers. However, most of literatures on EDI rarely analyse about linking EDI to its manufacturing planning system. Due to limited access to the journals sources, the number of journals have not covered all the articles that related to electronic data interchange. But we expect, this paper can provide and strengthen a comprehensive view of the EDI research in the future and proposes some directions for the development of EDI concepts.

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