

New Challenges for Supply Chain: Electronic Invoicing and Its Use Perspective

Aurelija Burinskiene

Vilnius Gediminas Technical University, Lithuania

Abstract. Apparently, the importance of information flow in supply chain is increased. Information flow correspond physical products flow between supply chain actors under modern globalization conditions and the application of information and communication technologies (ICT). E-trade process is usually more efficient than traditional paper-based one. The products speed to the market and efficiency in supply chain become crucial factors. The implementation of e-trade process is exclusively important for supply chain companies aiming to operate the chain in efficiency manner. The research is oriented to the usage of e-trade attributes by trade sector in country, which corresponds to more efficient supply chain in general. In the study historical changes between supply chain actors and future opportunities are identified. Finally, the maturity model is presented for electronic invoicing process.

Keywords: e-trade; industrial buyer behavior; supply chain; e-invoicing

1. Trends in supply chain

Nowadays, SCM is characterized by explicit integration of environmental or social objectives which extend the economic dimension.

Many past researches have paid attention to the environmental and ecological awareness, corporate social responsibility, sustainable development, environmental protection, recycling, etc. Numerous studies were available since 1970.

The earliest related literature reviews (Gungor & Gupta, 1999; Kleindorfer et al., 2005) identify green product, process development and application, green logistics management, and reproduction.

Table 1. Trends on Environmental Management

Stage of Environmental Policy	Primary Characteristic(s)	Year(s)
Risk Management	Waste management and pollution control.	1970 - mid 1980
Pollution Prevention	Process improvement to reduce material use, minimize waste, and improve efficiency	mid 1980 - mid 1990
Life Cycle Management and Industrial Ecology	Systematic product and process management to maximize profitability and ensure environmental quality. Focus on life cycle environmental effects of processes and products.	mid 1990 - ?
Corporate social responsibility	Ilgin and Gupta (2010) observe the modeling of green reproduction and product refurbishment	2008

In addition, authors are developing new solution methodologies applicable for designing green supply chain networks (Wang, Lai, and Shi, 2011). Nevertheless the number of models in green logistics is not widely developed, intermodal transportation giving reduction in greenhouse gas emission or more efficient vehicle routing algorithms are some examples for related research questions. Further on researches, which has strong focus on environmental aspects and efficiency, are required as important a lot.

In previous decades, companies were used to manage their supply chain individually and produce inaccuracies in overall chain performance. To avoid inefficient revenue and expense operations, companies need an end-to-end view of the supply chain. The implementation of supply chain management solutions gives wider visibility for production, better planning of orders, and reduction of inventory. In accordance, with new operational models order-to-cash and procure-to-pay and holistic view on supply chain companies get opportunity in decision-making as well as business growth.

2. Behavior aspects of industrial buyer

The behavior of supply chain actors has been changed since 1970 due to some reasons:

- globalization has forced business to create tied supply chain

relationships between actors;

- demand becomes a key element in serving customers at their locations with the diversity of products available in required time frame;
- outsourcing has been installed for different support functions such as logistics and finance services;
- the use of ICT in trade has influenced the selling processes, which is now handled with more advanced producers and wholesalers IT systems (ERP enterprise resource planning and WMS warehouse management systems) and the link between them.

When consumer demand at supply chain is linked with deliveries from producer to retailer, such is known as two-tier model. But in more complex supply chain systems, the models of three tiers (or more) can be deployed; they incorporate the link with intermediate (then there are links: retailer to service provider to manufacturing plant). Some retailers are carrying large varieties of product but small inventories, so these have to purchase products frequently from wholesalers, plus invoicing is leading each trade transaction.

The model becomes more complex when enterprises are vertically integrated to outsourcing. Such is the preferred way of handling products in supply chain. So, the application of e-trade process is a joint decision made by producer and their supply chain partners. Supply chain linkages are important for both producer and intermediate as they are connecting with each other faster.

In general, behavior theory is concerned with the complex interaction of cultural, economic, and social factors, which are involved in the process of buyers' decisions. Besides differences in countries in cultural, social and economic conditions, these differences would cause the usage of eco-friendly services.

In general, service oriented into environmental protection is called eco-friendly service and has some specifics. Many eco-friendly services are considered public goods or common usage resources. But one type of such services is electronic or paperless invoices. Such service is rapidly increasing.

These four types of behavior can be applied for new eco-friendly services. The first group of enterprises exposed to the eco-friendly services, is called initiators. As the innovation spread continues, the other three behaviors will come into effect in order of early imitators (open to try), later imitators (accumulation), and last adopters (market in mature) (DiClemente & Hantula, 2003). There are studies which compared adopter firms with non-adopter firms. For small businesses, benefits are perceived to be higher by adopter firms than by non-adopter firms.

The Behavioral Perspective Model (described by Foxall (2009)) – decision making tool that embodies benefits and costs associated with buyer choice and

can be used to interpret the wide range of behavior cases like innovative choice, imitation, 'green' buyer behavior. Buyers who purchase eco-friendly services will have positive effect on the environment.

Green buyers are entities who support the trade in the environmental friendly or green manner (Renfro, 2010). There is the increasing number of green buyers in the market.

In study author Klein (1990) discovered that buyers are linking their buying behavior with the impact on the environmental - more than 60% of them select this preference.

O. A. Hart, M. N. Barinedum, J. I. Benjamin (2010) presents a modified technology - organization - environmental model (TOE) that incorporates the dimensions of the technology deployment and organization link with environment which influences intelligent decision-making and application in organizations.

The founders of Technology-Organization-Environment model (TOE) - L. G. Tornatzky and M. Fleisher (1990) take the technological, organizational and environmental factors and their influence on the decision of technology application by enterprises (Tornatzky et al., 1990):

- Technological factors are the internal and external technological solutions necessary for the development of the company. The enterprise's technological solutions include actions related to the use of technology solutions within an enterprise, in order to innovate and expand business processes, while external technology solutions include the adoption and use of technologies available in the market;
- Organizational factors are the company's resources and its characteristics: enterprise size, structure, complexity of managerial aspects, and quality of human resources;
- Environmental factors are the size of the market, competitors, suppliers, macroeconomic factors and legal regulation of business processes.

By assessing the influence of all three (technological, organizational and environmental factors) on business processes and technology applications, it can be argued that these factors highlight not only possibilities but also limitations in order to adapt modern technologies not only to local trade but also for international one.

Hart et al. (2010) can be applied to small and medium-sized businesses when focusing on business development, the use of advanced technology. The approach to the use of modern technologies is based on the evaluation of the system, which affects a positive attitude that encourages a high level of buyer engagement in

making intelligent decisions. Feedback is based on experience and buyer repeat behavior. Then industrial buyer experience and knowledge can be adapted to reduce unwanted behavior.

Beckstrom's Law offers many insights for different processes in sectors and efficiency gains which can be made under different chain structures, taking the aspects of economics, ICT and industrial behavior.

According Beckstrom's Law the value to each user is determined by calculating the net benefit value the presence of the network adds to all transactions conducted by its users (buyers, sellers) over that network. The model can be used for any size of network, whether it has two users or billions. The network means e-services to participating parties, which are provided to entities, and those services can be valued by an accounting of the costs and benefits of all transactions that are enabled by those services. Since benefits and costs are calculated from the unique standpoint of each party, when there is no double counting (Beckstrom 2009).

Asare et al. (2011) mention that the usage of electronic invoicing provides benefits to the participating firms. These specific benefits are linked with both the extent to which it is diffused and applied and the level of subsequent benefits that are gained and accumulated by companies. The number of suppliers found that despite being forced into e-trade, process adoption, they were obtaining some competitive advantage, and having received new business possibilities (e.g. international contracts) partly as the result of being electronic invoicing capable.

3. Electronic invoicing in trade

Trade is an important linkage between countries. The implication of increased trade means that trading countries, which are engaged in trade integration, are becoming more closely linked.

The implications of classic theory present that trade should take place between countries that complement each other (based on inter-trade patterns). Increased trade is leading to closer across countries trading partners. The increased trade does not mean the increased process synchronization among trade partners. But in general option to make process more synchronized between trade partners exists.

The adoption of electronic invoicing is first delayed because of switching costs, transaction costs, originating in the lack of usage in the market, and the difficulty of assessing its return from economies of scale. The condition of increasing returns makes it possible. The adoption of electronic invoicing starts from large

companies and continues until the critical mass in usage is reached.

Increasing returns are combined with the introduction of e-service as the innovation.

In theories of economy the application of e-trade is associated with quick response for maximizing efficiency through economies of time (by reducing inventory cycle time).

The usage of common standard in the sector would decrease the cost of e-invoice implementation (economies of scale, implementation costs and lower costs of transactions, etc.). In fact e-trade process replacing standard process by cutting costs and streamlining to make it more efficient.

Service provider (SP) is also taking important role to speed the implementation of electronic invoicing, in the market. It is specializing in transforming supplier's invoice format into the desired format of buyer. Supplier does not have to agree on format with the buyer but can use its own as service provider will shift information from one format to another. However, if supplier has multiple buyers using different SPs it still has to connect to all of those.

Schumpeterian Mark II model presents companies that are able to introduce an innovation at time t and to earn profits above the norm for a long period of time.

Nevertheless electronic invoicing regulation across countries is different. Some countries require e-signature for authentication reasons. Companies need to focus as well on correct documentation accompanying buying and selling operation. Compliance with operational models order-to-pay and procure-to-pay touches such areas: companies' internal purchasing policies and procedures, contracted pricing, and payment terms.

Today companies could choose from variety of viable options. The growing number of standardized and cloud-based supply chain management solutions is driving down costs and reducing implementation time.

Properly settled e-trade process reduces costs and increases efficiency in supply chain.

The greater the level of cooperative behavior between supply channel members, the greater the level of efficiency achieved in the chain.

4. Development of a maturity model for electronic invoicing

Maturity model is used to demonstrate different phases of process integration and activity optimization (Salah et al. 2014). Some maturity models (BPRMM) focus of business process reengineering BPR, other models (PML process maturity

ladder) imply continuous process improvement. But still there is lack of literature on e-invoicing maturity models.

Capgemini (2012) has created electronic invoicing maturity model, which includes seven different levels of electronic invoicing and mainly relies on how information is gathered. First level represents manual invoice entry; second level – paper invoice scanning; third level – portal solution for placing invoice on web; fourth level – EDI channel; fifth level – service provider platform; sixth level – 4-Party model; seventh level – self-billing. In shortly maturity model of Capgemini is more oriented on how information is set up and who is responsible for invoice creation. In general, it could be classified as BPMMM (business process management maturity model). It doesn't represent supply chain which is the network of entities, directly or indirectly interlinked.

The model of author, presented in this paper, will cover different type of tiers (direct and indirect), as well, phases that cover shift from single stand-alone solution to virtual community e-invoicing solution. According BPM literature it could be classified as Business Process Maturity Model (BPMMFisher), which presents shift from siloed to intelligent operational network.

For building maturity model Transaction Cost Approach (TCA) is taken. It has the potential to combine the interdisciplinary setting insights provided in supply chain and organizational behavior literature. According to transaction theory, transaction costs increase when company (called “transactor”) allocates resources for new solution.

First phase – company starts to use electronic invoicing for internal transactions between branches. This is single tier model. The company just introducing to electronic invoicing, starting from IT preparation and system architecture.

Next phase – traditional B2B selling and buying, called as two-tier model. There are on relationship establishment between sellers and buyers – single interaction between supplier, who is selling, and buyer, who is reaching electronic invoice (Age 2011). Relationship-specific adaptations are a common business practice. It requires investments and procedures specific to the needs or capabilities of an exchange partner. It usually is one-to-one integration and if the number of integration grows, such means that many unique standards have to be maintained at buyer level.

Supplier and buyer behavior oriented to B2B integration reduces some of the costs associated with transactions. The transaction cost theory can be used to explain the increase in efficiency related to such behavior.

Third phase – the involvement of service provider (SP). Service provider could

also participate in this interaction. The primary interest to use, service provider comes when customers realize that provider create value. Thus, value creation by provider becomes the area of interests for companies. It can be translated into the access of technology, new markets, and information. Finally, buyers realize that this help them to achieve sustainable competitive advantage. European e-invoicing service providers report significant growth for the year 2015: 27% growth rate and additional 1.25 bln processions of e-invoices (Academic Conferences and Publishing Limited, 2017).

Service provider is putting money into capital investments. This as well shows that gains between transactors are possible when firms are willing to accept relation-specific technologies and investments. The findings suggest that the economic value created by service provider for transactors, in terms of lower transaction costs, may be substantial.

According to this model, buyer-supplier-service provider relationships are characterized by these main elements: investments that might be necessary to conclude a particular transaction and gradual adaptations that might occur over time, switching costs, and the value delivered to one or both parties connected to these investments reduce costs, increase revenues, improvement in e-invoice processing. A time consuming task are quite often manual entry errors, but by switching to e-service, accounting starts to check if e-invoice is right

While in the short term for service provider investments would be greater, in the long term, the two should converge in that over time the lost value add would lead to an equal and offsetting investment in replacing network functions with new one.

Fourth phase – transactions are expanded to other geographic territories. If seller seeks to sell goods abroad the connection between two or more service providers is needed, because, the activity of single service provider is limited by geographic territory where it is presented. The example of such case could be electronic invoicing among countries in South America and Western Europe. Usually, service provider connects to the abroad service partner to support cross-border transactions. Both supplier and buyer are using service provider located in national markets. Derivatives in such case are created considering various parties' incentives and stand-alone business behavior analysis.

Timely performed transactions are very important. The performance of service provider system is critical. It appears that data placed to system by one party is not delivered to another party on-time due to technical system issues. The losses of service provider are the sum of all losses of network members, which appears due to system breakdowns. To minimize losses service providers invest into

system secure performance.

Fifth phase – “classical” B2B service expands to multi-tier B2(B2B) service concept. Such requires the development of platform that supports communications not between two trade partners, but between various entities. This allows multiple buyers and suppliers to meet each other on e-platform seeking to conduct transactions online. If in past mainly large firms were interested, now also small businesses are able to join the platform. The participation in platform could be passive, active, or in-between. Such depends on how many partners of company are using the service. Whereas the other connectors focus on joint behaviors and shared expectations, adaptive behavior is defined so that it focuses on the individual behavior specific to the other party in the relationship.

The platform itself is a hub between companies. There are multiple companies which use the service. The buyer does not have to maintain a lot of connections with different suppliers but just the single one with e-platform.

Sixth phase – company reach its centric position on e-platform. Suggested derivatives apply the B2B centric perspective. This means that synergy effect is reached for firm having centric position when new members join transactions. According this logic benefits are accumulated by company having critical mass of its partners on e-platform. The benefits of company placed in center grow the new member joins the same network and increases the number of transactions. As main costs are constant, synergy effect is reached as the number of transactions increase benefits for company having centric position.

Table 2. Maturity in electronic invoicing

Maturity levels	Internal boundaries (B)	External boundaries (B2B)	Triangle (B2B & SP)	Multiple service providers (SP2SP)	E-platform (B2(B2B))	Centric position in multi-tier e-platform
Standardization	Stands on own format	Each connection stands on different unique format	Mandatory to agree on standard	Service providers agree on standard	Multiple standards possible	Company selects the standard
Costs	Initial development	Manual process with high number of integrating FTE	SP takes technical control, monitoring & data	Corporate investment into system performance	Costs of joining e-platform	Main costs are constant

			transfer insurance	nce security		
Benefits	Internal optimization	Number of transactions reached from 1-1 connection	Corporate information exchange, faster invoice processing	Minimization of security related losses	Growth if more members joining the e-platform	Synergy effect if the number of transactions grow

Major U.S. office furniture manufacturers adopted electronic invoicing primarily to improve the efficiency of supply chain transactions. Such had reduced transaction-processing time and whether this improvement was more visible in complex cases.

5. Conclusions

The paperless invoicing is the result of environmentally responsible behavior in supply chain. The research presented is based on behavior model with generic relationship types and not taking into account adaptive behavior (individual behavior specifics). Such is much emphasized in Technology-Organization-Environment (TOE) model.

Talking about transactions in supply chain, two-tier (B2B) models were more common in past, but these days multi-tier B2(B2B) models are present, which requires the development of e-platform that support communications not between two, but between various companies. This allows multiple buyers and suppliers to meet each other on e-platform seeking to exchange real-time invoicing data.

The maturity model in electronic invoicing process offers a structured way which could help company to determine where it stands and which direction to select for grow. Companies due to perceived complexity of electronic invoicing process are having various implementation challenges, which additionally slowing down its broad implementation. E-invoicing process treated as the exchange of invoices by electronic tools excluding manpower intervention, generates benefits such as time and cost savings in supply chain. The suggested maturity model created by author, starts from stand-alone phase, when company optimize its own information flow, finally shifts to upmost mature level, where optimal efficiency is reached in end-to-end process and real-time e-invoicing is achieved.

As the number of maturity models for electronic invoicing slightly increases,

the future work could focus on integration and consolidation of contemporary presented maturity models.

References

Academic Conferences and Publishing Limited (2017). ECDG 2017 17th European Conference on Digital Government. Academic Conferences and publishing limited, 18-134.

Age, L. J. (2011). Business manoeuvring: a model of B2B selling processes, *Management Decision* 49(9): 1574–1591. doi: 10.1108/00251741111173998

Asare, A. K. Brashear, T. G.; Granot, A. E.; Kashyap, V. (2011). The role of channel orientation in B2B technology adoption, *Journal of Business & Industrial Marketing*, 26(3): 193 – 201. doi: 10.1108/08858621111115912

Beckstrom, R. (2009). A New Model for Network Valuation. National Cyber security Center, Research paper: 1-10.

Capgemini (2012). e-Invoicing Maturity Model. Capgemini Oracle Blog. Retrieved August 21, 2017 from <http://www.capgemini.com/blog/capgemini-oracle-blog/2012/11/e-invoicing-maturity-model>

DiClemente, D. F. Hantula, D. A (2003). Optimal Foraging Online: Increasing sensitivity to delay. *Psychology & Marketing* 20(9), 785-809.

Du, J., (2009), Comprehensive Evaluation Method of Supply Chain Based on Complexity, *Statistic & Decision*, 1, 43-45.

Foxall, G. (2009). Interpreting Consumer Choice – The Behavioural Perspective Model. Routledge, 200 p.

Gungor, A., & Gupta, S. M. (1999). Issues in environmentally conscious manufacturing and product recovery: A survey. *Computers & Industrial Engineering*, 36(4), 811–853.

Hart O. A., Barinedum M. N., Benjamin J. I. 2010. The uptake of electronic commerce by SMEs: a meta theoretical framework expanding the determining constructs of TAM and TOE frameworks. *Journal of Global Business and Technology*, 6(1): 1-27.

Ilgin, M. A., & Gupta, S. M. (2010). Environmentally conscious manufacturing and product recovery (ECMPRO). A review of the state of the art. *Journal of Environmental Management*, 91, 563–591.

Klein, E. (1990). The selling of green. *D&B Reports*, Vol. 38, September/October, 30-1.

Kleindorfer, P. A., Singhal, K., & van Wassenhove, L. N. (2005). Sustainable operations management. *Production and Operations Management*, 14(4), 482–492.

Renfro, L. A. (2010). Green business operations and green marketing. *Research Publication*, 2.

Salah, D., Paige, R., Cairns, P. (2014). An evaluation template for expert review of maturity models. In Jedlitschka, A., Kuvaja, P., Kuhmann, M., Männistö, T., Münch, J., Raatikainen, M. (Eds.), *Product-focused software process improvement*, LNCS 8892 (318–321). Switzerland: Springer.

Tornatzky, L. G., Fleischer, M. (1990). *The Processes of Technological Innovation*. Massachusetts: Lexington Books.

Wang, F., Lai, X., & Shi, N. (2011). A multi-objective optimization for green supply chain network design. *Decision Support Systems*, 51, 262–269.