

# Electronic Data Interchange and Demand Forecasting Implications on Supply Chain Management Collaboration: A Customer Service Perspective

Ilyas Masudin<sup>1\*</sup>, Mohamed S. Kamara<sup>2</sup>

<sup>1</sup>Industrial Engineering Dept, University of Muhammadiyah Malang  
Jl. Raya Tlogomas 246 Malang, Indonesia, +62341464318

<sup>2</sup>Postgraduate Program of Management, University of Muhammadiyah Malang  
Jl. Bandung No. 1 Malang, Indonesia, +62341464318

\*Email: [masudin@umm.ac.id](mailto:masudin@umm.ac.id)

## Abstract

*Customer service is a very important aspect within the supply chain. Through collaboration, the goal of each party within the supply chain is to add value to a product, in order to accelerate good customer service. Good customer service leads to customer satisfaction and most importantly it developed customer loyalty. These are the main goal of ever firm in the supply chain, starting from raw material, production, distribution and down to the final consumer. This work is developed to investigate the impact of supply chain management collaboration activities on customer service in an inter-organizational context. This is done by examining how effective collaboration in supply chain management creating confidence and trust between vendor-customer relationships that provides benefit to both organizations; one of such benefit is improved customer service. This can be obtained through the use of Electronic Data Interchange (EDI), which ensures that products are delivered to customers faster with great accuracy, and demand forecasting and inventory management, which ensures that vendors maintain optimal inventory level so that they always have what customers want in stock. The method used in this work is by gathering information from several articles, journals and text books relating to this research work. There is a total of 49 including journals, books and articles used in this work, all of which are related to this study.*

**Keywords:** Supply chain management, collaboration, customers service.

## 1. Introduction

The supply chain management philosophy stresses that maximizing service to customers of choice at the lowest total cost requires a strong commitment to close relationships among trading partners. It is generally believed that increased collaboration among supply chain participants leads to lower total cost and enhanced service performance [1]. Collaboration begins with customers and extends back through the firm from finished goods distribution to manufacturing and raw material procurement, as well as to material and service suppliers. Effective SCM is made up of a series of partnerships and, thus, SCM requires partners to build and maintain long-term relationships [2-4].

Supply chain is the network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services delivered to the ultimate consumer [5]. In other words, a supply chain consists of multiple firms, both upstream (i.e., supply) and downstream (i.e., distribution), and the ultimate consumer. Supply Chain Management is directly related to a company's customer service. A company with a better customer service, can get a leg up on the competition. To be successful, companies must take advantage of every opportunity it can to stand out from the competition. Good supply chain

management boosts your company's customer service. Lambert, Stock, and Ellram suggest the key processes typically include customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, procurement, and product development and commercialization.

Deliver products to customers faster and with greater accuracy and maintain optimal inventory levels so you always have what customers want in stock are considered as strengths that help vendors build relationships of trust with your customers. La Londe & Masters [6] proposes that SCM is the process of managing relationships, information, and materials flow across enterprise borders to deliver enhanced customer service and economic value through synchronized management of the flow of physical goods and associated information from sourcing to consumption. Therefore, when vendors consistently fulfill its promises and exceed expectations, their customers are more likely to keep coming back or even refer their friends to them. As economic conditions improve and consumers cautiously increase their spending, and a vendor can be placed in an ideal position by optimizing their supply chain management.

Part of this research aim at analyzing how of information usage through the supply chain to improve customer service in the product delivery process. Also the speed of response to customer demand has long been recognized as a key attribute to business success since customer loyalty can be won or lost on product availability. One of the key attributes of a successful winner in today's highly competitive marketplace is the ability to respond rapidly to the end consumer demand [7]. To maximize competitive advantage all members within the supply chain should "seamlessly" work together to serve the end consumer [8]. Improved information flows and is an extremely important aspect within leading organizations in the fight to decrease lead times [9]. Therefore, the introduction of electronic data exchange in many companies has offered improvement in the speed of transmission of orders.

It has been suggested that success in today's competitive business environment is largely dependent on the degree to which firms are able to integrate across traditional functional boundaries to provide better customer service [10, 11]. Therefore, firms place more emphasis on customer service, due to increase in demand with customers. Achieving better levels of customer service requires working together across departments or functions. Providing customer service in the supply chain is largely the domain of marketing and logistics [12]. If we distinguish between the operational function of customer service and the resultant goal of customer value and satisfaction, this discussion leads us to conclude the consequences of SCM are lower costs and improved customer value and satisfaction to achieve competitive advantage. Industry reports support this contention. The literature of this work will focus of collaboration as a key player in the supply chain management, also we shall examine the significant of the use of EDI and its effects of product deliver to customers faster with greater accuracy, furthermore, we shall examine impact of demand forecasting and inventory management in maintain optimal inventory levels so that vendors can always have customers' want in stock. Finally, we conclude.

## **2. Supply Chain Collaboration**

Collaboration in the perspective of supply chain management became hot issues since the middle of 1990s in the form of collaborative planning forecasting and replenishment or known as CPFR. The discussion continues to grow in the advance form of supply chain collaboration such as the use of Vendor Managed Inventory (VMI) and Continuous Replenishment programmes (CPR). The importance of collaborative supply chain is real in today's business due to most organizations have to manage effectively the

internal activities in term of supply activities, manufacturing processes, warehousing system, distribution activities and other logistics activities. Those activities could not stand alone and disconnected each other without any coordination and collaboration among the members of supply chain. The integration and collaboration in demand and replenishment for instance, could be the effective way to reduce costs of inventory, reduce stock out probability, improve customers responsive and finally improve the competitiveness of the organization. Supply chain collaboration has been strongly advocated by consultants and academics alike since the mid 1990's under the banner of concepts such as Vendor Managed Inventory (VMI), Collaborative Forecasting Planning and Replenishment (CPFR), and Continuous Replenishment (CR). It is widely accepted that creating a seamless, synchronized supply chain leads to increased responsiveness and lower inventory costs. The driving force for effective Supply chain management is collaboration. Strategic supply chain management requires collaboration amongst all parties involved in the supply chain, whatever their size, functions, or relative position. One cannot optimize its own operations until it understands the real-time demand of its customer's customers as well as the current constraints to its supplier's supplier [13].

O'Leary-Kelly and Flores [14] who state that "*...integration refers to the extent to which separate parties work together in a cooperative manner to arrive at mutually acceptable outcomes*". This definition contains elements pertaining to the degree of cooperation, coordination, interaction and collaboration. Also, O'Leary-Kelly and Flores [14] and Kahn and Mentzer [15] define integration as a process of interaction and collaboration in which manufacturing, purchasing and logistics work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization.

Horvath [13], the level of increase of collaboration and information sharing in supply chain management needs a new form of collaboration technology infrastructure. These infrastructural capabilities vary with role, each participants size while some fundamental attributes of SCM remain constant. These include:

System and channel integration: Participants must be able to integrate and access information regardless of the application or channels used to acquired it. Such channels could include web sites, online marketplaces and intranet, call centers, physical store, branches etc. Applications may range from sales to account payable to order management to master customer information.

Very large, flexible, multimedia data storage capabilities: The infrastructure for value chain must be able to store and relate large quantities of data from many different sources, in many different media. These could include images, engineering drawings and program codes as well as conventional data files and text documents. Implementation of a common data model for data storage may prove similar, faster and far more efficient than an attempt to integrate all the various data models in use across the chain.

Supply chain collaboration exchanges: Today's e-business exchanges are essential markets, with value exchanges limited to buying and selling. Advanced supply chain management will offer exchange that allows members of the supply chain to collaborate in the design and development of products, manufacturing processes, logistics and distribution strategies and all related forms of supply chain and demand chain planning. Supply chain collaboration exchanges will also offer value-added capabilities to their communities, including commerce, business and enablement services. Community will benefit from proven complete collaboration solutions from service industry leaders.

Prior study in collaborative supply chain such as Ramanathan & Gunasekaran [16], Ramanathan [17], Cao & Zhang [18]. For instance, Ramanathan & Gunasekaran [16], discussed about the effect of collaborative planning, collaborative decision making of supply chain partners and collaborative execution of all members of supply chain in

the successful supply chain collaboration. The results of their collaborative supply chain indicated that collaborative planning, collaborative decision making and collaborative execution have significant impacts on the success of Sc collaboration and also have positive implication on the long term future collaboration.

### 3. Degree of SC Collaboration

Previous research identified the level of collaboration in different levels based on the degree and quality of collaboration. Manthou, Vlachopoulou, & Folinas [19] categorized SC collaboration into basic communication, limited communication and full communication among partners of supply chain, while other study by Skjoett-Larsen, Thernøe, & Andresen [20] divided into three level such as basic collaboration, developing collaboration and advanced collaboration. Moreover, Simatupang and Sridharan (2004) grouped SC collaboration into two types: low and high SC collaboration. In addition, an interesting study has been made by Ramanathan [17] who considers the number of partners of supply chain, multi echelon supply chain, duration and level of involvement in measuring supply chain collaboration performance. This is relevant with the general theory developed previously that the active participation of each member of supply chain would improve the overall performance supply chain. Ramanathan [17] have developed the mathematical models dealing with the degree of supply chain collaboration taking into account the number of involved collaborating partners, total number of collaborative years and total investment on the Sc collaboration.

$$\text{Degree of SC collaboration} = \frac{\text{Number of supply chain collaboration partner}}{\text{Number of supply chain memebr}} \\ \times \frac{\text{Collaborating years}}{\text{Business duration}} \times \text{level of involvement}$$

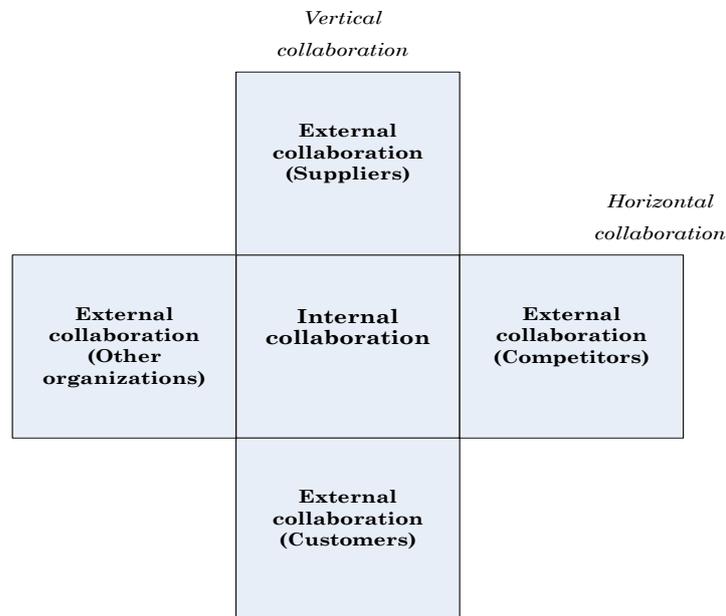
Where, level of involvement is defined as the proportion of partner in collaborative operations of supply chain to total activities. The level of involvement is formulated as:

$$\text{involvement level} = \frac{\text{Collaborative investment}}{\text{Total investment}}$$

where, collaborative investment is defined as the percentage of investment which contributed on training and technology per year, while total investment also means that the proportion of investment by partners of supply chain collaboration on training and technology per year.

The main objective to initiating supply chain collaboration is to achieve high overall performance of supply chain through the collective efforts from the members of supply chain [21]. In term of the level of involvement of the members of supply chain, Barrat [22] believed that the involvement of SC members is one of the essential keys for successful supply chain collaboration and must be made by SC members as front-end agreement. The involvement level in supply chain collaboration also includes information sharing and power sharing among the member of supply chain. As part of partners' involvement level, leadership issues is an important key in initiating formal collaboration. For instance, all strategic decision making in supply chain in term of cross-functional activities and the involvement of department in all member of SC should be made by top management of each partners of SC. The benefits of the involvement level on information sharing are vital, especially for manufacturers, suppliers, distribution centres and retailers. In the perspective of information sharing, the involvement of SC partners on quality and accelerated information sharing among

the members of supply chain could improve the reliability and validity of orders made by members along the supply chain channels. According to Aviv [23], the involvement of partners on information sharing will improve forecast accuracy, potentially reduce costs and improve customer responsiveness.



**Figure 1** the general scope of collaboration (*Adopted from Barratt [22]*)

In general speaking, the scope of supply chain collaboration can be divided into two categories: vertical and horizontal collaboration. Barratt [22] identified the SC collaboration in vertical category as the internal collaboration of SC members such as with customers, across internal function on supply chain and suppliers, while the horizontal category is SC collaboration includes competitors, internally and non-competitors like manufacturing capacity sharing and third party logistics facility sharing (Figure 1). A complete internal collaboration of firms' supply chain must integrate purchasing, manufacturing, logistics and marketing activities especially in information sharing, shared resource, joint goals and shared vision of each department. For the effective results in collaborative supply chain, internal collaborations must be connected with external collaboration (supplier and customer's collaboration) in term of relationship, sharing information and processing integration [22]. In other words, information technology applications can directly or indirectly impact the degree of supply chain collaboration by creating value for customers as many value-added activities.

#### **4. Electronic Data Interchange (EDI) in Supply Chain**

EDI is the movement of information electronically between buyers and sellers for the purpose of facilitating a business transaction in order to improve delivery performance; and thereby improve customers. It represents a powerful application of computer-communications technology. Its value includes such benefits as reduced paperwork, elimination of data entry overheads, improved accuracy, timely information receipt, accelerated cash flow, and reduced inventories. The implementation of the use of EDI has a great benefit among firms in inter-organization in the supply chain. For example, numerous researchers and practitioners [24, 25] argue that the use of EDI is expected to yield higher on-time delivery performance, yet only a

few empirical studies have been conducted in this regard. In a vendor–customer relationship, EDI can provide many benefits to both organizations; one such benefit is improved customer service [26].

In the past, several studies had focused on retailer-distributor networks to examine the effectiveness of EDI with a few empirical studies focusing on plants. The plants (production facilities) in the supply chain add value to the products. Therefore, manufacturing plants can be chosen as the unit of analysis and use its delivery performance to evaluate the effectiveness of EDI. Therefore, a firm that uses EDI for most of its transactions is expected to have higher deliver performance than those that seldom use it. EDI provides integration among firms in the supply chain through timely exchange of information. This sharing of patent information makes the supply chain responsive and thereby enabling transacting organizations share information in a timely fashion to react to immediate changes. Therefore, the use of EDI is expected to improve delivery performance.

EDI is also increasingly becoming a necessary way to do business [27]. This is especially true in an environment characterized by quick-response [28]. Therefore, the interest in efficient supply chain management is mostly driven by the urgency to be more flexible by being responsive to the customers' needs [29]. A manufacturer can be responsive to the customers' needs by delivering products promptly when demanded by the customer. Measures such as throughput time (the elapsed time between start of the first step of production of a product/part and the end of the last step of production of that product/part) and lead time (the elapsed time between receiving a customer's order and filling it) have been used in the past as indicators of responsiveness to customers [6]. In a seminal publication Stalk and Hout [30] emphasized the importance of time compression through a supply chain in order to gain shorter lead times, order control, and stock level reductions.

Peters [31] notes that EDI links foster the exchange of a wider range of electronic documents such as purchase orders, material releases, advance shipping notices, freight bills, receiving discrepancy reports, invoices, and remittance advices among trading partner. Such exchange of patent information expedites transaction processes; on-time delivery of products, which in turn improves customer service. A good customer service leads to customer satisfaction. According to a survey by Hansen & Hill [32] on the benefit of EDI on a 5 point scale of which 5 being the most important and 1 being the least important, the benefit rated highest is improved customer service.

## **5. Demand Forecasting and Inventory Management**

Demand management is the main key in supply chain management components because business processes of the organizations starts from this components. In supply chain perspective, demand management is a trigger in supply and demand activities along the supply chain network. Poor demand management would result serious inefficient problems in inventory, distribution, production and purchasing processes in all channels along the supply chain. Thus, forecasting activities; the initial important step of demand management; should be done precisely by strategic level of management. The first forecasting activity is determining the method to forecast demand for future which correlated with historic data source provided such as historic demand data, sales projection, promotion plans, market share and inventory projection [33].

Contemporary concept of supply chain management strives for cooperation in order to reduce inventory throughout the chain, whereas planning is carried out using the principle of continuity, dividing all the information required in order to control the

processes of flow [34]. Each party cares only for their own interests, being in close relationship with suppliers and customers. This behaviour leads to maintaining a particular level of inventory in each party, which is kept in a 'ready state' in order to satisfy customer needs at any moment [35]. Suitable inventory management under conditions of demand forecasting should focus on proper customer service, control of current and future demand and minimization of costs connected with maintaining and replenishment of stock [36].

Each participant in supply chain, starting from manufacturers, distributors, wholesalers or retailers strives for taking suitable measures at their levels towards forecasting of demand for their products with the goal of ensuring possibly highest customer service [37]. Each party cares only for their own interests, being in close relationship with suppliers and customers. This behaviour leads to maintaining a particular level of inventory in each party, which is kept in a 'ready state' in order to satisfy customer needs at any moment [35]. Supply chain management is an essential part of inventory management. Good inventory management saves time by eliminating time-consuming processes, lowers costs by reducing inventory levels to their optimal amounts, and boosts productivity and thereby accomplish complex inventory management tasks.

Independent inventory management is fundamental part is safety stock, which occurs at each stage of company's operation and plays a role of a buffer in case of unexpected change in order size. Its task is to ensure a suitable customer service level. The most important factors in managing independent inventory include Krzyżaniak [38] optimization of fast-moving stock, proper definition of safety stock, reduction in excessive inventory. Furthermore, in order to ensure proper customer service, it is essential in the case of independent demand to point to 'ordering point' which determines a safe deadline for collecting the order without the risk of premature depletion of the inventory [35]. The best way to make sure your inventory management and supply chain management are as strong as possible is by using inventory management software. Inventory management helps you keep track of inventory levels, orders, shipments and more. It would be difficult to measure all of these things by hand. Inventory software handles most of the work for a firm, so it can focus on growing its business and satisfying its customers.

Johnston [39] described the design and implementation of a forecasting and stock-control system that enabled the quantification of strategic decisions, such as the consequences of changing the total investment in stock, or the overall service level. His system enabled managers to appreciate, for each stock grouping, how various control settings would affect stock values, out of stock percentages, excess stocks and working stocks. In order to minimize inventory costs in a single level of a supply chain, it has long been recognized that accurate forecasts of the demand over the lead time and review period are required. This is because the variance of the forecast error of the demand over the lead time and review period is equal to the inventory variance, for certain inventory control policies. Thus, in a single echelon of a supply chain, optimal forecasts that minimize the mean squared error over the lead time and review period are required.

In order to obtain possibly most precise forecast and to avoid excessive inventory, one should make use of advanced methods of forecasting, such as '*Collaborative Forecast, which satisfies the demand from the customer and the availability of raw material supply at the manufacturers' end*' [40]. Collaborative Forecast might ensure the highest level of accuracy of the forecast demand and reduce costs throughout supply chain.

## 6. Measuring the degree of SC collaboration performance

The benefits of appropriate collaborative planning, execution and decision making are significant in today's business. Therefore, it is important for supply chain managers to know the measurement of their collaborative supply chain performance. Before making decision to collaborate supply chain, the areas of improvement are required to be pointed. Ramanathan [17] made categories in discussing measurement performance model of supply chain collaboration (SSC): mathematical empirical model and nature model. However, both types of those models have the objective to identify the problems in order to improve the collaborative SC. Many researches study the measurement of SC network performance based on different perspective. For example, Ramanathan and Muydelman [41] used forecast accuracy as an indicator to measure the use of proper communication in supply chain collaboration, while Simatupang & Sridharan, [42] used benchmarking initiation as the indicator of SC collaboration performance. Moreover, some studies used indicators such as costs, quality and customers responsiveness as SC collaboration performance measurement. The following Table 1 shows the distribution of studies dealing with the supply chain collaborative performance measurement.

**Table 1** Studies dealing with the SC collaborative performance measurement

Author(s)	Model of collaboration SC performance measurement			remarks
	Simulation/ Conceptual	Optimization	Mathematical	
Cheung, Cheung, & Kwok [43]	√			Knowledge base model
Angerhofer & Angelides [21]	√			SC Performance measurement
Ramanathan & Muyldermans [41]			√	Demand information in collaborative forecasting
Aviv [44]		√		Collaborative forecasting SC performance
Aviv [23]		√		Collaborative forecasting between manufacturer and retailer
Nakano [45]			√	Collaborative forecasting and planning on logistics performance
Holweg, Disney, Holmström, & Småros [46]	√			integrating external collaboration with internal production and inventory control
Helms, Ettkin, & Chapman [47]	√			Collaborative forecasting on supply chain performance
McCarthy & Golicic [48]	√			Collaborative forecasting and replenishment planning on supply chain performance
Cao & Zhang [18]			√	supply chain collaboration enables supply chain partners to achieve synergies and create superior performance
Dash [49]	√			extension of a collaborative forecast based business model one step upstream in the supply chain with utilisation of modern ICT technology

## 7. Conclusion

Effective Information sharing is the backbone of collaboration in supply chain management. The ultimate competitive advantage relies on the business' ability to leverage the intelligence inherent in supply chain management networking and transform existing business. Direct utilization of the market sales information by each player in the supply chain certainly improves the overall speed of response and lessens the impact of the demand magnification phenomena.

Based on the finds, it supports the content that EDI leads to a better delivery performance. Proper demand forecasting with little error helps vendor maintain optimum stock level that makes stock available to customers, whenever they are needed by them. If a company is able to make stock available to customers at any point in time they are needed and also ensure that stocks are delivered at speed to customers, this increase customer's satisfaction and eventually lead to customer loyalty. Moreover, the determined model of collaboration supply chain performance measurement plays an important role in a successful application of supply chain collaboration.

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