

Understanding the Value of Information in Supply Chain Management

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Abstract: Supply chain is a composite structure which integrates logistics, capital flow and information flow. It connects manufacturers, retailers, until the end consumers. Traditional supply chain companies only focus on logistics and capital flow, but often neglect information flow. The information flow is the flow of information throughout the supply chain. It is a virtual form, including the supply and demand information and supply chain management information. Company ignores information flow resulting in serious information asymmetry, leading to the lack of coordination of supply chain operations, supply chain information distortion, and mutual trust between the enterprises. The information has a high value in supply chain, and it is important to supply chain. This paper will discuss the value of information in supply chain and try to find the best way to improve the value of information in supply chain.

Keywords: Value; Information Flow; Supply Chain

Introduction

For supply chain management, information is the key element, and it is an important factor to strengthen the competitiveness in supply chain. Information to be viewed as elements as the goods, capital can be transferred and the flow of information not only play an important role in the overall operation of the supply chain enterprise, and to strengthen the coordination between the various enterprises in the supply chain, improve supply chain reaction speed and competitiveness ^[1].

The poor information flow in Supply chain leads to the bullwhip effect. The supply chain node enterprises only consider the effect of adjacent nodes demand caused by consumer demand for reverse progressively enlarged ^[2]. The bullwhip effect reduces the operational efficiency of the supply chain, and increase logistics costs, which contradicts the original intention of building a supply chain, therefore, how to promote information exchange and transfer of the supply chain is a basic task of the enterprise. Supply chain information sharing is the process of interaction and transfer of information between enterprises in the process of enterprise cooperation. The quality of the information sharing is the basis for the operation of supply chain coordination ^[1].

1. Information asymmetry and the uncertainty in the supply chain

1.1 The bullwhip effect

According to Cachon and Fisher ^[3], the value of information is the difference of expected utility value of the information between getting the information or not. The value of information refers to information effect throughout the supply chain decision-making, reduced costs, shortened response cycle. The value of information is determined by the information validity. The information validity assessment has three aspects of the composite indicator include the quantity of information, the truly of information, the timely information. The purpose of the enterprise information flow of supply chain management is maximizing the value of information. The information flow is the flow of information throughout the supply chain. It is a

virtual form, including the supply and demand information and supply chain management information ^[4].

Supply chain management is an incredibly special because the main body of the management cannot control all the resources on the supply chain. Although the entire supply chain is a community of interests, the supply chain members is an independent business entity. They have own business strategy, target market, technological level, operational level and their own corporate culture, even in the presence of an enterprise belong to several competing supply chain situation, all of this led to information asymmetry. It increases the uncertainty in the supply chain operations ^[3].

The bullwhip effect is a description of a situation that the uncertainty information of supply and demand has distorted in supply chain cycle. when each node enterprise in supply chain decision-making only based on orders from its adjacent upstream and downstream enterprises partners, the inauthenticity of the demand information along the supply chain upstream, resulting in progressively enlarge. When the information of customer market demand reached the materiel suppliers, it has a large deviation ^[5].

Lee et al ^[5] identified the four major causes of bullwhip effect as demand forecast updating, order batching, price fluctuation, rationing and shortage gaming. The bullwhip effect is mainly caused by any one or more of these causes. First is demand forecast updating. Most companies use standard forecasting techniques for production scheduling, inventory control, capacity planning and materials requirement planning. Mason-Jones and Towill ^[6] pointed that the order information is subject to delay, bias and noise before being transferred onto the supplier. The forecasting technique chosen and the way the demand signal is processed are significant contributors to the bullwhip effect. Second is batch ordering. In a supply chain, each company places orders with an upstream organization using inventory control mechanisms decided by the firm's inventory policy. The demands from customers may be small and frequent which deplete the inventory gradually; firms would wait until the inventory level reaches a predetermined minimum level before order is initiated. This order size is large compared to the regular demand faced by the firm. The supplier receives a large, highly erratic stream of orders with a spike during one cycle, but no orders for the rest of the period. This variability is much larger than the demand faced by the downstream firm. Linden and Reddy ^[7] points out that one way an artificial demand signal is often generated is by sales and marketing department personnel creating an artificial lower price for a product by foregoing a percentage of their own sales commission. Sales made in this way distort demand information and contribute to uncertainty. Third is price fluctuation. Just as sales prompt consumers to buy an item in greater numbers compared with their usual buying patterns, special promotions and price discounts from manufacturers or suppliers result in retailers and wholesalers buying in large quantities and stocking them up. The manufacturers or suppliers often offer these to raise sales volume and to meet sales targets for a period. This is commonly known as 'meeting the quarter' in industry circles. The retailer takes advantage of these promotions to maximize profit. There is a similar buying spree when a price hike is expected. Forth is rationing and shortage gaming. Shortage gaming occurs in an environment of tight supply and when the manufacturer is expected to ration its products. The customers, wholesalers and retailers may order in large quantities with the expectation that they will receive a greater allocation of products that are in short supply ^[1].

1.2 The main information problem in bullwhip

Cachon, Fisher ^[3] pointed that the information flow barrier is a main reason of bullwhip. On the one hand, the information is competitive and exclusive, if the information cannot share with levels, it will leak enterprises intellectual property. On the other hand, the supply chain should flexibility and agility to suit market change, but this means that information sharing will make the secret become public and increase the business risk ^[3]. Information sharing has been a problem of supply chain information management, there are a lot of "information island" phenomenon. The information data not accurate could easily lead to wrong decisions and the opaque information of the supply chain cannot let the enterprises collaboration ^[1].

The participation of enterprises in the supply chain is an independent business ownership and the relationship between them is the market transactions. They focus on the short-term interests, so participating companies inevitably have opportunistic behavior and tampered with real information for their own interests which make the information distortion problem get worse and cause long-term supply chain in an unstable and ineffective ^[2].

Supply chain information flow is step by step and non-adjacent unit companies cannot communicate directly. They

receive indirect and distorted information which were changed by up supplier ^[3]. In addition, information wills hysteresis in each node, because the next one is on information processing over a period of time. Information hysteresis make the supply chain response to asynchronous or delayed, resulting in slow response of the entire supply chain.

1.3 The method of reducing bullwhip effects

The demand amplification or bullwhip effect in the supply chain is system induced and is directly affected by both information and material delays in the supply chain and the feedback process in the decision-making process ^[6]. In practice, any effort to reduce the bullwhip effect is likely to be difficult and challenging. McCullen and Towill ^[8] identify three prime dimensions to the problem of the bullwhip effect. They describe the order aspect of the bullwhip effect as the replenishment dimension affecting the flow of materials and information throughout the system. There are two other prime dimensions which make it difficult to identify and reduce the effect. These are geographical and temporal. Mason-Jones and Towill ^[6] provides the following diagram which shows the uncertainties associated with a supply chain and what strategies are available to tackle these.

Reducing uncertainty by information visibility across the supply chain as this will reduce the bullwhip effect. Practices that support an effort to reduce uncertainty involve the implementation of systems such as electronic data interchange (EDI) and extensible markup language (XML). Both these technologies allow companies to share information (such as consumer sales) with partner companies in the supply chain. EDI uses specific network services with an agreed information protocol while XML supports information sharing over the Internet. POS (point of sale) data can be transmitted to all chain operators, which will enable them to have a clear picture of consumer demand.

Reducing demand variability is an effective approach to reducing the bullwhip effect as this variability causes the forecast error which in turn is the principal cause of the effect. How can we do reduce variability? As demand at the retailer often fluctuates with the price attached to a particular product, a unvarying price such as EDLP (everyday low price) should reduce demand uncertainty. By eliminating price fluctuations, a retailer can eliminate much of the demand variability associated with the product.

Decreasing the lead time between each level of the supply chain will aid in reducing the bullwhip effect. In fact, it has been recognized that time compression is the key to supply chain excellence. Supply chain lead time is made up of the delays in information processing and materials processing. Mason-Jones and Towill ^[6] refer this as two distinct lead time pipelines: the order information transfer pipeline, moving upstream from point of sale to raw material supplier and the product transfer downstream from raw material to customer. While in the short term the material flow lead time can be reduced by transportation techniques like cross docking, information pipeline lead time can be reduced by effective information sharing using technology.

2. The values of the information sharing in supply chain

2.1 The introduction of information sharing

Information sharing aim is improving the overall value of the supply chain, to achieve the profit goal in each node of the supply chain. According to Lee ^[5] information sharing in supply chain refers to in a specific transaction or process of cooperation, exchange of information between different enterprises and delivery. This information includes inventory information, sales data, order status information, production information, demand forecasting information, product information. This information has timeliness, visibility, and dynamic characteristics ^[5]. To note is that the information sharing in supply chain is not sharing all the members' information of the companies, because of they have its own independent just as part of the supply chain. However, the shared only affect running of the supply chain, not all corporate information. Supply chain information sharing from the shared content, the following types:

Share inventory information is the most common collaboration within supply chain members. Therefore, access to supply chain inventory information throughout the supply chain can reduce inventory levels and inventory fluctuations. However, retailers and distributors, distributors and manufacturers, manufacturers and suppliers cannot be shared inventory

information throughout the supply chain is not only a large amount of safety stock, and the entire supply chain operating costs will be greatly increased. In practice, sharing inventory information can be implemented in different ways.

General sales data from the point-of-sale POS data, supply chain members can share sales data to analyze sales trends, customer preferences and customer distribution, in order to improve the customer relationship management level in the entire supply chain, to achieve a personalized, differentiated customer services meet the needs of different types of customers. Thus, the share sales forecasts generic form of information is the enterprises and their suppliers to share their forecast information. This is because of under normal circumstances, the members are closer the market supply chain more understand the market, and the more accurate prediction of the market demand. They share this information with members of the upstream supply chain, to enable them to design a more accurate production planning ^[9].

Usually, downstream enterprises rarely know the state of the production of goods to suppliers, because on any production status of an enterprise is not only involved in the supply chain of its suppliers, but also with the supplier's supplier. Therefore, the downstream enterprises do not know when the goods arrival before we know the time and delivery. So, catch up on orders, production status can respond quickly when face to problems in the operation of the supply. Meanwhile, improve the efficiency of the supply chain and decision-making within corporate.

Share product information is the basis for the existence of supply chain, and the bridge of the upstream and downstream enterprises to establish the relationship between supply and demand ^[9]. If the downstream enterprises do not know the upstream firm to supply products, or upstream business does not know the types of downstream enterprises of the required product quality, performance, price and other information, the downstream enterprises will not be able to obtain the required product, while the upstream firm will produce a large number of inventories, and even lead to the upstream firm cannot carry out the production and sales. Therefore, only establish the smooth sharing of information channels and information sharing mechanisms, to make the company among supply chain receive the maximum satisfaction and establish a close cooperative relationship.

2.2 The values of the information sharing in supply chain

Information sharing can improve supply chain information values. Information on sharing can eliminate the information hysteresis problems. For example, Wal-Mart's information systems to make real-time inventory information and vendor information is synchronized, so that storage costs reduced to a minimum, to achieve zero inventory management. The value of information sharing can be reflected from the practice of supply chain operations, as follows ^[9].

Information sharing can let each node of the supply chain synchronization and respond to the needs of dynamic changes in the supply chain ^[3]. Between the upstream and downstream enterprises in the supply chain is often the produce high transaction costs due to asymmetric information. Full information sharing, transparency of information, can greatly reduce the transparency cost of the members in the supply chain. On the other hand, in the process of supply chain operations, information from supplier is easy to be stuck in a node and impede the normal operation of the entire supply chain. Information sharing can promote information flow and improve the operational efficiency of the supply chain ^[9]. The asymmetry of information between supply chain enterprises makes the node enterprises to develop their plan in its own interests and quality of service in the whole chain cannot be guaranteed.

Conclusion

For supply chain management, information is the key element, and it is an important factor to strengthen the competitiveness in supply chain. To sum up, the value of information in the supply chain including help to reduce the fluctuation of demand in the supply chain; help suppliers to make better predictions to explain the promotion and market changes; able to coordinate the manufacturing and distribution system and its strategy; enable distributors to provide a better service to the customer and enables distributors to suppliers to respond quickly and adapt to these supply problems.

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