Supply Chain Collaboration:  
Making Sense of the Strategy Continuum

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Summary

Collaboration in the supply chain has been widely discussed, and a wealth of concepts is at hand. Large-scale projects like the Efficient Consumer Response (ECR) in the fast moving consumer goods sector, for example, or Vendor Managed Inventory (VMI) and Collaborative Planning, Forecasting and Replenishment (CPFR) initiatives more generally provide a rich continuum of strategies for collaborating amongst supply chain partners. While individual successful implementations of the latter have already been reported, there has not yet been the widespread adoption that was originally hoped for. In our research, we looked at implementations across several industries and countries, and our findings show that the slow progress to date may be due to a lack of common understanding of these concepts, and the difficulty of integrating external collaboration with internal production and inventory control. In this paper, we set out to classify collaboration initiatives using a conceptual water-tank analogy, and discuss their dynamic behavior and key characteristics. We draw upon case studies from both successful and less successful implementations to illustrate what companies need to do to fully benefit from their collaborative efforts, given their particular circumstances. We conclude that the effectiveness of supply chain collaboration relies upon two factors: the level to which it integrates internal and external operations, and the level to which the efforts are aligned to the supply chain settings in terms of the geographical dispersion, the demand pattern, and the product characteristics.
1. Collaboration in the Supply Chain – Behind Expectations?

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 concepts are simple and powerful, and individual success stories have been reported across many industry sectors. Yet mainstream implementation within these industries has been much less prominent than expected, which seems surprising considering the benefits that initially had been claimed. In our view, one important reason is that collaboration practices are not well understood; despite their superficial simplicity, these concepts are not at all as well defined as one would hope. For some, supply chain collaboration means simply holding consignment stock; for others it is a complete philosophy on how to control the stock replenishment and production rates across multiple tiers of their respective supply chain system.

In our research, we have analyzed a wide range of implementation cases in supply chains across different industry sectors. Primarily, we have worked with a range of companies in the grocery supply chain - with both multinational manufacturers as well as local manufacturers in the United Kingdom and the Nordic countries. On the retail side, we worked closely with several large retailers in Finland and in the UK. In addition, we have analyzed

* See [www.cpfr.com](http://www.cpfr.com) and [www.ecrnet.com](http://www.ecrnet.com) for more details.
supply chain collaborations with individual companies in the automotive, electronics and construction sectors, to complement our findings.

In comparison, collaborative efforts in the grocery sector have been the most developed. Yet even here we have found accounts of both success and of unexpected difficulty, which mirrors recent comments made by proponents of Efficient Consumer Response (ECR), who find a growing number of supplier companies very critical of the way supply chain collaborations have turned out in practice (Corsten and Kumar, 2003). Let us explore why such simple concepts can be so difficult to implement, what pitfalls companies have encountered, and what companies need to do to get the most out of collaborating with their supply chain partners. To this extent we develop a framework to guide companies in their choice of the type of collaboration best suited to their particular circumstances.

2. Visibility – The Holy Grail

Collaboration in the supply chain comes in a wide range of forms, but in general have a common goal: to create a transparent, visible demand pattern that paces the entire supply chain. Several seminal studies have identified the problems caused by a lack of co-ordination, and to what extent competitive advantage can be gained from a seamless supply chain (Forrester, 1961; Lee et al., 1997; Chen et al., 2003). Also, there is little doubt that the success of the Japanese manufacturing model is largely attributed to their collaborative supply chain approach and the tight integration of suppliers in Just-in-Time delivery schemes (Dyer, 1994; Hines, 1998; Liker and Wu, 2000).
Recent studies on the other hand have questioned the benefits of demand visibility, and in particular, the benefits of information sharing. Some critics argue that the benefit of reducing delays and replenishment batches exceeds the benefit of information sharing, see for example Cachon and Fisher (2000), whereas others point out that the order history already available to the supplier provides the same information as information sharing if both supplier and retailer know the stochastic properties of demand and these do not change over time (Raghunathan, 2001).

This underscores the fact that, however well thought out in theoretical / simulation models, in practice the issue of how to benefit from external collaboration and use demand visibility to improve capacity utilization and inventory turnover is still not well understood (Lapide, 2001). Firms often have diverging interests in the short term, and such conflicts of interest mitigate the commitment of supply chain collaboration and fully sharing demand information (Cachon and Lariviere, 2001).

Furthermore, the complexity of today’s business world means that it is often impossible to link external sources of information into the vendor’s production and inventory control processes (Stank et al., 2001), as in many cases the same level of detailed information cannot be obtained from all of the distribution channels. We also learnt that many companies do not integrate the information received from their supply chain partners into their own operations. For example, large multinational manufacturers typically do not use the information gained through collaboration to fine tune their day to day operations, but collect it in business data warehouses and use it off-line in process development and performance measurement studies. Considering the high hopes for the potential benefits derived from harnessing global demand
visibility through collaborative planning to improve supply chain efficiency, this marks is a rather sobering account of the current state of supply chain collaboration.

Reducing uncertainty via transparency of information flow is a major objective in external supply chain collaboration. Unpredictable or non-transparent demand patterns have been found to cause artificial demand amplification in a range of settings (also referred to as the ‘bullwhip’ or ‘whiplash effect’). This leads to poor service levels, high inventories and frequent stock-outs. Typically, studies cite demand visibility as the key antidote to deal with this costly effect (Forrester, 1958; Sterman, 1989; Lee et al., 1997). But how can this be achieved in practice, when a supplier has hundreds of stock-keeping units, and hundreds of customers to consider? What are the challenges of increasing the use of customer information in the production and inventory control decision when moving from a traditional system to a collaboration framework? The different types of concepts at hand differ drastically in the external information sources used for production and inventory control, as we will discuss in the following. Thus, in the light of the complexity of today’s global supply chains, it is not obvious which approach is best at integrating external supply chain collaboration with internal production and inventory management processes under the given circumstances. Unsurprisingly, many find it is hard to reap the full benefits from their efforts of collaborating with their supply chain partners.

To guide our investigation on what makes it so difficult to link external supply chain collaboration and internal production and inventory management processes we develop a simple framework to identify the alternative configurations – a water tank analogy representing
the inventory and ordering policies in the system†. We will use this analogy to discuss the four basic supply chain configurations that we have encountered in practice – from a traditional supply chain to a supply chain sharing both demand visibility and decision-making responsibility with suppliers. We discuss the subtle but crucial differences in the control of material flows, the use of information flows, and the decision-making processes. We highlight the opportunities and challenges of each stage, and discuss under what circumstances to apply these concepts.

† A similar water tank analogy has been used George Plossl (1985) to illustrate the interplay of order release rates, inventory and lead-times in a single echelon manufacturing system.
3. Classification of Concepts for Collaboration

Despite their superficial simplicity, we have come to the conclusion that the concepts for supply chain collaboration are not as well defined as they should be. In fact, we often found that managers used definitions interchangeably – results of their implementation efforts varied accordingly. Granted, the differences in ordering and replenishment policies may be subtle, but the consequences for the dynamics of the supply chain can be drastic, which makes it ever more important to be specific. We have identified four different supply chain configurations, which will be discussed and compared (see Figure 1). The configurations are distinguished by the differences in inventory control and the planning collaboration.

![Figure 1: Basic supply chain configurations for collaboration](image-url)
We have chosen the collaboration on inventory replenishment and forecasting as our dimensions in this model. Admittedly, there are more dimensions that one can collaborate on, such as the promotions or new product introductions, however these are the ones most commonly used in practice. Furthermore, as Fisher (1997) points out, factors such as product characteristics equally have an effect on the system. We discuss these as contingent factors in our framework.

A set of ‘water tank’ models will be used to describe each of the four categories of collaborative arrangements in supply chains (Holmström et al., 2003). The supply chain water-tank model is shown below in Figure 2a. We can see that there are two ordering decisions (the ‘ball-cock valves’) in series to describe a simple two level supply chain. Water represents inventory and the flow of water represents sales of products.

![Figure 2a: Our water-tank model](image)

**Type 0 – The Traditional Supply Chain**

**Definition:** ‘Traditional’ means that each level in the supply chain issues production orders and replenishes stock without considering the situation at either up- or downstream tiers of the
supply chain. This is how most supply chains still operate; no formal collaboration between the retailer and supplier.

In Type 0 supply chains the only information that is available to the supplier is the purchase order issued by the retailer. Relying on purchase orders only often cause the bullwhip problem, as there is no visibility of the actual demand, so the human psyche is tempted to order some ‘just-in-case’. In his seminal experiment with the so-called ‘Beer Game’, John Sterman showed that multiple ordering decisions, delays and also the human tendency to over-order in uncertain times to ‘play it safe’ caused dynamic distortions in the supply chain (Sterman, 1989). As a result, the variance of orders increases as demand moves up chain, causing significant costs in the system. It has been estimated that the economic consequences of the bullwhip effect can be as much as 30% of factory gate profits for manufacturing companies (Metters, 1998). Bullwhip leads to excessive inventory investments throughout to cope with the increased demand uncertainty, reduced customer service due to the inertia of the production/distribution system, lost revenues due to shortages, reduced productivity of capital investment, increased investment in capacity, inefficient use of transport capacity, and increased missed production schedules, Carlsson and Fuller (2000). Essentially, the bullwhip problem comes with every plague in Pandora’s industrial box.

In Figure 2b, we have overlaid the water-tank analogy with an example from the grocery retail chain, where the actual demand signal from the customers in the supermarket for a soft drink is amplified many times before it reaches the soft drink supplier. As can be seen, the demand for this soft drink is relatively steady, shown here in the EPOS (electronic point of sale) data, taken directly from the check-outs in the supermarkets. The second level shows the
orders placed by the stores on the regional distribution center (RDC) to replenish the drinks sold. Already, a certain increase in variability can be observed, caused by some stores over-ordering, and the fact that the packaging used means that only a multiple of 12 drinks can be ordered at a time. The orders placed by the RDC on the drink supplier however bear no resemblance to the actual sales to the final customer. Here, the purchaser at the RDC simply orders against his own demand forecast, and unknowingly amplifies the demand variability many times. The largest weekly order placed on the supplier is 205,000 cases, which is no less than five times the average weekly sales volume in the supermarkets.

![Diagram of bullwhip effect]

**Figure 2b.** In a traditional supply chain, the ‘bullwhip effect’ is generated by independent ordering decisions at each level.

Although the presence of bullwhip becomes very obvious once the demand patterns of all tiers in the supply chain are plotted over time, as in this soft drink case, one should not
assume it is easy to solve. First, only once the corresponding demand data of all tiers in the system is actually analyzed does the effect become apparent, and even then it is not a trivial problem to solve. The bullwhip problem is embedded in the structure of such traditional supply chains where each level decides independently on their ordering, and is therefore very difficult to avoid. The supply chain’s structure (mainly in terms of decision tiers and delays in information and material flows) drives its dynamic behavior - a problem we have encountered across all industry sectors we investigated.

In our research with SOK, a major Finnish grocery retailer, we analyzed the consumption (purchases by consumers) of a washing detergent in its chain of retail stores in Finland. The weekly variability of consumer demand over the long-term average demand is less than 10 percent. The shops are all replenished from a distribution center operated by the chain. When the shop orders placed on the distribution chain for the detergent from all the shops in the retail chain are aggregated however, the weekly variability over the long-term average demand is already somewhat higher, on average 26% higher. The next step in the chain is the manufacturer. The major detergent manufacturers typically produce detergents for all markets in Europe in focused manufacturing plants. By the time the order gets to the manufacturer, the demand variability was amplified nine times between the local market and the European manufacturing plant, due to the aggregation of purchase requests and production orders into larger batches.

Interestingly, despite the obvious disadvantages, the manufacturer is reluctant to pursue anything other than a traditional supply chain structure because of the geographical distribution. At the time, the company had six focused plants each producing a limited range of
products for all of the more than 15 local sales companies supplying hundred's of large distributors and retail chains across Europe. Because of this structure one collaboration implementation with anyone of the, say, 50 largest customers would also need to be implemented in each manufacturing plant. Not all of the largest customers are willing to collaborate in the same fashion. Further, some see their purchasing flexibility as a core competence, often taking advantage of low prices and promotions, and do not want to jeopardize this mechanism in which they compete against their competitors.

**Type 1 – Information exchange**

**Definition:** *Information exchange (or information sharing) means that retailer and supplier still order independently, yet exchange demand information and action plans in order to align their forecasts for capacity and long-term planning.*

Taking end customer sales into consideration when generating the forecast at supplier level - even when complete visibility is not available – is a major improvement over simply relying on the orders sent by the retailer. Delays in translating the demand signal are removed, and unnecessary uncertainty is eliminated.
Information sharing not only helps to create more visible and predictable demand in the system, but is also easier to implement than complete customer-specific control processes. Taking information sharing one step further is collaborative forecasting. This step is frequently advertised as a key objective in an implementation of VMI, but is less frequently taken. The reason is that the customer often does not have a forecasting and planning process in place that can provide the supplier with information on the level of detail required, and at the right moment in time. Linking the customer and supplier planning processes on a sufficiently detailed level is also a cornerstone towards implementing the CPFR strategy.

Another example from the consumer goods industry illustrates a typical implementation of information sharing. As part of developing the customer-supplier relationship a multinational consumer goods company tries to collect inventory reports and sales figures from large customers on a weekly basis. To facilitate this process the company has developed both web-portals and standard messaging formats. The company has also taken a central role in
developing standards for information sharing in the industry. However, despite the significant efforts spent on improved information sharing, a formal process is in place only with a handful of customers.

Why is it difficult for companies to reach a stage where forecasts are developed in collaboration with supply chain partners? The case company above has weekly visibility of sell-through data, and at best times also sees the EPOS\(^\d\) from up to 80% of its distributors and wholesalers. Still the company forecasts demand between itself and the distributor, and not between the distributors and retailers or consumers. This is done because campaigns and promotions are laborious to manage for a specific retail chain or distributor, as in this case inventory policies also often change depending on the risk of obsolescence and stock-outs. Large and seasonal peaks in demand introduce further complications. By aggregating a forecast of what the distributor requires, the impact of distributor specific inventory strategies and differences in policies is handled by human planners informally. This is a ‘simpler’ solution on the sales company level, especially as some distributors may find it to be to their advantage to stop providing the sell-through and EPOS information or distort it in shortage situations.

\[^\d\] ‘Sell-through’ data refers to the product quantities moving through the distributor warehouses to the retail outlets. EPOS (Electronic Point of Sales) is the scanning data collected on consumer purchases in the retail outlets.
Type 2 – Vendor Managed Replenishment

**Definition:** Type 2 means that the task of generating the replenishment order is given to the supplier, who then takes responsibility for maintaining the retailer's inventory, and subsequently, the retailers’ service levels.

Under vendor-managed replenishment settings, the customer has given the responsibility for placing replenishment orders to the supplier. Having full visibility of the stock at the customer’s site, the supplier is wholly responsible for managing the inventory. That way, the inventory investment needed to maintain customer service levels can potentially be reduced. In effect the supplier has a dedicated process to generate exactly the same replenishment orders based on the same information that the customer previously used to make its purchase decisions. The difference is that in shortage situations the supplier prioritizes customers for whom it is responsible for managing the inventory.

Vendor Managed Replenishment (VMR), also often referred to as Vendor Managed Inventory (VMI), is a major cornerstone of the Efficient Consumer Response initiative in the grocery sector, and there are similar developments in the textile sector called Quick Response Manufacturing (QRM) (Kurt Salmon Associates, 1993; Hunter, 1990). Here, suppliers manage inventory replenishment cycles for the customer in order to speed up the supply chain and cope with short product life cycles.

It should be noted here that ‘consignment stock’ is merchandise which is stored at the customer’s site, but which is owned by the supplier. The customer is not obliged to pay for the merchandise until they remove it from consignment stock. The customer can usually return
consignment stock, which is unused. Counter to common perception, this arrangement is also a Type 0 supply chain, and is not ‘simply another term for vendor-managed inventory’ (as many managers wanted to make us believe). The reason is because the change in the ownership of the inventory does not change how the replenishment orders are generated: the same decisions are being made, based on the same information as in a traditional supply chain, and thus no dynamic benefit is derived.

Undoubtedly there are benefits in centralizing decision making in the supply chain. However, from a supply chain dynamics perspective, nothing fundamental has changed because the same amount and type of decisions are still being taken. When implementing vendor-managed replenishment, suppliers do not make the final step and incorporate the customer information into their own production and inventory control process. The supplier hence loses out on an important opportunity: in principle, the customer's inventory and sales information is available for the supplier to use for controlling his own production and inventory control process, but we found that in practice the supplier does not use this information for his production and inventory control processes. Why is it that the demand information is not being used to improve the supplier’s ordering processes?
Figure 4: A Type 2 supply chain, where the supplier has sufficient information to eliminate the ‘bullwhip effect’, but often finds it difficult to exploit it

The challenge is that the retailer is typically only one of many customers of the supplier. Generating the replenishment order in the place of the customer's purchasing department is straightforward, even for many customers at a time. It is much more difficult to set up a production and inventory management system that can integrate all customers’ requests into the production and inventory control process. And simply setting up a production and inventory control process specifically for a single large customer – which is not integrated with that of the rest of the supplier company – may cause problems. For example, more safety stocks, smaller production batches or longer intervals between production runs may be the result.

The problem here is that there are still two decision points. The Type 2 approach, in fact, could eliminate bullwhip completely, but as two decisions are made the danger of misalignment remains and the opportunity is lost. Casting two separate decisions also mean that two safety buffers have to be held. If a supply chain could be configured to have a
common decision-making point, and one common inventory level it would have the potential to be dynamically very stable. However, because players don’t know how to use the available information, they are content with collaborating on replenishment. We have observed this effect in several supply chains, and it is the most common end-result of supply chain collaboration efforts. In our research with a UK soft-drink manufacturer, selling to one of the largest supermarket chains in the UK, we have seen that the retailer can and does pass sell-through data and inventory levels to the manufacturers plants. The supplier exploits this information implicitly in strategic planning issues, such as capacity planning and manning levels in the factory. But at the end of the day, the supplier is still left wondering how its widely fluctuating delivery schedule is generated, and is surprised when it does not match the sell-through data. In our study, we have observed a five-to-one increase in the bullwhip effect at each level of this two echelon supply chain, because the manufacturer does not exploit the consumption information at a tactical planning level. This matter was further complicated by the fact that the supermarkets were open every day of the week and the soft-drink supplier only produced on five days per week.

Hence, despite sharing operational and forecast information, we have found that few companies are able to fully exploit the advantages of collaboration in their supply chains – even if a sophisticated system for CPFR is put in place. Let us explore what it takes to reap the full benefits of collaboration.
Type 3 – Synchronized Supply

**Definition:** Synchronized supply eliminates one decision point and merges the replenishment decision with the production and materials planning of the supplier. Here, the supplier takes charge of the customer’s inventory replenishment on the operational level, and uses this visibility in planning his own supply operations.

In our research we have seen companies benefiting from collaboration in several ways. Most commonly, collaboration gives suppliers a better understanding and ability to cope with demand variability – an important feature when trying to counter the costly bullwhip effect. Also, companies have achieved minor improvements in inventory turnover.

However, the critical step that many companies have not been able to take so far is to incorporate customer demand information into their production and inventory control processes. We found that companies that do collaborate typically exchange information on a high-level, but the production planning process remains unchanged, thus foregoing the opportunity for a radical improvement of the dynamics in the supply chain. In our view, the critical feature is not only to exchange information, but equally, to alter the replenishment and planning decision structure. In our water-tank model, this would correspond to linking the two tanks together. The demand at the retailer drives the combined inventory and production control process, together with feedback on complete supply chain inventory, rather than at individual tiers in the supply chain. That way, a range of additional benefits can be achieved (see Table 1).
Benefits typically achieved through supply chain collaboration:

1. Collaborative forecasting enables better customer service levels, or a reduction in inventory (but generally not both. In fact, in many cases these are traded off against each other, or service levels are traded between customers).

2. Reduce the rationing game by giving the supplier responsibility for replenishment. However, if there is a general shortage this collaboration can quickly break down. For example, when demand for a product is rising dramatically, such as for mobile phones or PDA’s in the 1990’s, vendor managed replenishment arrangements are easily abused to secure a larger share of supply. A distributor triggers an early replenishment by transferring inventory to other stocking locations, which the supplier then would misinterpret as consumption, and replenish.

Additional benefits, typically not achieved without supply chain synchronization:

1. Elimination of the bullwhip effect by linking the inventory and replenishment decisions. This still is a technical challenge, but modeling with real demand shows how collaboration can filter out the bullwhip effect (Smáros et al., 2003).

2. A reduction of inventory levels by up to 50% without compromising customer service levels (Disney and Towill, 2003), and better utilization of production capacity as the extended visibility of the supply chain provides a certain additional flexibility to prioritize or delay customer replenishment without compromising service levels, thereby reducing the need for capacity buffers (Waller et al., 1999).

3. Better utilization of transportation resources, because shared information allows for better load consolidation. For example, in the collection of used oil from reclaimed cars, collectors monitor the level of oil in on-site tanks and uses this visibility to exploit opportunities in the routing of collection vehicles (Le Blanc et al., 2004).

4. Controlling the risk for constrained components or materials. For example, monitoring key items with long-lead times can create an early warning system of future supply constraints. For example, Volkswagen introduced their e-Cap system to control their engine supply, as the soaring demand for diesel engines (and complexity of sharing these across the Audi, VW, Seat and Skoda brands) threatened the continuity of meeting customer orders on time.

Table 1: Benefits of supply chain collaboration and synchronization
To illustrate what needs to be done to synchronize supply with demand, let us consider our water-tank model again. If the supplier can incorporate the complete supply chain inventory level (the water level in the tanks) into his production and inventory control process, this would correspond to directly connecting (‘synchronizing’) the two tanks, with the water in the connecting pipe being the replenishment in transit. Now that the tanks are ‘leveled’ is it possible to achieve the additional benefits shown in Table 1; with both tiers synchronized by a single ordering decision, the demand pattern cannot amplify, and the bullwhip effect does not occur. Equally, since both tanks are linked, the overall amount of inventory needed to meet end customer demand and buffer against uncertainty is much less. Whereas previously two safety buffers were needed, now there is only need for one. Also, the visibility of end demand facilitates the control of production capacity requirements.

![Figure 5: Type 3 supply chain, linking external demand and inventory information to internal production control](image)

One company that has achieved such synchronization of the supply chain with several of its customers is Cloetta Fazer, a Finnish chocolate maker. With its local plants serving the local Nordic markets, the company has been able in its Vantaa plant (in Finland) to
substantially benefit from linking external collaboration to internal processes. The Vantaa plant has been eager to set up collaborative inventory management solutions with anyone of the 5-6 largest distributors in its local markets. Through vendor managed inventory and collaborative forecasting in product introductions the company is able to prioritize production requirements according to the availability situation at the distributors. As a result, 3 weeks of inventory have been removed from the supply chain. This directly translates to significant cost savings as the company product is perishable. The product have a shelf life of 4 to 6 months, of which more than half has to remain when received by a distributor. Thus removing inventory from the supply chain directly translates into fresher product, less obsolescence and fewer returns from the customers.

However, most importantly, a reduction of bullwhip in production and inventory control is achieved. Considering the stock held by large distributors and the manufacturer equally as stock on hand when making a decision on new production orders, automatically levels requirements on production. This is simply because shipping a quantity of product from the manufacturer to the distributor – i.e. moving the product from one part of the tank to the other - does not create a requirement for producing more. The requirement to produce more is only generated when the customer requires products, which in our analogy is shown as the water leaving the tank altogether. Driving purchase requirements using the same logic provides the further benefit of aligning supply of long lead-time materials with demand more quickly. For a food manufacturer this becomes especially important at the introduction of new products.

Yet problems can remain. Linking internal and external processes works well with relatively short distances between the nodes. What happens, though, if retailer and supplier are
far apart? Suddenly, the inventory and lead-time incurred in the transportation becomes a crucial element. In this case, collaboration can be extended, and the supplier plans distribution on the customer level in addition, which is needed when there is a long transportation delay relative to stock cover at the customer, or where the products are perishable. Stock that goes in and out of the transportation system will create ‘wiggles’ in the inventory feedback loop in the supplier’s production planning decision. This feedback loop can be a serious cause of the bullwhip problem in supply chains with long lead-times, and endanger supply chain collaboration as demand appears to be more erratic than it actually is.

Whilst linking the retailer’s and suppliers’ operations together is a fairly straightforward task for companies located in the same market, the realities of global sourcing create complications. In the past, when supplier and retailers were located far apart, the transportation leg made joint inventory control often impossible. With increasing proliferation of product identification technologies, such as radio frequency identification (RFID), the possibilities of tightly controlling inventory pipelines even over long distance have today become feasible. Radio Frequency Identification, or RFID, is increasingly introduced in the grocery supply chain. As the technology matures retailers are finding that the payback time for investments, in terms of reduced obsolescence and handling costs, are shortening from two years to months. Currently the challenge is to identify the savings for supplier companies that would justify the investments (Kärkkäinen, 2003).
In the water-tank analogy in Figure 6, the ‘eye’ refers to such an RFID system, which creates visibility of the pipeline stock, even across long distances. Hence, the system allows for the transportation batches to be included in the production and inventory control system of the supplier. SE Makinen, a specialist car distribution company, is a good example here. SE Makinen used to operate a standard enterprise system to control the inventory of cars on hand, which meant that for each compound a separate inventory control system was needed. Today, SE Makinen tracks each car individually using ID tags, and regardless of the location of the car, it is visible to the inventory controller. Tracking individual products has replaced traditional inventory book-keeping per location, and the entire notion of stocking locations, or separate ‘water tanks’.

Given the complete demand and inventory visibility in such a system, it is not of relevance whose ‘hand’ is actually controlling the cup, i.e. who places the replenishment order
between supplier and retailer. For this very reason we do not like to refer to this scenario as ‘vendor managed inventory’, as it is implies that the supplier should in fact be in control of ordering and replenishing. However, as can be seen from the water tank analogy, it is indeed ambivalent which tier handles this activity.

4. Making Sense of the Collaboration Concepts

Our research made us look at a wide range of collaboration projects across industries. We have seen successes, showing the substantial benefits for supply chain partners that find the right collaboration solutions for their situation. However, we have also seen that many collaborative projects fall drastically short of their golden objective of synchronizing supply and demand. We have found that there is not a one-fits-all solution to supply chain collaboration, as factors such as geographical dispersion, logistics lead-time and product characteristics determine which level and type of collaboration are most suitable for a particular supply chain. We have identified a set of key factors that need to be considered before beginning efforts towards synchronizing the supply chain (see Table 2):
Factors | Why important?
---|---
Geographical dispersion of customers and supplier plants | The closer, and more dedicated supply is, the easier it is to implement synchronized production and inventory control.
Demand pattern of the product | The more stable the product’s consumer demand, the greater the dynamic benefits of eliminating bullwhip and synchronizing demand and supply in the system.
Product characteristics, in particular selling periods and shelf life, as well as value. | The longer the shelf life or selling period of the product, the more sensible it is to consider collaborative practices. Equally, the more valuable the product, the more impact tighter inventory control yields.

Table 2: Key factors that guide supply chain collaboration strategy

Geographical dispersion is an important factor for two reasons: first, the more individual nodes there are between supplier plants and customer sites, the greater the effort to implement synchronization, and the smaller the return on the individual collaboration will be. Hence, a steep Pareto of customer demand in terms of volume generally yields greater benefits by implementing it with few main customers. For example, Cloetta Fazer, the chocolate-maker, only has two plants and four of its major customers are in its home market, so collaboration yields large benefits for them. On the other hand we have often heard from large suppliers that they have difficulties in finding use for shared information gained through supply chain collaboration. The detergent manufacturer we discussed earlier on the other hand has centralized plants that supply all of Europe with a particular product line, hence the benefit of collaborating even in one market with all the customers will only be of limited impact. A
general mismatch between producing centrally, and collaborating locally, inevitably dilutes the benefits of such collaboration.

The characteristics of demand have a direct impact on the amount of inventory and capacity needed in the supply chain. Seasonal products, such as ice cream or lawn mowers, require seasonal and even weather-dependent forecasting and safety buffers, which generally mitigates the benefits of synchronized ordering and common inventory control. In this situation information sharing captures the main benefits. For non-fashion driven products with stable demand, such as toothpaste or beer, the benefits of supply chain synchronization can be realized with comparatively little effort.

With respect to product characteristics, two factors are important. First of all, the shelf life of the product dictates the speed the supply chain should operate at. Consider highly perishable fruit and vegetables, such as strawberries, which have a shelf life of a few days only, and therefore are planned three times a day by some retailers. Here, the potential cost of obsolescence overrides the savings through economies of scale in transportation and warehousing activities. The opportunity to collaborate on inventory levels is not given, because inventory cannot be kept in the first place. The main benefits can be captured simply with information sharing and forecasting collaboration. However, for goods such as basic electrical appliances or canned food, efficiency in the supply chain is derived from low inventory levels and high capacity utilization, thus making synchronization very attractive.

Having discussed the types of collaboration and the factors that are important to consider, the simple question that remains is what supply chain configuration should be used? Or, should all companies strive towards a synchronized Type 3 supply chain? From our
analyses across industry sectors we have come to believe that much of the frustration with the lack of financial return on supply chain collaboration effort is due to the fact that many efforts are a mismatch between the structure of the supply chain, product characteristics, and the type of collaboration envisaged.

A large, multinational supplier should focus synchronization efforts on the products that offer the best opportunities of linking local demand with local supply, aiming at a Type 3 system. For those products that are supplied centrally or regionally into many markets from a focused manufacturing plant the cost-benefit ratio for synchronization efforts will be accordingly reduced. It still makes sense to gather better demand information in such cases, aiming at Type 1 collaboration, but the effort required to implement must be justified by benefits from better forecasting. In many cases, in particular when there are a large number of different customers and distribution channels, moving away from a traditional Type 0 supply chain is not economically viable.

We also have observed multinationals using Type 2, or vendor-managed replenishment (VMR) supply chain configurations under such circumstances. Type 2 is very common in both manufacturing industries for the ‘nuts and bolts’, as in retailing for slow-moving non-perishable product, such as stationery for example. These systems greatly reduce the transaction costs of replenishing the stock, and in most cases are easy to establish and maintain. Yet they serve more of a customer service and a ‘corporate marketing’ purpose than to foster operational improvements for the supplier itself.

For smaller-size, local suppliers the situation is different. Here the focus should be on synchronizing with the major customers in their market, aiming at a Type 3 system. In fact one
of the key benefits of smaller scale operations is increased customer responsiveness, or responsiveness to local or specific customer needs, Pil and Holweg (2003). With increasing proliferation of RFID technology in logistics operations, the cost of controlling inventory is decreasing, and thus opportunities for synchronization are extending – even in the case of a longer transportation pipeline.

Supply chain collaboration is undoubtedly a worthwhile target: jointly creating the common pace of information sharing, replenishment, and supply synchronization in the system reduces both excess inventory and is essential to avoid the costly bullwhip effect that is still prevalent in so many sectors. Yet our research clearly highlights that these benefits need to be seen in perspective. The right approach for a company depends very much on the individual settings that the supply chain has to deal with in terms of dispersion of retailers and supplier plants, as well as in terms of the product characteristics. Also, the understanding of what the different concepts for collaboration entail is often sketchy, and definitions vary considerably. Using our water-tank analogy, we hope to have provided a useful point of reference that overcomes this deficiency.

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