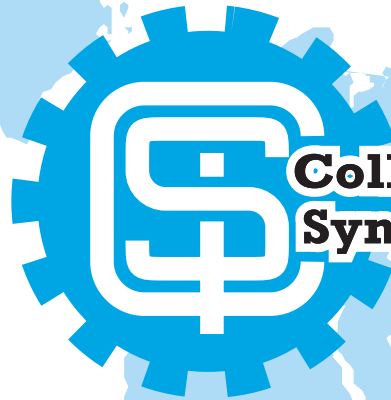


Collaborative Planning, Forecasting, and Replenishment

CPFR®



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Introduction

This paper will provide an in-depth explanation of collaboration specifically aimed at retail industries and the manufacturers serving this business segment. The history of traditional interaction and inventory decisions will be explained to provide a basis for newer methods of vendor managed inventories (VMI) and jointly managed inventories (JMI) that have evolved into a true collaborative approach. The focus is on processes and methods regarding inventory management between the manufacturer and the retail store, and methods for determining demand in the value chain. Although the methods presented here are most applicable to the processes outside the manufacturer it is an excellent base of ideas and experiences to apply collaboration deeper in the supply chain network.

About the Author

Michael McClellan has over 30 years of experience serving and managing manufacturing enterprises. He has held a number of positions in general management, marketing and engineering, including President and CEO for a multi-division equipment systems supplier. In 1984 he and a group of associates founded Integrated Production Systems, a company that pioneered the use of computer systems to manage and track production events on the plant floor. His first book, *Applying Manufacturing Execution Systems*, defines manufacturing execution systems and explains the reasoning and history behind them. He is a frequent speaker at companies and manufacturing conferences, has presented a number of papers on plant information systems, and holds one patent. He has recently completed a new book, *Collaborative Manufacturing: Using Real-time Information to Support the Supply Chain*.

He currently lives in Washington state and is President of Collaboration Synergies Inc., an advisory company providing consulting services in the area of collaborative manufacturing system development and implementation, plant floor information systems and manufacturing execution systems.

Collaborative Planning, Forecasting, and Replenishment CPFR®

The term, CPFR® is a registered trademark of the Voluntary Interindustry Commerce Standards Association (VICS). VICS is made up of a number of large consumer goods manufacturers and retailing corporations that set out to improve manufacturing scheduling and responsiveness to demand fluctuations. Study by participants indicated the problem resulted from cascading forecasts. One example of the study was disposable diaper manufacturing, a product that intuitively should have had a steady demand requirement that followed the birth rate but it didn't. With as many as four intermediaries in the chain from manufacturer to the retail outlet, forecasting was following the Forrester effect with precision. These companies set out to do something about the problem and as part of that process established operation guidelines to reduce these fluctuations and improve cost and inventory management.

The guidelines are based on the observation that significant business improvement opportunities were possible through more effective practices.

- Revenue Opportunities---Reducing lost sales due to a miss-match in demand and supply in front of the customer would create revenue opportunities.
- Inventory Reductions---Collaboration could have a major impact on the management of the value chain uncertainty and process efficiencies, the drivers for building and holding inventory.
- Improved ROI—The return-on-investment from CPFR for most companies could be substantial.
- Improved Technology ROI—Technology investments for internal integration can be leveraged through extending these enabling technologies to trading partners.

According to a 1996 study, retail product stock-outs occur at an average rate of 8.2%. In other words, for every 100 customers going to a store to buy a specific product, eight will not find the item they wish to purchase because it is not in stock. These out-of-stock occurrences represent 6.5% of all retail sales.

For the retailer, 3.4% of the 6.5% figure is offset by alternative sales; the remaining 3.1% of sales are lost. (This does not take into account other intended purchases at the time of the visit that may also have been lost.) These percentages translate financially into the loss of significant margin opportunities and a possible increase in marketing expenses.

Customer dissatisfaction also affects the manufacturer. Of the 6.5% in lost sales described above, only 1.5% is recouped by alternative purchases from the same manufacturer. The remaining 5% becomes an opportunity for competitors. In addition, just as customers may lose patience with a retailer and go elsewhere, retailers may decide to allocate shelf space to another supplier.

To understand how collaboration can affect inventories it is worthwhile to examine some of the issues that drive inventory decisions. The most significant driver in nearly all inventory decisions is management of uncertain demand. The more unpredictable the demand, the more inventory is required to manage the risk of lost sales. In addition, the further away from the consumer an inventory buffer is in the value chain process, the more demand variability that inventory buffer will have to address. This is referred to as the bullwhip effect. The bullwhip effect is created by the lack of coordination of downstream demand information with supply processes back through the value chain. Each demand and supply pairing is managed independently. The cost of inventory generated by this lack of coordination ultimately is buried in the product cost to the consumer.

Another potential source of inventory distortion is the uncertainty of supply processes. Supply variability drives inventory at both the beginning and the end of value chain nodes. There can be several reasons for its occurrence. One of the most common reasons at the input stage of a supply chain node is a supplier failing to deliver what is ordered. At the output stage of a supply node, inventory depends on the flexibility, expressed as process cycle time, of the node process to react to demands on it. It is fairly common for output inventories to be equal to the node process cycle times. (Finished goods inventories for manufacturers are frequently equal to production lead times.) It is also common for process cycle times to have hidden time buffers to compensate for process inconsistencies. These time buffers are ultimately equal to output inventory buffers. Collaboration allows value chain participants to coordinate the planning for supply processes to reduce the multiple sources of supply variability and subsequent inventory.

A basic assumption behind CPFR® is that technology investments for improving internal integration can be leveraged if companies extend the technologies to their trading partners. These technologies include the investments in enterprise systems and supply chain planning systems. These systems represent a sizable investment and extending the technology to trading partners can be relatively low.

The return on investment generated by CPFR® for most companies will be substantial. Investments in the technology necessary for CPFR® are relatively small compared to the technology such as ERP systems that it leverages. The other area of potentially significant investment is the change management required to move to a corporate culture that supports collaboration. Financial improvement comes through revenue growth due to improved customer service, balance sheet improvement from reduced inventories and expense reduction from improved supply-process efficiency and productivity improvement.

To develop an idea of where progress can be made, begin with an examination of the current process. Currently there are three forecasting and replenishment processes being used by the retail value chain. The most widely used approach is the aggregate approach. The other two are vendor-managed inventory (VMI) and jointly managed inventory (JMI).

	Aggregate Forecasting	Vendor Managed Inventory	Jointly Managed Inventory
Joint Business Planning	Limited joint business plan development	Limited Joint-business plan development	Heavy emphasis on joint-business planning and coordinated execution planning
Assemble Data	Syndicated data and historical sales	POS, warehouse withdrawal data, syndicated data	POS data by product, store, and week; syndicated data
Sales Forecasting	Sales forecast done at a high level of detail: category, week or month, market or region	Sales forecast generated by: product, customer DC, by week. Store-level VMI is by product, store, week	Sales forecast generated at the store level by product by week. Identifies micro-marketing and micro-merchandising opportunities
Order Forecasting	Primarily focused on manufacturing support to its own distribution centers. Frequently not done by retailers	Focused on retailer DC driven by inventory and transportation cost targets; store-level VMI focused on store inventory; still focused on supply coming from supplier DC	Time-phased replenishment of stores, retail DCs, and supplier DCs
Order Generation	Generated by retailer expecting 100% fulfillment from supplier	Generated by supplier based on the pull from store replenishment or consumer demand for store-level VMI	Could be generated by either party based on store-level sales that are time-phased to supply capabilities
Order Fulfillment	Supplier provides what is available at it DC	Supplier fills orders from its DCs, giving priority to VMI customers	Supplier fills orders from its DCs or manufacturing, depending on the extent of integrated planning

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The prevailing aspects of the existing planning and forecasting practices are these:

- Most companies generate multiple, independent demand forecasts for different purposes.
- Most forecasting is done at a high level of detail that focuses on a product category or family, a market or region, and a period of weeks or months.
- Forecast accuracy is not measured frequently.
- Operational forecasts usually focus on interaction between two nodes on the value chain. These forecasts are not time-phased across the value chain.
- Manufacturing usually pushes inventory to its distribution centers based on manufacturing economics and not on forecasted consumer demand.

Aggregate forecasting and replenishment is the traditional method of interaction between business trading partners. The manufacturer and retailer views of this process along with some of their deficiencies will be reviewed. The manufacturing approach generally follows these steps:

Assemble Data The core data used for forecasting involve historical shipments, syndicated data, and sales forecasts. Typically, the data is aggregated to the product family or brand level by week or month, and by market regions. Data inaccuracy is compensated for or buried through an aggregate process.

Forecast Sales The available data inputs and plans from marketing that focus on influencing demand are used to generate an aggregated consumer demand forecast. Best practice is to use this forecast to drive integrated planning across the corporation. Frequently this does not happen as the desire for meeting short term targets often preempts the best forecasting algorithms.

Forecast Orders The aggregated consumer demand forecast drives a coordinated effort to create a supply plan that supports the designated level of sales. In today's environment the demand and supply is matched by planning the customer order flow and finished goods inventory flow into distribution centers. Conventional distribution requirements planning systems are sometimes used to facilitate a customer pull through process.

Order Generation As the execution phase begins, a purchase order is placed by the retailer. One primary driver of the ordering process is the replenishment activity. The key to this is warehousing withdrawals by stores. Other inputs involve the basic ordering parameters that factor inventory targets and transportation costs into ordering quantities. The third primary driver is promotional activity.

Order Fulfillment Once retail orders are received, manufacturers look to the available inventory and determine whether the order will be filled completely. If an allocation needs to take place, the manufacturer notifies the retailer. This contact marks the first collaboration within the process. Frequently the first notification of a shortage occurs when the retail receiver opens the back of the truck. In either case, given the short order cycles, the retailer and the manufacturer have little recourse for remedying the shortage. If the retailer has been carrying enough inventory, the consumer may not be disappointed. If not, sales are lost. Either outcome is costly.

The retailer goes through a series of steps similar but different from the manufacturer.

Assemble Data Historical sales, syndicated data, and inputs from suppliers on promotional plans and changing product offerings are the key data sources. Other inputs involving store openings or closing and retail promotional activities are the primary drivers.

Forecast Sales The assembled data leads to a category or merchandising plan. The level of detail varies but is generally high, categorized by major market areas. Independent sales forecasts may be generated by procurement, logistics and store operations to support operating plans. As with the manufacturing approach, the financial plan may prevail over the consumer sales forecast when it comes to operational planning.

Forecast Orders The forecasting of material flow is concentrated around distribution inventory and processing. Many retailers do not forecast for regular replenishment business. However, they attempt to predict orders for seasonal and promotional activity because of the operational impact on the business. Most businesses expect 100% responsiveness from their manufacturers in meeting orders within short time frames.

Order Generation Orders often are placed independently by replenishment, promotional, and seasonal buyers. Each has targeted inventory and sales plans to support. While lead times may vary for the different processes, the level of coordination with manufacturers is on an exception driven basis—coordination only takes place when problems come up.

Order Receiving Demand and supply come together for the retailer at the receiving dock. At this point, there is little time to react to shortages

The vendor managed inventory (VMI) approach was developed to avoid some of the process problems identified above. A key technology component that has made VMI possible is the ability of supply chain applications to manage inventories at retailer locations. Demand and supply now come together at the retail receiving location. This is frequently the distribution center, yet store level VMI is also common. VMI practices and technology provide a broader view of the inventory holding locations and pipeline activity, which gives the manufacturers better information for planning inventory deployment across the pipeline. It also allows the manufacturer to be more customer specific in their planning and to plan at a much lower level.

The key processes activities in VMI reside primarily with the vendor or manufacturer. They involve the same process steps described earlier.

Assemble Data The primary data driver for VMI programs focused on distribution centers is warehouse withdrawal from retailer distribution centers. Some companies complement this with point-of-sale data so that store level activity and inventory have greater visibility. Store level VMI uses point of sale data as its primary driver.

Forecast Sales The primary forecasting effort of most VMI programs is warehouse withdrawals from the retail distribution center. Store level VMI is consumer focused. Retail customer specific sales need to be reconciled with the overall market sales in the complementary aggregate forecasting process.

Forecast Orders Order forecasting is controlled by the manufacturer and generally works to agreed-on retail inventory target and transportation cost objectives. This allows the manufacturer to plan inventory for specific customers.

Order Generation The manufacturer controls the generation of purchase orders. These are driven by the store replenishment pull on the distribution center or actual consumer demand for store level VMI. Since the manufacturer controls the process, the customer usually receives priority service when shortages occur.

Order Fulfillment The manufacturer fills product primarily out of inventory.

VMI has advantages but there are also some imitations:

- The overall level of collaboration is limited.
- The level of detail for planning is still generally high.
- The focus on warehouse withdrawals for distribution center VMI is not as effective as a store level consumer level focus.
- Most companies fail to leverage customer specific data effectively for planning manufacturing operations. Instead they continue to make to stock.
- In some cases, reserving finished goods inventory in the manufacturers distribution centers actually causes shortages to other customer.

The jointly managed inventory (JMI) approach focuses on collaboratively planning and executing the business at a much lower level of detail. This allows an increased focus on the consumer and on exploiting opportunities frequently hidden in the aggregated data. Jointly managed inventory uses teams of people working only with key accounts. Frequently, team members are located geographically close to each other, which allows frequent fact-to-face meetings. This fosters open communication between functional counterparts, which in turn furthers process customization. The improved understanding of each other's operations and increased interaction that results helps foster trust between the trading partners.

The five functional steps described earlier are also part of the jointly managed inventory process. Normally, these are guided by the previously completed joint business planning. Jointly managed inventory, however, involves a much more intense joint planning effort and coordination of execution before the process steps begin. The level of customization of the process steps is driven by the capabilities of each trading partner, with a focus that is much more consumer centric.

Although there has been substantial progress in the ability to improve customer service and inventory management there are still opportunities for improvement. Working from the vendor managed inventory and jointly managed inventory best practices CPFR guiding principals have been developed.

1. The trading partner framework and operating processes focus on consumers and are oriented toward the value chain process.
2. Trading partners manage the development of a single shared forecast of consumer demand that drives planning across the value chain.
3. Trading partners jointly commit to the shared forecast through risk sharing in the removal of supply process constraints.

One key finding in this development process is that no single business process fits all trading partners or all situations between trading partners. Trading partners have different competencies based on their strategies and investments. They also have different sources of information and different views of the marketplace.

Retailers see and interact with the end consumer in person and infer consumer behavior using point-of-sales information. They also see a range of manufacturers, their product offerings, and their plans for marketing those products. Manufacturers see a range of retailers and their merchandising plans. They can also monitor consumer activity, with some delays, through syndicated data. Given these different views, the trading partners can improve their demand planning capabilities through an iterative exchange of data and business intelligence without breaching confidences. The end result is a single shared forecast of consumer demand at the point of sale. This single shared demand plan can then become the foundation for all internal planning activities related to that product for the retailer and the manufacturer. This gives us value chain integration.

Embedded in the concept of a **single shared forecast** is the orientation of forecasting toward a level of detail that supports the identification of consumer opportunities. While information sharing and demand planning at some level of aggregation is practical, the ability to work together to discover and exploit these opportunities requires an interactive flow of information within a framework of collaboration.

The value of having a single demand plan, if nothing else changes, would be to better coordinate value chain process activities. This coordination would yield significant, but not dramatic benefits. Dramatic benefits come from using the demand plan to affect the constraints inhibiting supply process performance. An example of a significant constraint would be manufacturing flexibility.

Manufacturing capacity is not used because retailers' normally short order cycle times are inconsistent with longer manufacturing cycle times. By extending the retailers' order cycle and thus making it consistent with the manufacturing cycle, production could move to a "make-to-order" process for some products. This removes the need to hold a significant amount of finished goods inventory in the value chain and improves customer service. Another example of constraints that could be addressed involves dynamic inter-enterprise scheduling to optimize asset utilization across manufacturing, transportation, and distribution centers. Optimization across the value chain depends on collaboration to ensure a consistent and focused view of the interests of all parties in the value chain.

Collaboration is not something that is a naturally occurring phenomenon even though the advantages seem to serve everyone. The guidelines provide a process model that identifies the steps necessary to gain alignment between the value chain partners.

Step 1. Develop a Front-End Agreement

Purpose---This step is where the retailer/distributor and manufacturer establish the guidelines and rules for the collaborative relationship. The front-end agreement addresses each party's expectations and the actions and resources necessary for success. To accomplish this, the retailer/distributor and manufacturer co-develop a general business agreement that includes the overall understanding and objective of the collaboration, confidentiality agreements, and the empowerment of resources (both actions and commitment) to be employed throughout the CPFR process.

Output--The output of this step is a published CPFR front-end agreement that gives both partners a co-authored blueprint for beginning the relationship or redefining it in accordance with the CPFR standard. The document clearly identifies the process in practical terms. It also identifies the roles of each trading partner and how the performance of each will be measured. In addition, it spells out the readiness of each organization and the opportunities available to maximize the benefits from their relationship. The agreement also documents the commitment to pursuing a higher level of performance and willingness to exchange knowledge and share the risk.

Step 2. Create a Joint Business Plan

Purpose-- In this step, the manufacturer and retailer exchange information about their corporate strategies and business plans in order to collaborate on developing a joint business plan. The partners first create a partnership strategy and then define category roles, objectives, and tactics. The item management profiles (e.g. order minimums and multiples, lead times, order intervals) for items to be collaborated on are established.

Output--The result from this step is a mutually agreed-on joint business plan that clearly identifies the roles, strategies, and tactics for the items in the agreement. The joint business plan is the cornerstone of the forecasting process. Having such a plan at the front end should greatly reduce exceptions and the need for overly excessive collaboration.

Step 3. Create Sales Forecast

Purpose---In this step, retailer point of sale data, casual information, and information on planned events are used to create a sales forecast that supports the joint business plan.

Output---A sales forecast is initially generated by one party, communicated to the other party, and then used as a baseline for the creation of an order forecast.

Step 4. Identify Exceptions for the Sales Forecast

Purpose---This step identifies the items that fall outside the sales forecast constraints set jointly by the manufacturer and distributor.

Output---The output from this step is a list of exception items. This information is necessary in step five.

Step 5. Resolve/Collaborate on Exception Items

Purpose---This step involves resolving sales forecast exceptions by querying shared data, email, telephone conversation, meetings, and so on and submitting any resulting changes to the sales forecast.

Output---Collaborative negotiations between the retailer/distributor and the manufacturer resolve item exceptions. An adjusted forecast is then submitted. The increased real-time collaboration fosters effective joint decision making and increases confidence in the eventual committed order.

Step 6. Create Order Forecast

Purpose---In this step, point-of-sales data, casual information, and inventory strategies are combined to generate a specific order forecast that supports the shared sales forecast and the joint business plan. Actual volume numbers are time-phased and reflect inventory objectives by product and receiving location. The short-term portion of the order is used for order generation, while the long-term portion is used for planning.

Output---The result of step 6 is a time-phased, netted order forecast. The order forecast allows manufacturers to allocate production capacity against demand, while minimizing safety stock. It also gives retailers increased confidence that orders will be delivered.

The real-time collaboration reduces the uncertainty between trading partners and leads to consolidated supply chain inventories. Inventory levels are decreased, and customer service responsiveness is increased. A platform for continual improvement among the trading partners is established.

Step 7. Identify Exceptions to the Order Forecast.

Purpose---This step determines what items fall outside the order forecast constraints set jointly by the manufacturer and distributor.

Output---The result is a list of exception items that have been identified based on the predetermined criteria established in the front-end agreement.

The CPFR @committee later developed this Roadmap to guide and assist companies as they began CPFR@ initiatives.

Team Members, Roles and Responsibilities			
Role	Responsibilities	Typical Position Buyer	Typical Position Seller
Sales Collaboration	The sales collaboration team is responsible for establishing sales forecasts, promotion plans, collecting and reporting sales results. The team is also responsible for recommending and implementing changes to the replenishment system.	Category, Manager Buyer, Replenishment Analyst	Sales Representative (Account Relationship Owner)
Replenishment	The replenishment team determines the order forecast, and collects actual order and inventory information.	Inventory Analyst Buyer	Customer Service Manager, Forecast Analyst, Order Management Analyst
Collaboration Technology	The collaboration technology team sets up the collaboration environment, monitors technology effectiveness, and evaluates technical rollout requirements.	IT Coordinator, Project Manager, Systems Manager	IT Coordinator, Project Manager, Systems Manager

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Step 1. Evaluate Your Current State—CPFR begins long before piloting, with an assessment of the company’s needs, values, strategies, culture, partner relationships and track record of implementing best practices. This step looks for areas where change is needed to implement CPFR successfully. Only after this step is done will your company be prepared to articulate a meaningful vision for CPFR. In addition, the senior leadership of your company must not only understand the concept of CPFR, but also must openly offer their support.

Step 2. Define Scope and Objectives--After the vision is created the next step is building the team and setting initial objectives. Step 2 requires:

- Gaining commitment from trading partners.
- Assigning team members and establish their roles.
- Selecting products and locations that will be included in the process.
- Deciding which parts of the nine step process to test.
- Establishing key performance metrics to measure the initiative’s success.

Step 3. Prepare for Collaboration—In step three the project team studies the details of the CPFR business process and identifies the technology and additional resources required to support it. Sales and replenishment team members develop ground rules for managing exceptions and changes. Collaboration technology team members install and configure the information systems (purchased, developed, or simple spreadsheets and e-mails) used to support collaboration between partner pilot teams. At the end of this step collaboration is ready to begin

Step 4. Execute: Performing the Pilot--In step four the sales and replenishment collaboration teams begin to exchange forecasts with each other, modifying them to respond to changing conditions. The collaboration technology team gains experience managing the environment, and prepares for rollout to a large number of locations and projects after the pilot is complete.

Step 5. Assess Performance and Identify Next Steps--In step five the team and its management reviews progress, reports results to their respective organizations, and make preparations for broader CPFR® rollout. The suggested next steps include:

- Expand to other CPFR® processes.
- Add more products to the initial lineup.
- Increase the level of detail by going from warehouse information to store level information.
- Automate the process. The vision of CPFR® is that of managing forecasts by exception, which can best be achieved through an automated process—especially when the number of products and trading partners is high.
- Add trading partners.
- Integrate the results. For the supplier, this means using the collaborative forecast in the production planning, capacity planning, and materials requirements planning processes as well as financial planning. For the buyer or retailer this means integrating the collaborative forecasts into buying, merchandising, replenishment and financial planning processes.

The underlying principles of the process are what generate the dramatic potential benefits of collaboration. Building a trading partner framework, creating a single forecast of consumer demand, and synchronizing manufacturer and retailer order cycles all focus on creating an inter-enterprise value chain environment that reduces waste and cost. Collaboration supports marketing, promotion, management, manufacturing, transportation and planning activities. The information shared as part of this process enhances the accuracy of the forecast and order fulfillment. The extension of the collaboration into the value chain environment is the fundamental change that creates new opportunities.

A large portion of the information presented has been taken from the Collaborative Planning Forecasting and Replenishment Guidelines and The Roadmap to CPFR®:The Case Studies. There is more information available from VICS at their website www.vics.org. and the CPFR® Committee website at www.cpfr.org. The CPFR® Committee has done an outstanding job of guiding development and implementation of collaboration and are now engaged in the Global Commerce Initiative to expand the application of CPFR® and define n-tier CPFR® as a multi tiered collaborative solution across the supply chain. Their pioneering work at the distribution to retail level has gone a long way in developing collaboration as a viable business strategy.

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