Collaborative Forecasting in Practice

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Abstract

The Collaborative Planning Forecasting and Replenishment (CPFR) process model developed by the Voluntary Inter-Industry Standards (VICS) association has received significant attention from both practitioners and academics. However, despite promising pilots, the adoption rate of CPFR has been slower than expected, especially in Europe. The reason seems to be that the proposed collaboration process is currently too labour-intensive for many European companies. There is a need for streamlined approaches to get collaboration started in Europe.

This paper presents a case example of a supplier and a retailer collaborating to increase the retailer's forecasting accuracy for new product introductions. The approach is based on creating one forecast that is then shared within the supply chain. Three other streamlined approaches to planning and forecasting collaboration are also presented on a more general level. Finally, the paper discusses how the product life-cycle model can be used to select and combine the most suitable approaches to collaboration in different market situations.

Keywords: Collaborative Planning Forecasting and Replenishment (CPFR), forecasting, planning, information sharing, supply chain management, co-operation, collaboration, product life cycle.

The promise of collaborative forecasting

In recent years, the concept of inter-company collaboration, especially in the area of planning and forecasting, has received significant attention. By developing processes that make it possible to adjust plans and forecasts in a collaborative fashion, supply chain parties aim to make it easier to take into account events, such as promotions, new product introductions or assortment changes, that affect demand throughout the supply chain (Barratt and Oliveira 2001).

Collaborative forecasting makes it possible to take advantage of the expertise of all, or at least several, supply chain members. One benefit that is suggested to follow from this is a reduced reliance on historical records. (Helms et al., 2000) Time series methods that build on historical data can forecast changes that follow continuous or recurring patterns, but cannot accurately forecast the impact of events, such as price changes, that happen irregularly (Bowersox and Closs, 1996, p. 233; Mentzer and Schroeter, 1994). Through collaborative forecasting, a company or department can get access to better information on important demand drivers, such as promotions. This makes it possible to complement time series forecasting either with regression analysis, which examines the relationship between sales and other variables, such as advertising, or with subjective forecasting, which relies on expert opinion (Jain, 2000; Mentzer and Schroeter, 1994). Furthermore, working based on one shared forecast reduces the problems related to what Mentzer et al. call the "islands of analysis" phenomenon, where different groups, departments or companies develop their own forecasts independently of each other according to their own specific needs, and risk ending up acting based on conflicting plans (Helms et al., 2000; Mentzer et al., 1997).

The most visible undertaking and the igniting spark of the current collaboration boom is the Collaborative Planning Forecasting and Replenishment (CPFR) process model developed by the Voluntary Inter-Industry Standards (VICS) association. However, despite successful pilots and significant support from consultancies, IT companies and electronic marketplaces, the adoption rate of CPFR has been slower than expected. Especially in Europe, many implementations are stuck in a piloting phase, and large-scale implementations are extremely rare. This gives rise to questions concerning the applicability of CPFR in the European retail environment, as well as whether there are more suitable approaches to collaborative forecasting than the CPFR process model.
This paper starts with a brief presentation of the VICS association’s CPFR process model. Some problems related to the application of the model, especially in Europe, are highlighted. Next, an alternative approach that is currently being piloted by a large European packaged consumer goods supplier and one of its retail customers is discussed in detail. Three other approaches to collaboration are presented on a more general level. Finally, the paper discusses how the product life cycle model can be used to select and combine the most suitable approaches to collaboration in different market situations.

The VICS CPFR model

The first CPFR project was initiated in the mid 1990’s by Wal-Mart and Warner-Lambert and supported by IT companies SAP and Manugistics, as well as consulting firm Benchmarking Partners. The project was called Collaborative Forecasting and Replenishment (CFAR). During the CFAR pilot, Wal-Mart and Warner-Lambert independently estimated demand six months in advance and compared forecasts and resolved discrepancies on a weekly basis. In addition, Wal-Mart began placing its orders for the pilot product group, Listerine mouthwash products, six weeks in advance in order to match Warner-Lambert’s six-week manufacturing lead-time. This made it possible for the supplier to manufacture Listerine according to consumer demand and to follow a smoother production plan. Wal-Mart, on the other hand, saw an improvement in in-stock position from 85 % to 98 % as well as significantly increased sales in combination with a substantial reduction in inventory. During the pilot, the VICS Working Group overseeing the project worked on developing a widely applicable model for collaborative forecasting, which later evolved into the current CPFR model. (Seifert, 2002, pp. 41-42)

The CPFR process model contains nine steps (VICS, 1998):
1. Develop front-end agreement: the parties involved establish the guidelines and rules for the collaborative relationship.
2. Create joint business plan: the parties involved create a business plan that takes into account their individual strategies and defined category roles, objectives and tactics.
3. Create sales forecast: retailer point-of-sales data, causal information and information on planned events are used by one party to create an initial sales forecast, this forecast is then communicated to the other party and used as a baseline for the creation of an order forecast.
4. Identify exceptions for sales forecast: items that fall outside the sales forecast constraints set in the front-end agreement are identified.
5. Resolve / collaborate on exception items: the parties negotiate and produce an adjusted forecast.
6. Create order forecast: point-of-sales data, causal information and inventory strategies are combined to generate a specific order forecast that supports the shared sales forecasts and joint business plan.
7. Identify exceptions for order forecast: items that fall outside the order forecast constraints set jointly by the parties involved are identified.
8. Resolve / collaborate on exception items: the parties negotiate (if necessary) to produce an adjusted order forecast.
9. Order generation: the order forecast is translated into a firm order by one of the parties involved.

Although CPFR pilots between companies, such as Nabisco and Wegman’s, Kimberly-Clark and Kmart, and Wal-Mart and Sara Lee, have resulted in significant improvements in product availability, increased sales and reduced inventory (VICS, 1999), the adoption rate has been slower than expected. Most implementations involve only two or a few parties, and only a limited number of products. Large-scale implementations are rare, especially in Europe. Some European companies have even internally prohibited participation in CPFR pilots.

Several reasons have been presented to explain the difficulties in implementing CPFR. Frantz (1999) emphasizes scalability issues, problems related to trust and information sharing by adversaries, change management and the difficulty in reaching critical mass as the main problems in implementing CPFR. However, based on our experience, the single most important obstacle in Europe may, in fact, be the retailer’s lack of forecasting processes and resources.

The CPFR model was developed based on work done by Wal-Mart, a retailer with exceptional logistics processes, in the area of demand planning and forecasting. The general CPFR model was developed with a focus on the US retail climate, which significantly differs from that in Europe. The result is that many European retailers fail to meet the primary requirement of the CPFR model, i.e. that all parties
actively engage in forecasting, or at least have the necessary resources for forecasting. For many companies, implementing CPFR by the book simply requires too much work. Not only do they need to invest in collaboration, but also in developing forecasting processes and capabilities that they currently do not have. There is, therefore, a clear need for more practical solutions to get collaboration started in Europe.

**An example of a more streamlined approach**

It is, indeed, possible to co-operate using a much more streamlined approach than the VICS association’s CPFR model. Next, we will present how one large European consumer packaged goods supplier and one of its retail customers have started to co-operate to improve forecasting accuracy for new products.

When the companies first started discussing collaborative forecasting, they quickly realized that their planning and forecasting processes were significantly different. The retailer dealing with tens of thousands of products mainly relies on statistical, time series forecasts, whereas the supplier’s much smaller product range makes it possible for it to use expert judgment to manually adjust its statistical forecasts. In addition, the companies work with different planning horizons. Whereas the retailer needs a short-term forecast for efficient purchasing and inventory management, i.e. to form the basis for daily purchasing decisions, the supplier needs to estimate demand several weeks or even months ahead to cope with long production lead times.

The differences in processes are clearly visible in the way the companies deal with product introductions (Figure 1). To enable efficient production, the supplier’s sales company had to deliver a sales forecast to the factory months before a product launch. This initial forecast is based on information on previous launches and expert judgment, and is after the launch regularly updated using a combination of time series methods and qualitative estimates. The retailer, on the other hand, needs the forecast at a much later stage, i.e. when it starts purchasing the new product. If the product is a new variant of an existing product, the previous product’s sales history is used as a basis for time series forecasting. On the other hand, if the product is completely novel, the retailer usually does not use any forecast at all, but instead uses manual purchasing in the first months following the introduction. After some months, the retailer starts using statistical forecasts as a basis for purchasing.

The different processes also lead to different results. When we compared forecasts produced by the supplier to those developed by the retailer, significant differences could be found. These differences seemed to follow a pattern. When examining forecast information in February 2002, it could be noticed that the retailer’s forecast was remarkably lower than the supplier’s mainly for recently introduced products (‘Jan 02’ products in Figure 2). The retailer’s forecast was also significantly lower for products introduced approximately 5 months earlier (‘Aug 01’ products in Figure 2). The forecast was also to some extent lower for products introduced approximately 9 months earlier (‘May 01’ in Figure 2), although the retailer’s and the supplier’s forecasts for these products were, in general, similar. The products for which the retailer’s forecast was higher than the supplier’s were, on the other hand, mainly products that had been on the market for 9 months or more (‘May 01’ and ‘Old’ products in Figure 2).
Due to the detected differences in forecasts, the companies decided to take a closer look at the products that had been introduced less than 6 months ago (‘Jan 02’ and ‘Aug 01’ in Figure 2). When examining the forecasting accuracies of the retailer and the supplier for these products (Figure 3), it became clear that there was room for improvement on the account of both parties. However, the supplier’s forecast generally performed better than the retailer's statistical forecast. In fact, for some of the most recently introduced products, the retailer did not use the forecast at all, but instead purchased the products manually (for these products the statistical forecast generated by the purchasing system is included in Figure 3 to enable comparison). It was also seen that the supplier had more resources to invest in improving its forecasting accuracy.

Based on the results of the analysis, the companies agreed to pilot a new forecasting process in which the retailer uses the supplier's forecast as its initial forecast for new products. The supplier updates the forecast a few months later and finally, when there is enough historical data, the retailer switches to statistical forecasting for mature products. Since the process is based on sharing existing information, minimal additional work is required from either party. The idea is to attain a higher return on the forecasting effort performed by the supplier and by using the available information more extensively.
The new forecasting process offers two significant benefits to the retailer. Firstly, as the supplier's forecast can be used to set inventory management parameters for new products, manual buying is no longer needed in the beginning of a product's life cycle. Secondly, as the forecasting accuracy improves, the retailer's service level to its stores increases. The improved store service is also the greatest benefit from the supplier's point of view, which expects the reduced stock-out risk to translate into increased sales and aims to reinforce this effect by further developing its forecasting capabilities.

**Several ways to co-operate**

The above-presented example of a supplier sharing forecast information on new products with one of its retail customers is not the only alternative to the CPFR process model. Other streamlined approaches include, among others, co-operation through sharing of sales data, co-operation through exchange of planning information, and co-operation through sharing of exception alerts.

**Sharing of sales data**

Marshall Fisher has done extensive research on the use of early sales data as a means of rapidly adjusting forecasts for improved efficiency - an approach that he calls "accurate response". Fisher's research reveals that early sales figures can show very accurately where sales are headed, making it possible to attain striking improvements in forecasting accuracy by updating initial forecasts when a couple of weeks' sales information is available. For example, in a case from the apparel industry, Fisher found that forecasting accuracy could be increased from a 45% accuracy level to a 92% accuracy level by updating the initial forecast based on the first two weeks' sales. (Fisher, 2000)

Fisher's results indicate that an efficient way to cooperate is for the retailer to share point-of-sales information on early sales of new products with suppliers. This type of cooperation does not significantly increase the retailer's forecasting workload, but can enable remarkable improvements in the suppliers' forecasting accuracy, leading to more reliable and efficient supply of products. By taking advantage of the suppliers' more accurate forecasts, as in the case example presented above, the retailer can also benefit from the improved forecasts in its own operations.

**Exchange of planning information**

Another way of cooperating is to exchange planning information regarding, for example, assortment changes, promotions and price changes. Although this type of cooperation is present in most retailer-supplier relationships, there are still some important development opportunities. By making relevant information available early enough, and by developing ways of dealing with it efficiently, i.e. translating it into accurate forecasts, significant benefits can be attained.

Research at the Helsinki University of Technology has shown that by offering suppliers of consumer goods systematic ways of dealing with information on changes, such as assortment changes and promotions, forecasting accuracy can be increased while decreasing the amount of time spent on forecasting. The translation of plans into forecasts can, for example, be based on using sales profiles, i.e. mathematical functions, describing how category sales are divided between top selling products, average sellers and niche products within a category, in short, describing how a product's ranking within the category is related to its share of total category sales. Since these sales profiles have been found to be stable even when products change rankings or, for example, when new products are introduced, the sales of each product in a category can be forecasted by estimating the rankings of the products within the category. The forecaster only needs to re-rank the category's products when changes occur. The ranking of a promoted product can, for example, be changed from seventh in the category to third in the category, increasing the product's share of total sales, while decreasing the shares of the products located between the promoted product's old and new rankings. This ranking approach to forecasting is described in more detail by Främling and Holmström (2000) and Holmström et al. (2000).
When suppliers improve their abilities to accurately translate planning information into forecasts, the focus of collaboration shifts from forecasts to plans. When plans, rather than forecasts, are discussed and compared, several steps in the CPFR process can be removed. The retailer does not necessarily need to use resources to translate all plans into forecasts, but can instead transfer already available planning information to the supplier, and in this way improve supply chain visibility and ability to respond to demand changes.

Sharing of exception alerts

Access to accurate sales information, ideally point-of-sales information, makes it possible to construct statistical tools to constantly monitor the relationship between actual and forecasted sales. These tools are based on the same idea as the statistical control cards used in manufacturing (see, for example, Mitra, 1993). The tools compare actual sales to a forecast, and alert when there is a statistically significant difference between the two, or when the difference between sales and forecast starts to follow a distinct, for example, increasing pattern.

Statistical tools make it possible to automate monitoring of mature products. It also presents an opportunity for co-operation. Since retailers typically have access to the most accurate and, oftentimes, least fluctuating sales information, they are the first to detect differences between actual and forecasted sales. By conveying alerts generated by the monitoring tools to the supplier, or by giving the suppliers access to the monitoring information, the retailers can give the suppliers an opportunity to react, without having to commit own resources to forecasting.

Conclusion: one size doesn't fit all, several collaboration models are needed

By developing a common, standardized collaboration model, the VICS association aimed at making large-scale, computer-aided collaboration easier. However, as the model was based on work done by Wal-Mart, perhaps the most industrially operating retailer in the world, and further developed in the North American retail climate where retailers have also previously engaged in forecasting, the application of VICS style CPFR in Europe is far from simple. Applying the CPFR process model in Europe would, in many cases, require that retailers replace their basic statistical forecasts with more sophisticated forecasting models – something that requires significant resources.

The CPFR model is based on comparisons and checks of independently developed forecasts rather than identifying who has access to the best information and knowledge and leveraging this in the rest of the supply chain. This means that the model includes a certain amount of duplicate work. It is, therefore, questionable whether it will really pay-off for European retailers to commit resources to CPFR, when they can achieve good results through more streamlined co-operation with suppliers. Regardless where one stands on this issue, it is clear that developing the retailers’ forecasting
processes and resources takes time. So, be it a temporary transition phase or the ultimate goal, there is a need for streamlined process to get retailer-supplier collaboration started in Europe.

The examples presented in this paper clearly show that improved forecasting accuracy can be achieved using very streamlined co-operation processes. These processes focus on sharing the most useful information available, translating the information into accurate forecasts and sharing it in the supply chain. What is the most useful information depends, among other things, on the market situation.

![Diagram](image.png)

Figure 5. There are different opportunities for collaboration in a product’s different life cycle phases.

The product life cycle model offers a natural framework for focusing on the essentials. When new products are introduced, the supplier needs to produce accurate forecasts for efficient use of manufacturing capacity. This means that the supplier is willing to invest a lot of time and effort in forecasting. Good ways to co-operate are, therefore, to share assortment and promotion information, to use the suppliers forecast throughout the supply chain and to use the retailer’s early point-of-sales information to rapidly update forecasts. In the maturity phase of the life cycle, focus is on the sharing of planning information as well as on statistical monitoring and exchange of exception alerts. This is only one way of combining a limited number of co-operation approaches. Different companies can decide to co-operate using different approaches in different situations to include new, better pieces of information in their processes whenever this type of information is available.

References