



Implementing collaborative forecasting to improve supply chain performance

Implementing
collaborative
forecasting

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Abstract Sales forecasting and collaboration are two business phenomena that have independently been recognized as contributing to improved organizational performance. The present research employs case study methodology to explore the synergies to be gained from combining the two processes. Depth interviews were conducted with executives at three firms currently engaged in collaborative forecasting with supply chain partners. Results revealed unique approaches to collaborative forecasting that circumvent the inhibitors of collaborative planning, forecasting, and replenishment adoption, and yield substantial improvement in company and supply chain performance including increased responsiveness, product availability assurance, optimized inventory and associated costs, and increased revenues and earnings. Seven guidelines to implementing interfirm collaborative forecasting are presented.

Introduction

The strategic competitive advantages to be gained by adopting a supply chain management approach to business are widely recognized (Cooper and Ellram, 1993; La Londe and Masters, 1994; Mentzer *et al.*, 2001). Supply chain management is defined as:

The systemic, strategic coordination of the traditional business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole (Mentzer *et al.*, 2001, p. 22).

Nix (2001) explains that a managed supply chain environment begins with forming collaborative relationships initially with immediate trading partners, then eventually with additional tiers in the supply chain.

Intuitively, focusing collaborative efforts on strategic sources of disruption between trading partners can result in improved performance for the supply chain. Ireland and Bruce (2000) suggest that forecasting is a pivotal business function that, when not strategically, systematically coordinated between firms, can contribute to disruption of activities at the point between trading partners where product is planned, ordered, and replenished. As such, collaborative forecasting provides a substantial opportunity for improved supply chain performance and should be viewed as a priority for firms adopting a supply chain management approach (Helms *et al.*, 2000).

Collaboration and sales forecasting are two phenomena that have each been extensively discussed in the literature, and have been independently identified



as contributing to corporate performance. The purpose of the current research is to explore how trading partners combine the two practices to create a collaborative forecasting effort. The existing literature on collaborative forecasting falls into two categories. The first explores intra-firm collaborative forecasting efforts among functional business units within a firm (Diehn, 2000/2001; Lapide, 1999; Reese, 2000/2001; Wilson, 2001). The second category addresses interfirm collaborative forecasting among trading partners, but largely focuses on one specific approach to integrated collaborative forecasting – collaborative planning, forecasting, and replenishment (CPFR) (Ackerman, 2000; Andraski, 1999; Barratt and Oliveira, 2001; Ireland and Bruce, 2000; VICS, 1999). Despite promising initial results and the detailed and comprehensive nature of the CPFR process model, a number of barriers have prohibited its anticipated widespread adoption. Among the barriers of CPFR implementation are the provision of adequate technology and software, difficulties of real-time coordination of information exchange, substantial investment of time and personnel for set-up, the process intensive nature of maintaining the efforts across several suppliers and products, lack of scalability from the pilot stage, and the required synchronous changes in corporate culture for both firms in the collaborative relationship (Barratt and Oliveira, 2001; Girard, 1999; Suleski, 2000).

In light of these barriers to implementation, Barratt and Oliveira (2001) call for a re-examination of the CPFR process model. If many firms are disinclined to implement the CPFR process due to the aforementioned barriers, we believe these firms would be interested in knowing if alternative approaches to collaborative forecasting are being adopted, and if they result in improved performance. Research in this particular area is lacking in both the academic and practitioner literature. This paper addresses this gap by specifically asking the question – How do firms engage in interfirm collaborative forecasting, and how do these approaches to collaborative forecasting impact supply chain performance, and thus, company performance? The present research explores collaborative forecasting in general, rather than the specific application of CPFR.

Collaborative forecasting cannot be effectively studied outside its context of business to business relationships. Therefore, an inductive research methodology – which logically progresses from naturally occurring, largely uncontrollable observations toward theoretical generalizations – is most appropriate (Bonoma, 1985; Yin, 1994). Case study methodology best meets these requirements and was consequently chosen for our research.

The following section offers a review of the supply chain collaboration literature and sales forecasting literature. Subsequently, we describe our case study methodology and present results of interviews with three organizations currently engaged in collaborative forecasting. Following presentation of results, we then return to and review the literature for support and triangulation of our findings on responsiveness, product availability assurance, optimized inventory, and increased revenues and earnings. Conclusions

and implications offer seven guidelines for firms seeking to implement collaborative forecasting initiatives. Finally, limitations and future research are discussed.

Collaboration among supply chain partners

Collaboration among organizations on the management of various supply chain activities is a current trend believed by some company executives to lead to a competitive advantage over other supply chains (La Londe and Masters, 1994; Mentzer *et al.*, 2000). Supply chain collaboration has been described in the literature in many ways – as a business tool that builds sales (Andraski, 1999); as an interaction among peers sharing a common set of goals and measures (Citera *et al.*, 1995); as a process for parties to jointly search for solutions (Haeckel, 1998); and as a relationship in which trading parties develop a long-term cooperative effort (Sriam *et al.*, 1992). Common to many of these descriptions is a long-term relationship between supply chain parties that work together. In interviews conducted with executives responsible for their organization's supply chain, Mentzer *et al.* (2000) asked respondents to offer their interpretation of supply chain collaboration. Respondents largely reiterated concepts previously mentioned from the literature, but added that the parties should work as one entity toward common objectives (Mentzer *et al.*, 2000). Therefore, we adopt the Mentzer *et al.* (2000) definition of supply chain collaboration as a long-term relationship among organizations actively working together as one toward common objectives. One area in which collaboration is taking place in the supply chain is forecasting.

Sales forecasting process and collaborative forecasting

Before a company can successfully engage in collaborative forecasting, it must establish its own internal forecasting process. Consistent, systematic and appropriate forecasting processes positively impact performance through decreased operations costs, improved customer service, increased sales, and reductions in inventory. These improvements have positively affected return on shareholder value (Mentzer, 1999). Models of the forecasting process offered in the literature provide inclusive guidelines to be followed by companies when creating their forecast (Lawless, 1990; Murdick and Georgoff, 1993; Reid, 1985). In general, researchers agree on the course of action for developing forecasts, although they may emphasize some steps more than others. Mentzer and Bienstock (1998) offer a comprehensive model of the sales forecasting management process, which categorizes the forecasting process into four components:

- (1) management;
- (2) systems;
- (3) techniques; and
- (4) performance measurement.

Organizations must recognize these four dimensions as part of their internal forecasting process before they can successfully enter into an interfirm collaborative forecasting effort.

Interfirm collaborative forecasting extends the process beyond the four walls of an enterprise to include trading partners, whether face-to-face or electronically, when building the forecast (Burgin *et al.*, 2000). When this occurs, the most appropriate and most accurate information is used to develop the forecast. The result is a higher quality forecast driving business decisions that are made in the supply chain. The ultimate goal is to have this information exchange occurring at all levels of the supply chain in the development of a single forecast. The benefits that come from collaborative forecasting are similar in type, but greater in magnitude than those that come from single-firm, intra-enterprise forecasting such as that described above.

Much of the existing popular press and scholarly literature on collaborative forecasting focuses on a tool referred to as CPFR. The voluntary interindustry commerce standards association (VICS) committee established CPFR in 1998 to help companies co-manage processes and share information. The roadmap developed by VICS (1998) instructs companies to:

- develop an agreement on the target(s) and metrics;
- create a joint plan to meet the target(s);
- jointly create a forecast;
- identify any exceptions;
- jointly address the exceptions; and
- create and fill the orders.

In total, CPFR process mapping involves four sub-processes, 26 functions, and a total of 51 outputs (Barratt and Oliveira, 2001), and requires trading partners to have a synchronous collaborative vision, the required technology, and resources to implement and execute successfully (Ireland and Bruce, 2000). According to VICS, the expected outcomes include improved efficiencies, increased sales, reduced assets and working capital, and decreased inventory. It must be noted that CPFR is only the tool that helps facilitate collaborative forecasting between supply chain partners. As with any other tool, the use of CPFR alone will not result in successful collaborative efforts unless internal forecasting processes have been established, and solid relationships among partners have been forged. In other words, relationships must evolve from being traditional, adversarial, and self-serving in nature to relationships characterized by sharing information and working together toward common goals with the focus on the end-use consumer.

Collaborative forecasting involves reliance on supply chain partners to provide accurate, detailed and timely demand information. It requires trust in that information as well as in the partners that provide it. Thus, we define collaborative forecasting as the purposive exchange of specific and timely

information (e.g. quantity, level, time horizon, location, probability of new business, etc.) between trading partners to develop a single shared projection of demand. We now describe the case study methodology used to determine how collaborative forecasting is implemented and what impact it has on supply chain performance.

Methodology

Case studies are appropriate for exploratory research when answering a “how” question such as ours (Yin, 1994). This methodology deals with a variety of evidence – the primary resources being systematic interviewing and direct observation. According to Yin (1994), the case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context. The business to business relationship context is highly pertinent to our phenomenon of interest. We use a multiple-case holistic design which is more robust for replication of results. Design of the study – including data collection, analysis, and quality – follows procedures recommended by Yin (1994).

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Sample

The unit of analysis for our case study is the organization. Within the context of the business to business relationship, either a supplier or customer is the focal organization that participates in collaborative forecasting. These companies were chosen based on desired replication of findings; that is, we selected companies that were known a priori to engage in collaborative forecasting. A review of the literature, which consistently attributed specific performance outcomes to supply chain collaboration in general, led us to believe we would find similar performance outcomes without much variation across organizations in the more specific collaborative forecasting consequences. Hence a small number of cases is acceptable as results should illustrate replication of findings (Yin, 1994). Three different industries – chemicals, consumer goods, and apparel manufacturing, each having different positions in a variety of supply chains – were selected in order to explore both similar and contrasting situations.

Research design

Our research started with a preliminary theory that collaborative forecasting efforts other than CPFR exist, and that these efforts impact supply chain performance. This is based on the positive performance contributions that both forecasting (Fildes and Beard, 1992; Makridakis and Wheelwright, 1977; Mentzer and Bienstock, 1998; Reid, 1985) and collaboration (Burt and Pinkerton, 1996; Ellinger *et al.*, 1999) have exhibited. The next step was to select cases in which the phenomenon was present and design a data collection protocol. The protocol included the open-ended questions that would be asked of our informants and plans for collecting other sources of evidence such as company documents and records. Each case study was conducted and analyzed individually. We used an iterative nature of comparing, explaining,

and revising the data interpretation to develop our theoretical model of collaborative forecasting. We then drew across-case conclusions and modified the initial theory as necessary. From this, implications were developed including guidelines for implementing interfirm collaborative forecasting. This research process is very similar to the four stages of draft, design, prediction, and disconfirmation recommended by Bonoma (1985) for case studies.

Data quality

Our research relies on all relevant evidence as recommended for quality by Yin (1994). There are four specific tests to ensure that a case study produces quality results. The first, internal validity, is not applicable for exploratory case studies such as the present research; causal relationships are not tested at this stage, but are proposed as a result of findings, and addressed in recommendations for future research. Construct validity ensures that correct measures are used for the research concepts. This is demonstrated in case study research through the convergence of multiple data sources (triangulation), a chain of evidence, and key informant reviews. The research uses interviews, field notes, company documents, and records to develop interpretations. All data were documented and tracked to maintain a verifiable chain of evidence. All informants involved in this research conducted member checks, reviewing and approving notes and reports pertaining to their company. External validity is supported through replication of findings. One goal of the study was analytic generalization – that is replicable results from which theoretical implications could be inferred. We used multiple cases and relevant literature as data sources to address this. The final test for quality is reliability, which ensures that the same results can be reached if the research is repeated. Reliability can be established by using a protocol and “database” (common location) for data collection and analysis. To address this, the research team followed a protocol for interviews and documented all data that were stored in a database. Outside reviewers were used to review the chain of evidence created which further supported reliability of the research.

Case study results

Table I offers profiles of the three companies involved in the case studies including the impetus for collaborative forecasting within each company, with whom they have entered into collaborative forecasting relationships (i.e. customers or suppliers), and how collaborative forecasting is integrated into their companies. It must be noted that the decision to implement collaborative forecasting in each of the three companies was subsequent to an internal forecasting process audit resulting in improved forecasting practices within the enterprise. When comparing the impetus for collaborative forecasting across the three firms, one consistent theme that emerged was recognition by senior management of the strategic competitive advantage to be gained by engaging in interfirm collaborative forecasting. Thus, management was committed to fostering an environment open to collaboration with trading partners.

Company profile	Impetus for collaborative forecasting	Collaborative forecasting partners and length of time	Execution
<i>Co. A</i> International chemical company with sales offices in over 30 countries, and annual sales volume approaching \$5 billion	The search for solutions to customers' satisfaction issues Recognition that differentiation on product or service alone was no longer sufficient to remain competitive Results from a survey of customers approximately three years prior revealing the primary customer satisfaction issue was product availability assurance Customers were looking to reduce the number of suppliers with whom they sourced inventory	Customers: two years	Salesforce was trained in CF and makes monthly "forecasting calls" (vs sales calls) to customers specifically for the purpose of reviewing the sales forecast. Forecasting meeting fosters conversation revealing actionable, qualitative market intelligence. Salesperson has live version of forecast on laptop – revisions are made and sent to corporate on real-time basis Customers have been encouraged to immediately communicate any changes in demand that would affect the forecast rather than waiting for the monthly meeting
<i>Co. B</i> Consumer goods company selling to both general and specialty retailers of over \$2 billion annually. They have facilities throughout North America and employ 18,000 employees	Independent forecasting business unit was established in response to management directives and key account requests to develop closer ties with customers to gain competitive advantage	Customers: three years Suppliers: just beginning	Prior to regularly scheduled monthly meetings with each key account, company B sends each account a system-generated forecast for that customer to review prior to their meeting. The two companies then work together to incorporate any new information that affects the forecast such as promotions, pricing changes, store expansions, product offering changes, or product obsolescence <i>(continued)</i>

Table I.
Summary of company collaborative forecasting information

Table I.

Company profile	Impetus for collaborative forecasting	Collaborative forecasting partners and length of time	Execution
<i>C₀, C</i> Manufacturer and marketer of basic apparel with some seasonal and fashion products. The majority of product is sold in large discount retail chains under the company's nationally recognized brand name, with a small percentage sold under various private labels	Senior management directives approximately three years ago to reduce costs and improve process efficiencies Decision to assess supplier performance, and reduce supplier base to those that that were most effective Process mapping of planning, forecasting, and replenishment processes between company C and largest customer. Outcome was recognition of the strategic value in sharing information with supplier to derive one consensus forecast for the dyad	Customers: two years Suppliers: three years	Company C sends 12 week rolling forecast to supplier on a weekly basis. Weekly conference-call meetings involving company C's purchasing and production planning representatives and suppliers sales staff are conducted to arrive at a collaborative forecast

All three firms focused on committing resources to train boundary-spanning personnel in collaborative forecasting methods. In particular, those collaborating with customers focused their efforts on training the salesforce, and for those collaborating with suppliers, purchasing was the focus of training efforts. These boundary-spanning personnel are in the most advantageous position to gather intelligence from the trading partner and to engage the partner in collaborative forecasting efforts. Intelligence gathering conversations with trading partners can elicit information from trading partners on decisions involving pricing, promotion, advertising, new store or plant openings, discontinued items or new product introductions, as well as other factors that can impact demand and forecast accuracy. In each case, training consisted of teaching the focal firm's personnel to:

- ask questions that would render quality;
- attain timely market intelligence from the trading partner;
- educate the trading partner about the advantages to be gained by both firms as a result of improved forecast accuracy due to collaboration;
- encourage the trading partner to communicate information that might impact forecast accuracy on a timely basis; and
- act as a "forecasting consultant" for the trading partner by teaching them how to improve their own forecasting skills.

This approach requires considerably less investment of time and personnel than that required by CPFR.

An additional common activity adopted by all three firms is institution of regularly scheduled meetings between the sales and purchasing departments for the sole purpose of discussing the forecast. Companies A and B established monthly meetings with their customers, and company C established weekly meetings with their supplier with the goal of developing a single shared projection of demand. Collaborative forecasting efforts were initially targeted at A-level accounts, but eventually adopted with many B-level accounts as the firms began to realize the benefits to be gained by expanding the scope of their efforts with minimal additional investment.

Regarding technology requirements, none of the three firms found it necessary to make substantial investments. Each of the firms had already assessed and upgraded their own internal forecasting system as a result of their enterprise forecasting process audit. Therefore, without joint electronic real-time access to the forecast, alternative methods of information sharing had to be established. Company A shares their forecast with customers during monthly "forecasting calls" where the salesperson displays a live version of the forecast on their laptops, and revisions are entered with the customer based on customer intelligence. Subsequent information exchange throughout the month is in the form of e-mail spreadsheet attachments, which is the primary method of forecasting information exchange for companies B and C. While it is recognized that this form of information exchange is far less efficient than the

integrated technology required by CPFR, the technology requirements of CPFR are cost prohibitive for many companies, rendering less formal information exchange an acceptable alternative. These less systematized methods of collaborative forecasting are not characterized as scaleable across trading partners. However, manufacturers do not perceive CPFR to be scalable as a firm's network of trading partners involved in CPFR increases (Girard, 1999).

As can be seen from the above results, barriers to implementation of CPFR can be lowered or circumvented by adopting less formalized methods of collaborative forecasting. The three firms in our case study clearly developed unique alternatives to CPFR, but with some common elements. However, the true test of the effectiveness and efficiency of these methods of collaborative forecasting can only be measured by assessing the performance outcomes. The following describes results of performance outcomes that emerged from the case study interviews.

Case study results (company A)

Over the last two and a half years, company A and their customers have recognized several mutually beneficial outcomes of the collaborative forecasting process. Among the benefits mentioned are increased responsiveness, increased product availability assurance, and optimized inventory levels and associated costs – all of which contribute to increased revenues and earnings for both partners in the collaborative relationship. Specific examples are offered below.

Increased responsiveness

Company A found that the more timely flow of information related to changes in demand allowed them to be more responsive to customers' needs. For example, during a collaborative forecasting meeting, a customer informed the salesperson of their plans to change the formula for a particular product which would involve substituting orders of a particular chemical – for which they were the only customer – with another chemical. Access to this information allowed company A to gradually decrease and cease production of the original product, and substantially ramp-up production of the new product in order to meet demand when the customer was ready to convert. Without collaborative forecasting, the salesperson would not have learned of the switch until the orders were placed, resulting in an overstock of the original chemical for which there were no other customers, and an inability to fulfill demand for the new product. Increased lead-time due to collaborative forecasting resulted in reduced product obsolescence and increased responsiveness.

Product availability assurance

Company A found that information garnered during collaborative forecasting meetings allows for improved production and distribution network planning, resulting in increased product availability assurance. For

example, when company A initiated collaborative forecasting with one key customer, that customer was only purchasing 30 per cent of their 16 million pound requirement from company A. As a result of collaboration, confidence in the forecast allowed company A to dedicate work in process (WIP) supply for this customer, and exhibit a consistent track record for product availability. Furthermore, collaboration lead to a reassessment and realignment of the existing distribution network to better accommodate the customers' needs. Ultimately, company A became the sole supplier for this customer.

In addition, through collaborative forecasting, salespeople are better able to understand what product availability means from the customers' point of view. For example, conversations with customers give salespeople better insights into what "on-time" delivery means to each customer, and thus they are able to assure availability of product when the customer needs it rather than when company A thinks they need it. Finally, in times of materials shortage, collaborative partners' forecasts are given priority for order fulfillment while other customers might be placed on product allocation.

Optimized inventory and associated costs

As previously mentioned, increased confidence in customers' forecasts has allowed company A to dedicate WIP supply for collaborative customers, and is therefore able to produce smaller, more frequent shipments. Consequently, customers are able to lower their overall inventory levels and are less compelled to carry excessive safety stock. Moreover, company A has significantly reduced their North American warehouse inventories and all costs associated with storing inventory (e.g. insurance, obsolescence, shortage, and other logistics costs) because dedicated WIP is being directly shipped to customers rather than being placed in storage awaiting shipment. Company A has also eliminated the need for safety stock for collaborative partners due to increased understanding of and trust in the mutual forecast.

Increased revenues and earnings

The examples of increased responsiveness, product availability assurance, and optimized inventory and associated costs described above all resulted in increased revenues or earnings, e.g. reduced obsolescence, sole-supplier status, and reduced warehouse inventories. Several other examples were offered by company A, including the following. In his first collaborative forecasting meeting with a long-term customer from India who consistently ordered 50 barrels of a particular chemical from company A, the salesperson learned that this customer was ordering 40 per cent of his total demand from a competitor. When asked why they were not ordering 100 per cent of the product from company A, the customer responded that several years ago when they attempted to order more they were informed that company A only had the capacity to fulfill 50 barrels, which the customer has continued to order over the years. However, company A's production capacity for that product had

since increased, but the customer's unfulfilled demand from years ago had not been recognized until collaborative forecasting began. In that initial meeting, company A was able to capture the remaining 40 per cent of demand for what was a very high margin product.

Increased responsiveness, product availability assurance, and optimized inventory and associated costs consistently emerged as outcomes of collaborative forecasting from company documents and the interviews with company A. These outcomes resulted in the improvement of supply chain performance through increased revenues and earnings.

Case study results (company B)

Feedback regarding collaborative forecasting at company B from both external and internal customers has been positive since the process was implemented. Information exchange has increased in both frequency and quality, which has positively affected the relationship between the company and its customers. The improvements have prompted company B to develop better measures to consistently capture the benefits and quantify the results of collaborative forecasting. Forecast accuracy at the customer and SKU levels have improved 1 per cent and 10 per cent respectively. Due to this improvement, company B has avoided excess inventory in the approximate amount of \$8 million. In addition, they have begun a similar process with their upstream suppliers which involves sharing the same forecast that was created in collaboration with customers. The primary benefits experienced by company B and their customers that became apparent during the interviews include increased responsiveness and optimized inventory, both of which will be described.

Increased responsiveness

Through the increased exchange of demand information, company B has improved their responsiveness to customers. Having more accurate predictions of customer demand has allowed the company to better anticipate and react to changes in demand. One respondent called this, "catching the winners and the losers [products] earlier." This has helped them better manage the number of expedited shipments to customer locations. Another example of increased responsiveness concerns seasonal products. Information concerning the introduction and termination of seasonal products flows between the companies in a more timely fashion than in the past. This contributes to increased service levels and decreased obsolete inventory (discussed in the next section). One specific example of increased responsiveness occurred with one retailer two weeks after the introduction of a new product. During the collaborative forecasting meeting, the retailer communicated early indication of a trend in sales for the new product that was substantially higher than originally forecasted. Company B was able to respond to the increase in demand, and the customer expanded the number of stores in which the product was offered from 100 to 800.

Optimized inventory and associated costs

Company B has been able to reduce their safety stock and excess inventory while maintaining the appropriate levels of inventory to meet their customers' needs through collaborative forecasting. Fill rates for company B's products are 95 per cent. Advanced notice of product changes has permitted the company to place approximately 10 per cent of their SKUs into "B status" in their production system, which automatically adjusts production requirements to remove all safety stock for that SKU. Specifically, one customer provided advanced notice of the discontinuance of a particular product style, which was produced in runs of 2500 pieces at \$125/piece. Company B was able to immediately place the SKU into B status saving over \$300,000 by eliminating production of safety stock for remaining runs, and reducing the number of remaining runs to allow sell-thru of existing safety stock. Overall, company B has seen a \$5 million decrease in inventory for the business units participating in collaborative forecasting.

Increased revenues and earnings

The preceding are just a few examples pertaining to increased responsiveness and optimized inventory levels that company B and their customers have realized as a result of collaborative forecasting. While each of the above examples resulted in increased earnings or revenues, the specific benefits have been difficult to quantify thus far. Therefore, in addition to expanding this process to suppliers, improving performance measures and running forecasting on an exception basis is the next step that company B plans to take in continuously improving their collaborative forecasting.

Case study results (company C)

For company C, the primary outcome of a functional process mapping with their key supplier was recognition of the value in sharing information with their supplier to derive one consensus forecast for the dyad. Such a collaborative process allows both companies to recognize and record true unconstrained demand, differentiate that unconstrained demand from the constrained demand plan based on the supplier's capability to fulfill demand, and ultimately reduce the gap between the two. Through the collaborative forecasting process, company C and their suppliers and customers have experienced benefits such as increased responsiveness, product availability assurance, optimized inventory and associated costs, and increased revenues and earnings.

Increased responsiveness

Company C believes that, by collaboratively forecasting with their suppliers, both partners have become more responsive to each other's needs. Prior to engaging in collaborative forecasting with their fabric suppliers, the communication process involved providing suppliers with a purchase order four to six weeks in advance of anticipated demand, and revising the requested

delivery quantity as actual demand was incurred. If actual demand fell short of the quantity ordered, surplus inventory was warehoused by the supplier for up to 60 days, at which time the inventory would convert to bill and hold status (i.e. company C would be billed for the inventory warehoused by the supplier). As a result of collaborative forecasting, company C now provides their supplier with a 12-week forecast on a weekly basis. The supplier is able to see changes in this forecast on a timelier basis and adjust their production cycles accordingly.

In one specific example, company C dramatically increased their forecast for four weeks out in response to a retailer's request to run a promotion. During the supplier forecasting meeting, the supplier communicated their inability to meet that demand in four weeks, needing five weeks to supply the fabric. Company C discussed the issue with the retailer, who agreed to push the promotion back one week. Prior to collaborative forecasting, the supplier would have been unable to meet the demand the week it was requested, and company C would not have been able to deliver product in time for the promotion, ultimately resulting in lost sales and dissatisfied customers. However, due to collaboration, all three members within the supply chain were allowed the opportunity to be responsive to each other's needs, resulting in an optimal solution.

Product availability assurance

For company C, product availability assurance emerged as an internal tool to convince their salesforce on the benefits of collaborative forecasting. As part of the company's initiative to reduce costs and improve efficiencies, the salesforce was expected to increase customer service levels while decreasing inventory levels. Although company C's salesforce had assured their customers of product availability prior to collaborative forecasting, the mindset was to carry large inventory levels to meet this assurance. However, the combination of high forecasting error and large inventories often meant overstocks in slower-turning SKUs and out-of-stocks in faster-turning SKUs. Company C was able to illustrate to the salesforce how improved forecast accuracy resulting from collaborative forecasting, combined with substantially reduced lead times, raw materials inventory, and WIP inventory (discussed in next section), would allow the salesforce to continue product availability assurance for their customers.

Optimized inventory and associated costs

Several examples of optimized inventory and associated costs have been evidenced by company C and their suppliers and customers as a result of collaborative forecasting. For example, by regularly sharing information with suppliers to derive one collaborative forecast, company C now receives insights they consider to be invaluable. As one company C executive stated:

The perspective of a different party many times offsets our biases or brings an unbiased perspective . . . We feel it has brought a balance and sense of reality that is not there when

you try to find a more accurate time series method or just get a different qualitative opinion from an internal executive.

Collaborative forecasting with suppliers and customers has allowed these supply chain partners to “take the wiggles out” of the problematic bullwhip effect experienced so often between trading partners by reducing demand forecast variability. Company C estimates that sharing 12-week forecasts on a weekly basis has removed approximately four weeks of inventory out of their supplier’s warehouse, and out of their raw materials, WIP, and finished goods inventories. In large part, optimized inventory and associated costs between company C and one of their primary suppliers is attributable to innovative methods of inventory warehousing, delivery, and billing that resulted from collaborative forecasting negotiations. The result is approximately 60 per cent shorter lead times. For goods shipped from one of company C’s manufacturing plants in central America, lead times have been reduced to 40 days from 120 days prior to collaborative forecasting. Company C has also managed to reduce retailers’ inventories, thus increasing inventory turnover and allowing retailers to “get more out of the investment of space” dedicated to company C’s product.

Increased revenues and earnings

Each of the above examples for company C resulted in increased earnings and/or revenues for all partners in the collaborative forecasting relationship. Due to significantly reduced lead times, company C is able to move more production to off-shore facilities, taking advantage of reduced labor costs and passing this cost savings along to customers while still experiencing improved lead times. In another example, as previously mentioned, a customer adjusted their scheduled in-store promotion as a result of collaborative forecasting which led to very effective supply chain demand planning. By adjusting and coordinating promotional activities with upstream trading partners, the retailer was able to maximize sales during the promotion, and company C did not incur chargebacks for inventory that otherwise would have been delivered post-promotion. Finally, because one of company C’s suppliers experienced substantially reduced costs associated with reduced inventory levels, the supplier did not pass along a price increase that had been a commitment in a contractual agreement. These benefits are directly attributable to the collaborative nature of the forecasting process, and would not have been achieved without sharing timely and accurate information between the two supply chain partners.

Theoretical model

The results across all cases involved in this study show compelling evidence of replication of findings. All three cases offered several examples of increased responsiveness and optimized inventory and related costs, some of which were presented above. In addition, companies A and C both offered examples of product availability assurance. In each case, the benefits of collaborative

forecasting directly resulted in increased earnings and/or revenues. Clearly, the barriers to implementation of CPFR can be overcome with alternative methods of collaborative forecasting that result in improved company and supply chain performance. Thus, based on these findings, we present our model of collaborative forecasting (see Figure 1).

Discussion of literature related to findings

When conducting exploratory research such as with the present study, Strauss and Corbin (1998) explicate the value of returning to the literature after data collection has been completed to confirm the findings, thus validating the relationships proposed among the constructs emerging from qualitative data analysis (Yin, 1994). As such, the literature is employed as an additional source of data providing triangulation. Thus, results from this study directed us back to the literature to address construct validity by providing multiple sources of evidence for the same phenomena. The following is a review of the literature related to the outcomes of collaborative forecasting.

Increased responsiveness

In today's fast paced environment, companies are seeking ways to establish time-based strategies to achieve competitive advantage including building responsiveness into operations (Bowersox and Daugherty, 1995). One way to accomplish this is by collaboratively sharing information with preferred suppliers. A preferred supplier will possess the capability to respond to unpredicted needs such as fluctuations in demand or sudden need for a new product (Leenders *et al.*, 1985). Company B's more timely access to their customers' demand data allowed them to be more responsive to large fluctuations in demand for highly seasonal products, thereby decreasing product obsolescence and stock-outs. In company A's responsiveness example, information gathered during collaborative forecasting allowed them to be responsive to their customer's needs for a new product in a timely fashion.

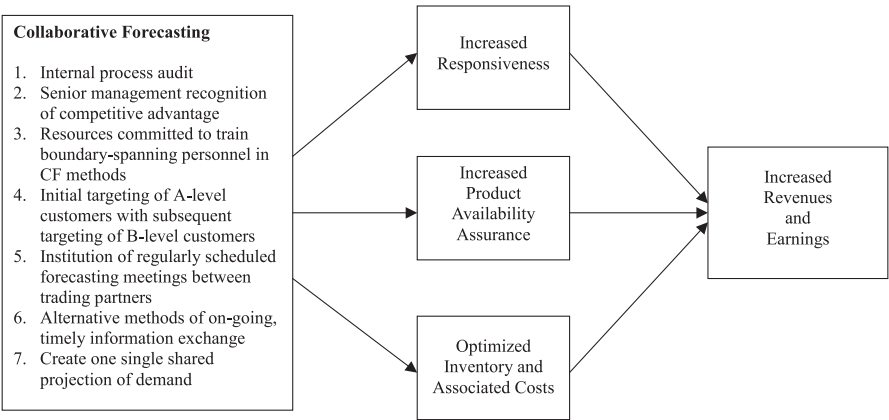


Figure 1.
Theoretical model of
collaborative forecasting

One method of creating flexibility in logistics systems is compressed order cycles, which facilitate the ability to be more responsive to changing customer requirements and exploit new opportunities (Bowersox and Daugherty, 1995; La Londe and Masters, 1994). Another method of developing flexibility involves identifying and suggesting creative new ways to serve customers needs, and customizing delivery of those needs for key accounts (Leenders *et al.*, 1985). Company C worked with their main supplier to create innovative methods for delivery of goods which contributed to shorter cycle times, allowing them to be more responsive to their customers needs.

Davis and Manrodt (1991) discuss the importance of responding to customers on a request-by-request basis, and to perform during the “moment of truth” when a critical need arises. In establishing responsiveness strategies, Nix (2001) indicates the importance of understanding how customers will respond to product stock-outs. Customer service levels should take these reactions into account, which can range from a one-time lost sale to permanent loss of the customer to a competitor. For company C, collaborative forecasting with one retailer and supplier thwarted what would have been an unsuccessful and costly retail promotion.

Product availability assurance

The current customer-side trend toward proactive procurement involves reducing the supplier base in order to maximize results from remaining vendors through increased supplier commitment, thereby securing improved customer service, and mitigating uncertainty and risk of stock outages (Bitner 1995; Smeltzer and Siferd, 1998). A primary factor in selecting a supplier is the ability to assure availability of product (Burt and Pinkerton, 1996; Heinritz *et al.*, 1991; Leenders *et al.*, 1985). Confidence in a suppliers’ ability to deliver product typically develops over time with continued performance, and requires extensive communication and cooperation between trading partners (Bitner, 1995). Due to collaborative forecasting efforts resulting in detailed information sharing between supply chain partners, companies A and C were able to confidently assure their internal and external customers of product availability. In turn, company A’s customers were confident in their ability to follow through on that assurance, and ultimately established them as a preferred supplier.

Leenders *et al.* (1985) suggest that an additional benefit to developing a close relationship with selected vendors emerges in times of materials shortage when suppliers establish priorities of customers on vital requirements based on the quality and commitment of their relationship. Company A extended that promise to each of their collaborative forecasting partners. In today’s proactive procurement environment in which customers are reducing their supplier base, long-term product availability assurance is a critical factor in selecting suppliers, and a collaborative relationship is one way in which to provide this assurance.

Optimized inventory and associated costs

"Inventory is an asset for which less rather than more should be the desired goal" (*Logistics Focus*, 1998, p. 19). Inventory managers are regularly challenged with this inventory management paradox. The inventory management objective is to minimize channel-wide inventory and related costs while avoiding undesired stock-outs resulting in loss of sales, given established customer service levels. Decreased uncertainty of demand can lead to reduced need for safety stocks and stockpiling of inventory (Cooper and Ellram, 1993) as stock levels begin to reflect true customer demand (La Londe and Masters, 1994). Company B has completely eliminated production of safety stock levels for certain SKUs due to consistent and timely communication of demand fluctuations from their customer. Similarly, company A's dedicated WIP for collaborative customers has reduced the need for their customers to carry excessive safety stock, and has reduced company A's warehousing levels because WIP is being directly shipped to customers rather than placed in storage. Stalk and Haut (1990) suggest that by communicating projected fluctuations in demand to upstream partners on a real-time basis, manufacturers can better plan their production cycles to avoid overhead expenses incurred by allowing factory output to ramp up and down to meet unanticipated demand that was not communicated in a timely fashion. By collaborating on the forecast, company C and their supplier were able to remove demand amplification from their consensus forecast, resulting in more efficient production cycles. Collaborative forecasting allows participating companies access to more accurate demand information, which then permits those companies to optimize their inventory levels.

Increased revenues and earnings

By far, the most often cited outcome of collaboration is an improvement in financial performance, including increased sales and profits, and decreased costs (Andraski, 1999; Kalwani and Narayandas, 1995; Mentzer *et al.*, 2000; Sriam *et al.*, 1992; VICS, 1998). Specifically, the literature offers abundant support for the notion that increased responsiveness (Berry, 1995, Nix, 2001), product availability assurance (Heinritz *et al.*, 1991; Leenders *et al.*, 1985), and optimized inventory and associated costs (*Logistics Focus*, 1998) result in increased revenues and earnings. Company C's substantial decreases in lead time have afforded them the flexibility to shift production to off-shore locations, thus reducing costs in the supply chain. Sole- or preferred-provider status is often granted to suppliers that provide responsiveness and product availability assurance to their customers (Burt and Pinkerton, 1996; Heinritz *et al.*, 1991; Leenders *et al.*, 1985). As a result, customers do not incur exorbitant switching costs (*Logistics Focus*, 1998), and suppliers are able to retain and grow their existing customer base rather than the more costly alternative of new customer acquisition (Fornell and Wernerfelt, 1987), ultimately producing increased earnings for both customers and suppliers. Company A cited specific examples

of customers that had chosen them as their preferred provider directly due to outcomes of collaborative forecasting, thus increasing the company's revenues.

Returning to the literature clearly provides support for the findings of our exploratory case study research and offers validation for the construct relationships proposed in our theoretical model. The findings presented here are exploratory, and the resultant theoretical model of collaborative forecasting presents several stakeholder implications and opportunities for future research.

Conclusions and implications

Many firms recognize the supply chain efficiencies and competitive advantage to be gained by implementing interfirm collaborative forecasting. CPFR is the primary tool discussed by practitioners in the popular press when referring to collaborative forecasting. While CPFR has shown great promise for improved supply chain performance in pilot studies, several barriers exist prohibiting widespread adoption (Barratt and Oliveira, 2001; Girard, 1999; Suleski, 2000). Results of the present study reveal alternative approaches to interfirm collaborative forecasting that do not require the substantial investment in human and technological resources required by CPFR. Moreover, results show these alternative approaches can result in increased responsiveness and product availability assurance, optimized inventory and associated costs, and increased revenues and earnings for the individual firms as well as the supply chain.

In assessing the common themes and practices emerging from case study interviews of three companies currently engaged in interfirm collaborative forecasting, we offer the following seven guidelines to be employed by firms interested in implementing collaborative forecasting with their trading partners. First, companies must begin by auditing their internal forecasting processes. Before considering collaborating with trading partners, firms must assess each of the four forecasting process components – management, systems, techniques, and performance measurement (see Figure 1) – to ensure they have consistent, systematic and appropriate internal forecasting processes (Mentzer and Bienstock, 1998). The second guideline emerging from the case studies is to gain senior management support for the collaborative forecasting initiative. It appears likely that interfirm collaborative forecasting will be taken more seriously and more effectively managed and integrated into the internal forecasting process if supported at senior levels.

The third step involves selecting and training the appropriate boundary-spanning personnel in interfirm collaborative forecasting techniques. The salespeople, purchasing managers, and buyers are in the most advantageous positions to gather market intelligence such as marketing mix activities from customers and suppliers and to best understand the impact they will have on shaping demand. In addition to gathering market intelligence, these boundary-spanning personnel should be trained to educate their trading partners of the benefits of collaborative forecasting and engage them in the process. Information sharing between partners reduces both demand and supply

uncertainty resulting in improved forecast accuracy and, thus, improved operational decisions stemming from the forecast such as production and logistics planning for both firms. Realizing initial benefits will allow the collaborative relationship to grow and more benefits to occur, such as more efficient and effective interfirm demand planning and demand management. The notion of training your trading partners to collaboratively forecast contradicts the recommendation that, to successfully pilot the CPFR process, a trading partner must meet or exceed your own supply chain capabilities and be ready for CPFR (Ireland and Bruce, 2000).

Each of the three firms in our study gradually phased their sales and/or buying staff into collaborative forecasting. This leads us to our fourth guideline: initially target key companies and subsequently target the lower levels. Companies A and B began by targeting several key accounts, and company C began the process with one primary supplier. By initially focusing on key accounts, our respondents realized quick returns on their efforts in the form of performance improvement. Quantifiable, measurable improvement directly resulting from collaborative forecasting can be used to “sell” the concept to skeptical internal personnel as well as customers and suppliers. These initial results reinforce management’s commitment to the process and provide further incentive to expand the efforts with additional trading partners.

The fifth guideline suggests establishing regularly scheduled meetings with the sole purpose of discussing the forecast. Topics addressed during typical sales calls, such as negotiations over price, quantity, and shipping terms, are not to be discussed during the forecasting meeting. Conversation should address broader issues related to accurately estimating demand. The timing, accountability, and deliverables for each of these meetings should be clearly understood by both parties. However, these meetings are not the only time information exchange related to demand should take place. The sixth guideline suggests that firms determine an appropriate method of on-going, timely information exchange. For some firms, this may involve EDI or Internet linkages, for others it may include e-mail or telephone calls. Whatever the method chosen, the information exchange will be most beneficial if executed on a timely basis.

The final guideline is to create one single shared projection of demand between the trading partners. Developing separate forecasts duplicates efforts and undermines the potential benefits to be gained by collaborative efforts. Results from this research clearly illustrate that firms wishing to pilot collaborative forecasting efforts but unable to surmount the barriers to implementing CPFR can successfully adopt alternative methods resulting in increased responsiveness and product availability assurance, optimized inventory and associated costs, and increased revenues and earnings for both firms.

The findings from this research present theoretical implications as well. While intra-firm forecasting has received a great deal of attention in academic literature, theory on supply chain collaboration is in the early stages.

Collaborative forecasting presents an opportunity to contribute to this theory building effort and to extend theory on forecasting and its impact on entire supply chains.

Limitations and future research

Case study methodology is primarily qualitative; as such there are several limitations which must be acknowledged and addressed in future research. This study relied primarily on interviews with personnel from three companies as data. Theoretical relationships were derived from rich interpretations; however this inductive method is only used to build theory. The literature was used to provide support for the developed theoretical relationships, but validation is necessary. That must be accomplished through further empirical investigation using a research design for theory testing.

Sampling procedures also limit this study's contributions. This study relied on purposive theoretical sampling; therefore, findings cannot be generalized to large populations. The entire population of companies involved with collaborative forecasting did not have an equal probability of being selected as study participants. The sample consisted of a few carefully chosen managers within the three organizations known by the researchers to participate in interfirm collaborative forecasting. At the most limited level, the findings can be generalized to the supply chains of the study participants. Again, empirical investigation with a larger sample will address these concerns.

Our research was exploratory and needs to be taken to the next step to test and explain causal linkages, and thus internally validate the model. More companies, whether through additional case studies or quantitative surveys, should be examined. Although the three companies we studied are diverse and we believe the results to be analytically generalizable, additional companies' outcomes would provide more support for external validity. The research described here along with the literature could be used to develop measures for this phase of the research. Nonfinancial outcomes such as relationship quality that are not addressed in this study should be researched and added to the model to determine their effect on the operational or financial outcomes and corporate performance. Furthermore, due to the short-term nature of the collaborative forecasting efforts of our case studies (i.e. two to three years), the ability to maintain the improved performance outcomes should be explored in a longitudinal study.

In addition to completing the outcome portion of the model, studies should be conducted exploring the processes companies use to begin achieving collaborative forecasting. In other words, the front end of the model (or antecedents) needs to be added. Qualitative and quantitative methods can be combined to determine the relational and operational factors that need to be in place as well as any moderators or mediators to the process. Hypotheses can then be developed in order to test the overall model.

Improved forecast accuracy and reduced uncertainty have increased the quality of business decisions that are based on the forecast. Collaborating with

supply chain partners on one consensus forecast helps to improve this accuracy and reduce uncertainty. Companies that implement collaborative forecasting will likely achieve the benefits of increased responsiveness, increased product availability assurance, optimized inventory and associated costs, which are expected to lead to increased earnings and improved corporate performance.

References

- Ackerman, K.B. (2000), "CPFR – how it could change the warehouse", *Warehousing Forum*, Vol. 15 No. 10, September.
- Andraski, J.C. (1999), "Supply chain collaboration", *Food Logistics Website*, available at: www.foodlogistics.com/collaboration.html
- Barratt, M. and Oliveira, A. (2001), "Exploring the experiences of collaborative planning initiatives," *International Journal of Physical Distribution & Logistics Management*, Vol. 31 No. 4, pp. 266-89.
- Berry, L.L. (1995), "Relationship marketing of services: growing interest, emerging perspectives", *Journal of the Academy of Marketing Science*, Vol. 23 No. 4, pp. 236-45.
- Bitner, M.J. (1995). "Building service relationships: it's all about promises", *Journal of the Academy of Marketing Science*, Vol. 23 No. 4, pp. 246-51.
- Bonoma, T.V. (1985), "Case research in marketing: opportunities, problems, and a process", *Journal of Marketing Research*, Vol. 22, May, pp. 199-208.
- Bowersox, D.J. and Daugherty, P.J. (1995), "Logistics paradigms: the impact of information technology", *Journal of Business Logistics*, Vol. 16 No. 1, pp. 65-80.
- Burt, D.N. and Pinkerton, R.L. (1996), *A Purchasing Manager's Guide to Strategic Proactive Procurement*, Amacom, New York, NY.
- Burgin, S.W., Golicic, S.L. and McCarthy, T.M. (2000), "Leveraging collaborative forecasting to optimize supply chain performance", *Annual Conference Proceedings*, Council of Logistics Management, Oak Brook, IL, pp. 245-51.
- Citera, M., McNeese, M.D., Brown, C.E., Selvaraj, J.A., Zaff, B.S. and Whitaker, R.D. (1995), "Fitting information systems to collaborating design teams", *Journal of the American Society for Information Science*, Vol. 46 No. 7, pp. 551-9.
- Cooper, M.C. and Ellram, L.M. (1993), "Characteristics of supply chain management and the implications for purchasing and logistics strategy", *International Journal of Logistics Management*, Vol. 4 No. 2, pp. 13-24.
- Davis, F.W. and Manrodt, K.B. (1991), "Teaching service response logistics", *Proceedings of the Transportation and Logistics Educators Conference*, Ohio State University, Columbus, OH.
- Diehn, D. (2000/2001), "Seven steps to build a successful collaborative forecasting process", *The Journal of Business Forecasting Methods & Systems*, Vol. 19 No. 4, Winter, pp. 23, 28-9.
- Ellinger, A.E., Taylor, J.C. and Daugherty, P.J. (1999), "Automatic replenishment programs and level of involvement: performance implications", *The International Journal of Logistics Management*, Vol. 10 No. 1, pp. 25-35.
- Fildes, R. and Beard, C. (1992), "Forecasting systems for production and inventory control", *International Journal of Operations & Production Management*, Vol. 12 No. 5, pp. 4-27.
- Fornell, C. and Wernerfelt, B. (1987), "Defensive marketing strategy by customer complaint management", *Journal of Marketing Research*, Vol. 24, November, pp. 337-46.
- Girard, G. (1999), "How can we collaborate? Let me count the ways", *The Report on Supply Chain Management*, November, AMR Research Inc., Boston, MA.

- Haeckel, S.H. (1998), "About the nature and future of interactive marketing", *Journal of Interactive Marketing*, Vol. 12, Winter, pp. 63-71.
- Heinritz, S., Farrell, P.B., Giunipero, L. and Kolchin, M. (1991), *Purchasing: Principles and Applications*, 8th ed., Prentice Hall, Englewood Cliffs, NJ.
- Helms, M.M., Ettkin, L.P. and Chapman, S. (2000), "Supply chain forecasting – collaborative forecasting supports supply chain management", *Business Process Management Journal*, Vol. 6 No. 5, pp. 392-407.
- Ireland, R. and Bruce, R. (2000), "CPFR: only the beginning of collaboration", *Supply Chain Management Review*, September/October, pp. 80-8.
- Kalwani, M.U. and Narayandas, N. (1995), "Long-term manufacturer-supplier relationships: do they pay off for supplier firms?", *Journal of Marketing*, Vol. 59, January, pp. 1-16.
- La Londe, B.J. and Masters, J.M. (1994), "Emerging logistics strategies: blueprints for the next century", *International Journal of Physical Distribution & Logistics Management*, Vol. 24 No. 7, pp. 35-47.
- Lapide, L. (1999), "New developments in business forecasting", *The Journal of Business Forecasting Methods & Systems*, Vol. 18 No. 3, Fall, pp. 24-5.
- Lawless, M.J. (1990), "A forecasting approach to operating profit", *Journal of Business Forecasting*, Vol. 9, Summer, pp. 6-10.
- Leenders, M.R., Fearon, H.E. and England, W.B. (1985), *Purchasing and Materials Management*, 8th ed., Irwin, Homewood, IL.
- Logistics Focus* (1998), "Taking stock to keep customers happy", *Logistics Focus*, Vol. 6 No. 3, pp. 19-20.
- Makridakis, S. and Wheelwright, S.C. (1977), "Forecasting: issues and challenges for marketing management: a framework for relating the available techniques to specific situations", *Journal of Marketing*, October, pp. 24-38.
- Mentzer, J.T. (1999), "The impact of forecasting on return on shareholder's value", *Journal of Business Forecasting*, Vol. 18, Fall, pp. 8-12.
- Mentzer, J.T. and Biemstock, C.C. (1998), *Sales Forecasting Management*, Sage Publications, Thousand Oaks, CA.
- Mentzer, J.T., Foggin, J.H. and Golicic, S.G. (2000), "Supply chain collaboration: enablers, impediments, and benefits", *Supply Chain Management Review*, Vol. 4, September-October, pp. 52-8.
- Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), "What is supply chain management?", in Mentzer, J.T. (Ed.), *Supply Chain Management*, Sage Publications, Thousand Oaks, CA, pp. 5-24.
- Murdick, R.G. and Georgoff, D.M. (1993), "Forecasting: a systems approach", *Technological Forecasting and Social Change*, Vol. 44, August, pp. 1-16.
- Nix, N. (2001), "Customer service in a supply chain management context", in Mentzer, J.T. (Ed.), *Supply Chain Management*, Sage Publications, Thousand Oaks, CA, Ch. 13, pp. 347-69.
- Reese, S. (2000/2001), "The human aspects of collaborative forecasting", *The Journal of Business Forecasting Methods & Systems*, Vol. 19 No. 4, Winter, pp. 3-9.
- Reid, R.A. (1985), "How to set up a forecasting process", *Journal of Business Forecasting*, Vol. 4 No. 4, pp. 9-10.
- Smeltzer, L.R. and Siferd, S.P. (1998), "Proactive supply management: the management of risk", *International Journal of Purchasing & Materials Management*, Winter, pp. 38-45.
- Sriam, V., Krapfel, R. and Spekman, R. (1992), "Antecedents for buyer-seller collaboration: an analysis from the buyer's perspective", *Journal of Business Research*, Vol. 25, December, pp. 303-20.

- Stalk, G.H. Jr and Haut, T.M. (1990), *Competing Against Time: How Time-Based Competition Is Reshaping Global Markets*, Free Press, New York, NY.
- Strauss, A. and Corbin, J. (1998), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory*, 2nd ed., Sage Publications, Thousand Oaks, CA.
- Suleski, J. (2001), "Beyond CPFR: retail collaboration comes of age", *The Report on Retail Business*, April, AMR Research Inc., Boston, MA.
- Voluntary Interindustry Commerce Standards Association (VICS) (1998), "Collaborative planning, forecasting, and replenishment (CPFR)", available at: www.cufr.org
- Wilson, N. (2001), "Game plan for a successful collaborative forecasting process", *The Journal of Business Forecasting Methods & Systems*, Vol. 20 No. 1, Spring, pp. 3-6.
- Yin, R.K. (1994), *Case Study Research: Design and Methods*, 2nd ed., Sage Publications, Thousand Oaks, CA.

Further reading

- Bowersox, D.J., Mentzer, J.T. and Speh, T.W. (1995), "Logistics leverage", *Journal of Business Strategies*, Vol. 12, Spring, pp. 36-49.
- Mentzer, J.T., Bienstock, C.C. and Kahn, K.B. (1999), "Benchmarking sales forecasting management", *Business Horizons*, Vol. 42, May-June, pp. 48-56.