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Abstract

Supply chain integration (or synchronisation) is to a large extent still only a promise, despite many considerable efforts by organisations and their customers and suppliers. Lack of visibility of true consumer demand and collaborative relationships based upon joint decision making remain significant barriers to the goal of supply chain integration. Collaborative planning, forecasting and replenishment (CPFR) is a strategy which promises to overcome these barriers, and seeks through joint planning, joint decision making and the development of a clearer understanding of the dynamics of the supply chain replenishment process to deliver some of the promised benefits of actual supply chain integration. Despite the existence of a detailed and comprehensive process model, and promising initial results there has not been widespread adoption of CPFR, justifying the need to revisit the process model and to further explore the inhibitors and enablers. Based upon a review of the

existing literature and a comprehensive survey of participants in existing CPFR implementations, this paper identifies the critical inhibitors and makes some proposals as to how these inhibitors may be overcome.

Introduction

Since the early 1990s, there has been a growing understanding that supply chain management should be built around the integration of trading partners. Christopher (1998) proposes that "today's business is increasingly 'boundary-less', meaning that internal functional barriers are being eroded in favour of horizontal process management and externally the separation between vendors, distributors, customers and the firm is gradually lessening". Bowersox *et al.* (2000) state that firms collaborate in the sense of "leveraging benefits to achieve common goals".

Anthony (2000) suggests that supply chain collaboration occurs when "two or more companies share the responsibility of exchanging common planning, management, execution, and performance measurement information". He goes further by suggesting that "collaborative relationships transform how information is shared between companies and drive change to the underlying business processes". Whilst process integration has already received some attention over the last decade the real opportunity remains in terms of externally integrating with external trading partners (Bowersox *et al.*, 2000). Research carried out by Andersen Consulting, Stanford University, Northwestern University, and INSEAD, as reported in Anderson and Lee (1999), recommends that industry participants "collaborate on planning and execution" of supply chain strategy to achieve a "synchronised supply chain".

Blackwell and Blackwell (1999), suggest that "the battle commands of today are flexibility, speed, and productivity, all amplified by the winds of consumer demand". Continuing, they suggest that "the new competitive realities are causing suppliers, manufacturers, wholesalers, and retailers alike to rethink their strategic initiatives with their supply chain partners".

Literature review

The first robust initiative created to enable integration in the supply chain dates back to 1992, when 14 trade association sponsors, including Grocery Manufacturers of America and Food Marketing Institute, created a group named "Efficient Consumer Response Movement", or "ECR", with the purpose of leading an unprecedented transformation in business practices (Robins, 1994). Late in 1992, the ECR Movement issued a report suggesting optimum business practice for the management of the supply chain (Kurt Salmon Associates, 1993). Supply chain benefits could be achieved by excelling in four core strategies: efficient promotions, efficient replenishment, efficient store assortment and efficient product introductions (for a more detailed explanation please refer to Kurt Salmon Associates (1993) and Glinner (1997)). The report proposed, for the first time, the driving need to "develop a trust-based relationship between manufacturers and retailers (including suppliers and customers in general), with the sharing of strategic information in order to optimise overall supply chain results". Having this requirement outlined, the various sectors of the industry began to develop a number of techniques to make the ECR promise a reality.

Whilst ECR brings many potential benefits to both suppliers and retailers in terms of efficiency improvements, the biggest opportunity it presents is to enable real supply chain collaboration. By sharing information, it enables supply chains to become demand driven and in so doing, to deliver enhanced customer value. Therefore, ECR can be seen as an enabler of the drive towards an integrated supply chain.

A number of other collaborative-based initiatives are worthy of mention. Vendor-managed Inventory (VMI) and continuous replenishment (CR) are coexisting supply chain management techniques that, in different ways, try to deliver the promised benefits of ECR. As Cooke (1998) states, VMI is a technique developed in the mid 1980s,

whereby the manufacturer (supplier) has the sole responsibility for managing the customer's inventory policy, including the replenishment process. VMI is probably the first trust-based business link between suppliers and customers. Bernstein (1997) suggests that VMI "can only work if the supplier-retailer relationship is a partnership based on trust, with extensive sharing of information".

VMI was adopted by many companies in different business sectors and, according to Cooke (1998), two of the first companies to put the theory into practice were Procter & Gamble[1] and Wal-Mart, in the USA. This partnership gave impulse to the diffusion of VMI within the grocery sector, at a pace quicker than has been observed in other sectors (see also Peck, 1998).

When the ECR Movement was launched, many companies predicted that VMI, if properly managed, would lead them to excellence in the four areas as listed above. Although a few companies still maintain the traditional VMI-based relationship with their trading partners, many others have abandoned the practice and migrated to other supply chain management techniques. The major weakness of VMI lies in the insufficient visibility of the whole supply chain (Barratt and Oliveira, 2001). Point-of-sale (POS) data as well as the backroom inventory level data are disregarded whilst the replenishment process (and the inventory policy) is based in the variation of stock level in the customer's main warehouse or distribution centre (Cooke, 1998; Frantz, 1999).

Because of all these weaknesses, the grocery sector has to a large extent abandoned VMI and has led the search for alternative techniques. Neil Tall Associates (in Bernstein, 1997), suggest that VMI is not going to be the only way, not even the predominant way, but that VMI will be one of many methods employed in the search for greater supply chain efficiencies. Another of these many methods is the Continuous Replenishment Programme (CRP, or simply CR), which emerged as a business practice in early 1990s attempting to address and improve ECR's four core strategies (Andraski, 1994).

In terms of supply chain management, CR moves one step ahead of VMI and reveals stock levels in retailers' stores. For the first time, POS data is used to generate a sales forecast. The inventory policy is then based on the sales forecast, built from historical demand data and no longer purely based on the variations of inventory levels at the customers' main stock-holding facility. A process which is usually owned by the supplier, the CR practice allows the management of the supply chain at different levels (such as by product or by store), according to business needs. Some customers have made their POS data available to their suppliers who usually consolidate this information as a monthly pattern in comparison with the previous year and, based on that, try to predict future sales.

At the same time CR represents an innovation in relation to VMI practices. The process of creating the sales pattern and then predicting future events is also CR's major weakness. According to Joe Andraski, vice-president of customer marketing operations at Nabisco (cited in Andraski, 1994), "CR is usually done by a manufacturer, based on algorithms and history, but its ultimate success is dependent on the skill of the continuous replenishment analyst working with a particular account, whereas real forecasts need to come from the retailer".

Ralph Drayer, vice-president for ECR at Procter & Gamble (cited in Andraski, 1994), suggests that there is still a lot of excess inventory in the pipeline, even after CR. Although CR has provided a better approach to replenishment and product assortment processes, there is still a long way to go. In relation to promotion and new product introduction processes, there is still a clear gap between CR practices and ECR promises.

Collaborative planning, forecasting, and replenishment (CPFR)

Following its emergence in 1995, "CPFR has won the support of companies in the drug, grocery, general merchandise, and apparel industries" (Blair, 1998). According to Cooke (1998), in October 1995, five companies,

Warner-Lambert, Wal-Mart, SAP, Manugistics and Benchmark Partners, initiated the first CPFR project. Hill (1999) reported that this new business model, applied to Listerine products, improved in-stock availability from 87 per cent to 98 per cent, and reduced lead time from 21 to 11 days.

CPFR can be seen as an evolution from ECR and Uchneat (1999) reports that in 1996, a working group was formed to develop the initial vision of collaborative forecasting and replenishment (CFAR) and that in 1997, the vision was expanded to CPFR. In 1997, voluntary inter-industry commerce standards (VICS) created a sub-committee to develop CPFR as an industry standard. One year later, in 1998, VICS issued the first document on CPFR: "VICS CPFR Guidelines", which has been constantly updated since then (see www.cpfr.org, VICS 2000).

At the heart of the CPFR process is the aspiration to cover the gaps left by previous business practices (such as VMI and CR). With CPFR, several issues are more fully addressed for the first time, such as:

- the influence of promotions in the creation of the sales forecast (and its influence on inventory management policy);
- the influence of changing demand patterns in the creation of the sales forecast (and its influence on inventory management policy);
- the common practice of holding high inventory levels to guarantee product availability on the shelves;
- the lack of co-ordination between the store, the purchasing process and logistics planning for retailers;
- the lack of general synchronisation (or co-ordination) in the manufacturer's functional departments (sales/commercial, distribution and production planning);
- the multiple forecasts developed within the same company (marketing, financing, purchasing, and logistics).

Andraski (1994) reports that CPFR engages the manufacturer and the retailer into exchanging marketplace information in order to come up with a customer-specific plan that can substantially reduce inventory. Forecasts force sharing of promotion schedules, POS data, and inventory data and that enables shorter lead-times and integration between forecasting and replenishment processes (Frantz, 1999).

Drayer suggests (cited in Tosh, 1998) that CPFR provides a natural evolution from what started with continuous replenishment. He argues that the real power of CPFR is that, for the first time, demand planning and supply planning have been co-ordinated under a joint business-planning umbrella – a major advance. Doug Carolan, president and CEO, Associated Wholesalers Grocers, Kansas City (cited in Tosh, 1998), reports that the link with the retailer is going to become the key to understanding the replenishment cycle.

POS data is fed into a model based on a sequence of steps that is relatively free of human involvement. Several established rules (jointly agreed) are set and the whole process is managed by exception – in other words, unless something goes wrong, the system is prepared to read the (POS) data on-line and based on this information, plan the replenishment sequence in terms of the optimum size and time of delivery. One step ahead of CR, the CPFR process is now based upon consumer demand and results in unprecedented flexibility and agility across the part of the supply chain between the retailer and manufacturer.

Benefits of CPFR

CPFR's benefits have been extensively discussed in the literature (Robins, 1998; Zimmerman, 1998; Koloszyc, 1998; Cooke, 2001) and are considered as strong incentives for organisations to implement the concept to make the ECR promise come true.

Some of these benefits are: more predictable order cycles, reduced costs, more receiver-friendly loads, reduced product damage, smaller shipments, daily download of information, more frequent deliveries, accuracy of

information, shorter production runs, timeliness of information, delayed final production, information formatted to facilitate usage, increased customer service, availability of information, fewer stockouts, internal connectivity/compatibility, improved reliability of deliveries, information formatted on an exception basis, faster inventory turns, real-time information, reduced overstocks, external connectivity/compatibility and reduced inventory holding.

The adoption of CPFR

Several partnerships have been built around the CPFR process, as follows:

- Liz Clairbone and Dayton Hudson;
- Compaq and Trading Partners;
- Thomson Electronics and Retailers;
- New Balance and Selected Retailers;
- Timberland and Selected Retailers;
- Lane and Broyhill and Wickes;
- Schering Plough and Eckerd Drug;
- Johnson & Johnson and Eckerd Drug;
- Ford and Dealers;
- GM and Dealers;
- Subaru and Dealers;
- Kimberly Clark and Kmart;
- Hewlett-Packard and Wal-Mart;
- Lucent and Wal-Mart;
- Procter and Gamble and Wal-Mart;
- Sara Lee B. Apparel and Wal-Mart;
- Nabisco and Wegmans;
- Heineken and Distributors;
- Mitsubishi and Dealers;
- Sofamor Denek and Customers (Dion, 2000; Frantz, 1999).

This list gives an indication of the adoption of CPFR across different sectors of the industry. Additionally, according to Blair (1998) and Schenck (1998), the following companies have also joined the CPFR process: H.E.Butt Grocery, Super-value (Blair 1998); Nabisco, JCPenny, Federated Department Stores, Schnuck Markets, Levi's, Mead, Corning, Kodak, Pillsbury, Fiedcrest Cannon, Wegmans (Zimmerman, 1998).

A survey published in April 2000 by the *Progressive Grocer/Supermarket Business* shows that 80 per cent of the executives (US Grocer sector) plan to increase collaboration with trading partners in the following 12 months. The same survey indicates that 37 per cent of the retailers' executives plan to implement CPFR programmes while this percentage, among the wholesalers' executives is 45 per cent (Koloszyc, 1998).

According to Uchneat (1999), CPFR pilots are operating in the UK, Germany, Mexico, Belgium, The Netherlands, and the Philippines, driven by multinational companies and their international trading partners. Several pilots were planned and have been executed, with all of them reporting sound results and a promising future. However, the number of pilot results available in the public literature is much smaller than the number of companies involved with the CPFR process.

Gaps in the research

Although the results achieved from the various pilot implementations of CPFR have been readily available in the supply chain management literature, the authors have found very few results and little information on the following issues:

- Implementation of CPFR – identification of the key inhibitors and enablers.
- A practical guide to the implementation of CPFR.
- What information should be shared to create the visibility offered by the concept of CPFR?
- What business functions/departments should be involved in the CPFR process?
- Discussions about the feasibility of rollout programmes; although in Frantz (1999), four major obstacles are listed: scalability, trust and sharing by adversaries, change management, and getting critical mass.
- Discussions about the impact or need for the use of any software solutions in the various stages of the implementation processes (Barratt and Oliveira, 2001).

Research objectives

The next stage of the research was the completion of a survey of all 220 members of the VICS CPFR contact list. All of the respondents taken from the list were assumed to have at least a theoretical knowledge about CPFR, with the majority of the survey population based in the USA, where the CPFR process was developed and initially tested and where most work has been undertaken in CPFR.

The objectives of the survey were to examine the CPFR implementation process[2] in order to better understand the inhibitors and enablers identified during the implementation of the various CPFR pilots and roll-out projects, and to identify which stages of the process have not been fully completed. An additional objective of the survey is to identify those steps in the CPFR implementation process where the use of software is more critical and appropriate.

Research design

The research assesses the implementation of the various CPFR pilots and roll-out projects, identifying the strengths and weaknesses. Additionally, the survey identifies for which steps in the CPFR implementation process the use of software is more relevant. In order to cover the previously identified research gaps, the authors have developed the following set of objectives:

- based on the CPFR implementation process to identify which steps have not been properly or completely performed and which outcomes have not been fully achieved;
- to assess the importance of the use of software at each step.

Owing to geographical and time constraints, and due to the size of the population, the authors opted for a “self-administered” survey. A questionnaire was prepared and sent via e-mail to 100 per cent of the population to be studied (see copy of the questionnaire in the Appendix).

Pre-testing is an essential procedure in order to endorse whether or not a survey truly measures that which it is intended to measure. It is also important to validate the wording to avoid any misunderstanding that might lead the survey to a wrong conclusion. A group of 12 people (representing 5.4 per cent of the whole population to be tested) received the questionnaire in the pre-testing phase. Six respondents replied whilst the other six did not. The questionnaire structure was reviewed as well as the wording and the instructions. The questionnaire was re-sent to the same initial group of 12 people and all replied positively.

IDEF0 process mapping and the questionnaire

In order to develop the questionnaire, the authors revised the VICS CPFR guidelines. To facilitate this revision, the IDEF0 process mapping tool was adopted (Federal Information Processing Standards, 1993). The primary objectives of this process mapping standard are to:

- provide a means for completely understanding and analysing an organisation's data resources;
- provide a common means of representing and communicating the complexity of data;
- provide a technique for representing an overall view of the data required to run an enterprise;
- provide a means for redefining an application independent view of data which can be validated by users and transformed into a physical database design;
- provide a technique for deriving an integrated data definition from existing data resources.

Figure 1(a) illustrates the general structure of a IDEF0 process mapping. For each part of the process, it identifies the inputs, the mechanisms that make this part run (i.e. an SAP system), the controls that limit the process (i.e. the inventory policy and parameters), and the output. The output of a process can be input for a following process. Each process can be detailed (lower level of the diagram) as required. Other important features of this modelling technique are:

- incorporating a data modelling technique into a methodology;
- using a data modelling technique to manage data as a resource;
- using a data modelling technique for the integration of information systems;
- using a data modelling technique for designing computer databases.

The authors reviewed and remodelled VICS CPFR IDEF0's Maps for two reasons:

(1) to have a clearer understanding of each step involved in the CPFR process; and

(2) to have a clearer understanding of each output of CPFR process.

In this section, the authors used, as much as possible, the existing definitions published at VICS CPFR Guidelines (VICS, 2000). The reviewed version of the CPFR process mapping has four major sub-processes: issuing the front-end agreement, developing the joint business plan, managing sales forecast, and managing order forecast. These processes are illustrated in Figure 1(b).

Each of these sub-processes is formed by a number of activities (called steps). Each step has at least one input and one output. The whole CPFR process mapping (the four sub-processes together) has 26 functions and a total of 51 outputs[3].

CPFR survey results: respondent profiles

This section presents the results of the CPFR survey[4]. Figure 2 shows that most of the respondents have two to four years of experience of collaboration with trading partners. The broken line is a cumulative curve, beginning with "more than eight years" of experience in collaboration with trading partners – this curve shows that 77 per cent of the respondents have at least two years of this experience.

Figure 3 shows that 100 per cent of the respondents have at least a theoretical knowledge about the CPFR process. A total of 61 per cent have experienced at least one CPFR pilot and 97 per cent of the respondents have attended VICS CPFR meetings.

Data analysis

Each of the 51 outcomes of the CPFR process mapping was evaluated. Figure 4 shows the results. The “Yes” line (marked with a circle) represents the percentage of people that believe that each outcome has been fully achieved in previous CPFR experiences. The “No” line (marked with a triangle) represents the percentage of people that believe that the outcome has not been fully achieved, implemented, or executed. The “Blank” line (marked with a triangle) represents the percentage of blank answers given to each outcome. This “blank” percentage remained below 5 per cent for all steps.

The information illustrated in Figure 4 is divided into four sub-processes, as indicated by the vertical dotted lines. The analysis of these data is carried out separately for each sub-process. The sub-process of issuing the front-end agreement is illustrated in Figure 5. It involves the following steps listed in the process mapping: establish event codes (outcomes 1 to 3); establish trading partner profile (outcomes 4 to 9); establish miscellaneous code tables (outcomes 10 to 14); create front-end agreement (outcome 15).

The results outlined in Figure 5 indicate that several introductory activities (outcome 3 to 10, and 14) have not been properly performed. Two main barriers are identified in this sub-process, as follows:

(1) Step 2 (outcomes 4 to 9): establish trading partner profile; and

(2) Outcome 14: define forecast purpose.

Both of these barriers are considered as having low impact on the CPFR process, as it is more of a formal step than a practical one. This is based on the assumption that there is a lack of discipline from the trading partners in the initial stages of the CPFR implementation. The willingness to reach the practical stages may have reduced the attention to this preliminary phase. This result indicates that the final outputs of the CPFR implementation process might be altered. The planning phase is key to enable a long-term consistent process.

Outcome 20 (define event impact type), in the opinion of the respondents, has only been properly carried out for 70 per cent of the time. Although it does not necessarily impact on the outcome 26 (issue the Joint Business Plan), it may weaken the future design of the CPFR.

Managing sales forecast, illustrated in Figure 6, involves the following steps: create sales forecast (outcomes 27 and 28); define sales forecast (outcomes 29 and 30); identify sales forecast accuracy exception (outcome 31); identify sales forecast change exception (outcome 32); identify differences accuracy exception (outcomes 33 and 34); identify operational results exception (outcome 35); collaborate on sales forecast exception (outcomes 36 and 37); review forecast (outcomes 38 and 39).

The survey outlines strong points of concern. Although the sales forecast (point 30) has been issued on time, and accurately, for 94 per cent of the respondents, the performance of the points that represent the management of the exceptions and the sales forecast review (outcomes 31 to 39) are far too low. This shows that although the sales forecast has been initially issued as expected, there is a degree of difficulty to manage it through exceptions. These difficulties culminate in the poor performance of the last two outcomes of this sub-process: sales forecast revised (74 per cent, point 38), and adjustment reason document issued (71 per cent, point 39).

This poor performance might well affect the order management process, in particular the management of order reviews based on exceptions. Managing sales forecast exceptions and sales forecast reviews is seen as having a high impact on the CPFR process. This is the first operational stage of the CPFR process. If this process fails, the whole CPFR initiative will fail. This stage directly impacts on the order forecast and, therefore, the order generation. Outcomes 38 and 39 (Issue the adjustment reason document) is seen as having a high impact on the CPFR process as this is the tool for communicating the exceptions management and the forecast review for the

trading partners. If this document is not issued, the information flow stops. This is based on the assumption that the lack of control over this stage brings a complete unpredictability to the results of the CPFR initiative. The trading partners will start using safety tactics to protect their business and soon the whole process is a complete failure. Being the input for the order forecast, the sales forecast is ultimately responsible for an efficient replenishment cycle that ensures low inventory and high product availability.

Managing order forecast is illustrated in Figure 7. It involves the following steps: create order forecast (outcomes 40 and 41); define order forecast (outcomes 42 and 43); identify order forecast accuracy exception (outcome 44); identify order forecast change exception (outcome 45); identify order differences accuracy exception (outcome 46); identify order operational results exception (outcome 47); collaborate on order forecast exception (outcomes 48 and 49); generate the order (outcomes 50 and 51).

The survey outlines the same pattern discussed in *Managing Sales Forecast*. Although the results show that 90 percent of the order has been issued on time, and accurately (outcome 51), the outcomes related to the management of exceptions and reviews (44 to 49) has still a low performance. This bad performance is expected once the sales forecast review process has also achieved low results. *Managing Order Forecast Exceptions and Order Forecast Review* is seen as having a high impact on the CPFR process. This is the operational stage that precedes the order generation and, therefore, is the trigger to the replenishment process, which impacts the inventory level in the supply chain and the product availability in the stores. This is based on the assumption that the lack of control over this stage destroys any attempt to reach the benefits associated with the CPFR process. The demand signal, which becomes weaker as the sales forecast exception process is not properly managed, will now disappear if this sub-process is out of control.

Overall analysis

The key steps of the traditional process have an average of 92 per cent of “yes” (positive answers): issue sales forecast (outcome 29, 96 per cent); issue sales forecast on time and accurately (outcome 30, 94 per cent); issue order forecast (outcome 42, 92 per cent); issue order forecast on time and accurately (outcome 43, 85 per cent); order generated (outcome 50, 91 per cent); order generated on time and accurately (outcome 51, 90 per cent).

The results found in this section of the survey demonstrated that although the traditional process has been performed well, there is a clear difficulty in managing the exceptions and the review processes.

The outputs related to the management of exceptions and review performed around 70 per cent. The key outcomes are: sales forecast revised, 74 per cent (outcome 38), and order forecast revised, 65 per cent (outcome 48). These points are illustrated in Figure 8 with a broken circle around them.

Data analysis: the relevance of software to the CPFR process

Additionally, the respondents were asked to assess the importance of the use of a software package to properly perform each of the 26 described steps. The following scale was used: 1 = low, 3 = moderate, 5 = high. The results of this section of the survey, illustrated in Figure 9, shows a clear trend: the use of a software package becomes more important as the CPFR process goes to the *Management of Sales Forecast*, and becomes fundamental in the *Management of Order Forecast*. For the steps related to *Issuing Front-end Agreement* and *Issuing the Joint Business Plan* the average result found is only 2.90. As all agreement-phase relies on these steps, there is very little room for the introduction of any automated activity. For the sub-process *Managing the Sales Forecast* (steps 11 to 18), the average found in the survey is 3.95. For the sub-process *Managing the Order Forecast* (steps 11 to 18), the average found in the survey is 4.35. Special attention must be given to step 25 (*Review Order Forecast*), with 4.8 out of 5.0.

Conclusions and areas for further research

As described above, the central objective of this paper was to identify and evaluate the principal barriers to the CPFR implementation process. The initial goal was to gain a deeper understanding of collaborative planning forecasting and replenishment, including the following key areas: the implementation process for CPFR; and the inhibitors and enablers of CPFR.

Official reports have focused on the benefits achieved from CPFR implementations (see, for example, Robins, 1998; Zimmerman, 1998; Koloszyc, 1998) and leave out discussions about the difficulties found during the pilot phase and the main barriers for the rollout phase. This paper also sought to address this process hiatus by surveying a comprehensive group of supply chain professionals who had been involved with CPFR process development and implementation from the early stages in 1995.

Barriers to the CPFR process

The barriers to the implementation of the CPFR are those factors that limit trading partner's visibility of the supply chain. For example, if the POS data is not available or if it is available but is not used quickly, then this is a barrier to the CPFR process. The following barriers were identified during the literature review (LR) and the survey (S):

- Ineffective replenishment in response to demand fluctuations (LR).
- Ineffective planning using visibility of POS customer demand (LR).
- No shared targets, statistically set based on SKU level, demand variability at DC, optimum service levels among stores, and total supply chain capability and cost. Safety, cycle and anticipation components (and accountability) are recognised (LR and S).
- Trust and sharing by adversaries (LR).
- Difficulty to manage the forecast exception/review processes (sales and order forecast) (LR and S).
- Trading partner focuses on the traditional supply chain steps, not on the exception/review processes (LR and S).
- Promotions and new items events are not jointly planned (LR and S).
- Scalability and getting critical mass (LR).
- Measurement is not externally focused (LR).
- Forecasts are not clearly communicated throughout the supply chain (LR).
- Non-existence of an integrated decision support system to provide consumer, customer and market data (LR and S).
- Sufficient information technology is a major need for the forecast processes (LR and S).
- Corporate organisations are not aligned with key trading partners to maximise mutual regional/local objectives aligned to corporate strategies (LR).
- Trading partners are not working together to ensure consistent delivery performance (LR).
- Ongoing change management (LR).
- No evaluation of the different product flow alternatives; joint weekly sales and order forecasts are not communicated internally and do not feed production and replenishment processes (LR).
- Lack of discipline to execute preliminary (and preparatory) phases of the CPFR process (in particular, in the stages of issuing the front-end agreement and the joint business plan) (S).

Interestingly, most barriers have been identified in more than one phase of this thesis, which strengthens the validity of the conclusions. There are a group of six barriers identified in both phases of the research. It is important to note that ten of the barriers identified from the literature review could not be evaluated in the survey, due to its design. The barrier that was only identified in the survey is the "lack of discipline to execute

preliminary (and preparatory) phases of the CPFR process". This barrier was not identified in the literature review.

Enablers of the CPFR process

The first step the trading partners should take to enable the implementation of the CPFR process is to develop an adequate environment. This environment must be founded on two concepts: trust and technology. Such concepts can be considered to be co-dependent, in that the development of information technology interfaces between trading partners cannot be completed without the development of trust between the trading partners. Developing trust is a long-term objective for organisations, although it must start somewhere. A possible approach is as follows:

- *Define single point of contact for each trading partner*: this ensures that the information is neither lost nor deteriorates during its flow between the trading partners.
- *Define agenda for collaboration (short-medium-long term)*: stabilising the collaborative goals across the time.
- *Expand collaborative projects (scope and complexity)*: to gain critical mass, the CPFR initiative must expand its scope and complexity across time.
- *Ensure continuous sharing of information*: the need to keep continuous information flow is paramount.
- *Trust develops*: a real trust-based relationship will only prevail after a relatively lengthy period. Meanwhile, small barriers are removed from the path of the CPFR process, which brings confidence to the trading partners that their long-term vision is tangible.

In terms of expanding the scope of collaboration there are a number of possible alternatives, which represent incremental changes in a CPFR initiative. These alternatives are:

(1) expand the number of processes;

(2) increase the number of products;

(3) increase the level of detail;

(4) increase the product offering;

(5) automate the process;

(6) add trading partners; and finally

(7) integrate the results.

Other possible ways may be identified according to specific business needs.

Any long-term expansion of a CPFR initiative must be supported by a consistent IT development. Having developed a CPFR friendly environment and set about driving both step and incremental changes for the implementation of a CPFR initiative, the natural trend is to gain critical mass and embrace different segments of the business. The CPFR process can only then truly enable the supply chain integration.

Suggestions for further research

Owing to the relatively embryonic stage of the concept, most of the aspects vulnerable to criticism are associated with the lack of information and, therefore, demand further investigation and study.

(1) There is insufficient data about previous CPFR pilots, raising questions such as:

- Have all previous pilots been successful?
- If not, what was the cause of the setback to these initiatives?
- Which goals were set but not achieved?
- What was learnt?
- Several other questions remain unanswered and therefore, require further studies.

(2) The short period during which this paper was undertaken, avoided the evaluation of several medium to long-term aspects of the supply chain.

(3) This work has not explored the relationships aspects of the CPFR initiative; this is definitely a major issue to be addressed whenever CPFR implementation is evaluated. However, due to the huge scope of this theme, and due to the limited period of time available to undertake this paper, this area is left for a further and more comprehensive study.

Based on the previous list, a number of further studies can be proposed. These further studies can be divided into three categories:

(1) collecting more data;

(2) developing new or existing tools to evaluate data; and

(3) developing tools to share the learning on the CPFR implementation process.

Notes

1. Within P&G, VMI is referred to as supplier managed inventory (SMI).
2. For further details of the CPFR implementation process see the VICS CPFT Web site at www.cpfr.org
3. An illustrated version of the process mapping can be found at www.e-scrf.ac.uk – under “downloads”.
4. A full breakdown of respondent profiles can be found at www.e-scrf.ac.uk – under “downloads”

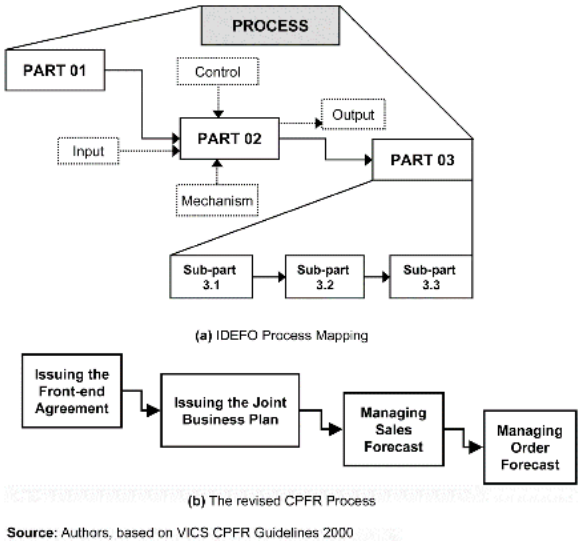


Figure 1. (a) IDEF0 process mapping and (b) the revised CPFR process

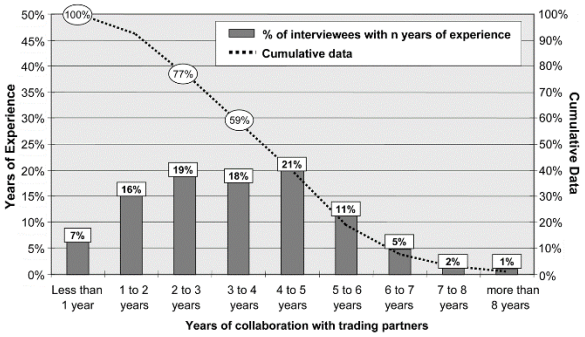


Figure 2. Respondents profile (1)

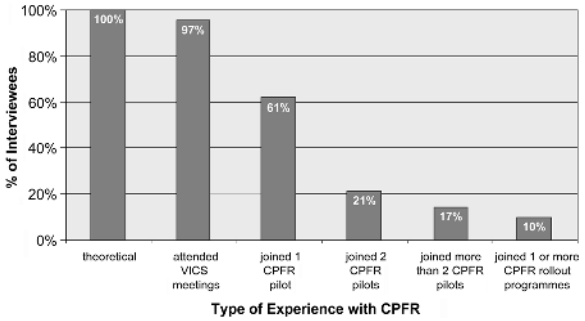


Figure 3. Respondents profile (2) – type of CPFR experience

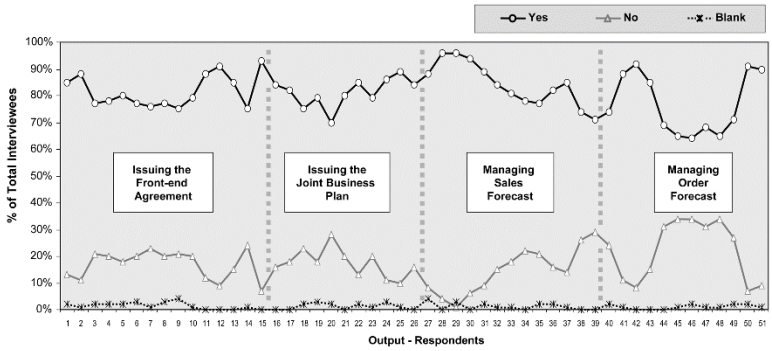


Figure 4. Overall survey results

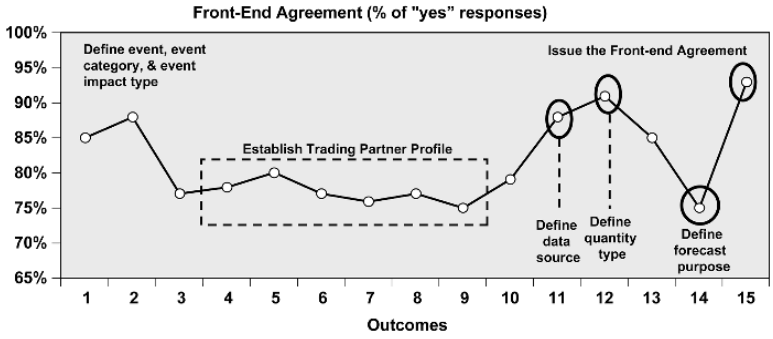


Figure 5. Issuing front-end agreement

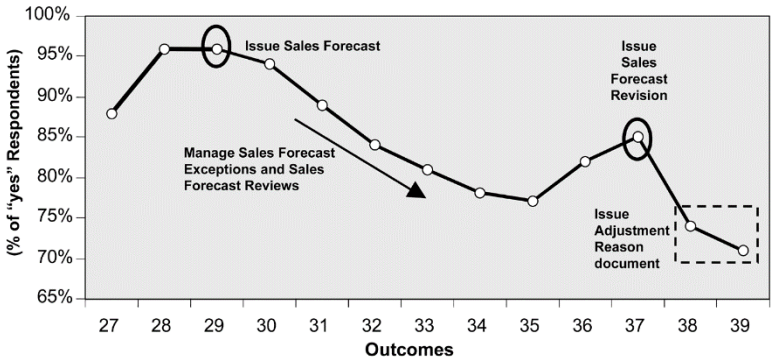


Figure 6. Managing sales forecast

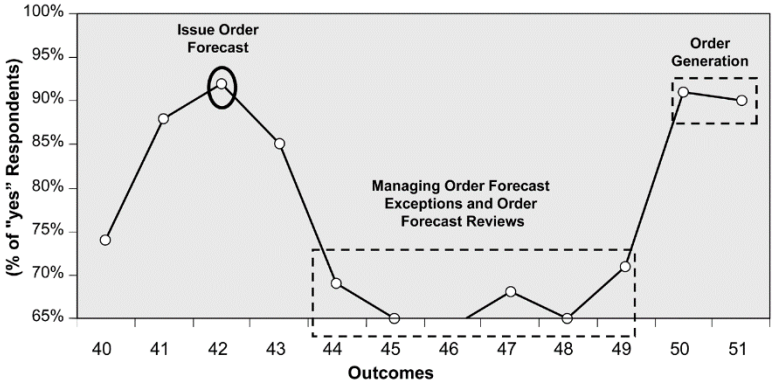


Figure 7. Managing the order forecast

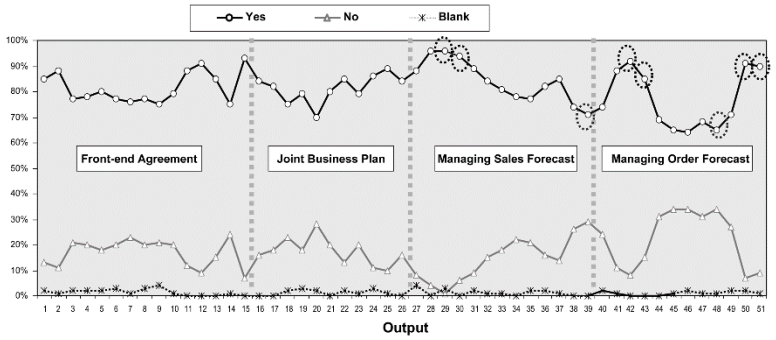


Figure 8. The traditional supply chain management approach

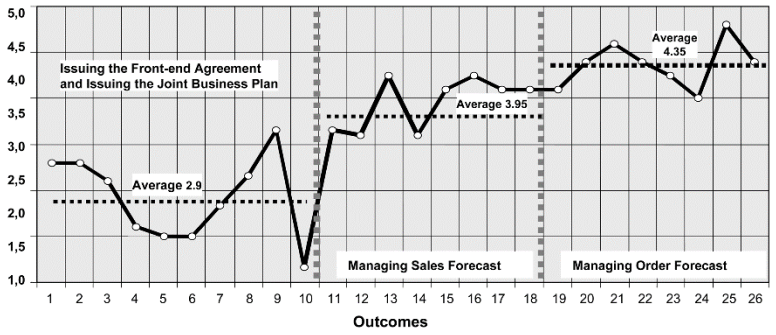
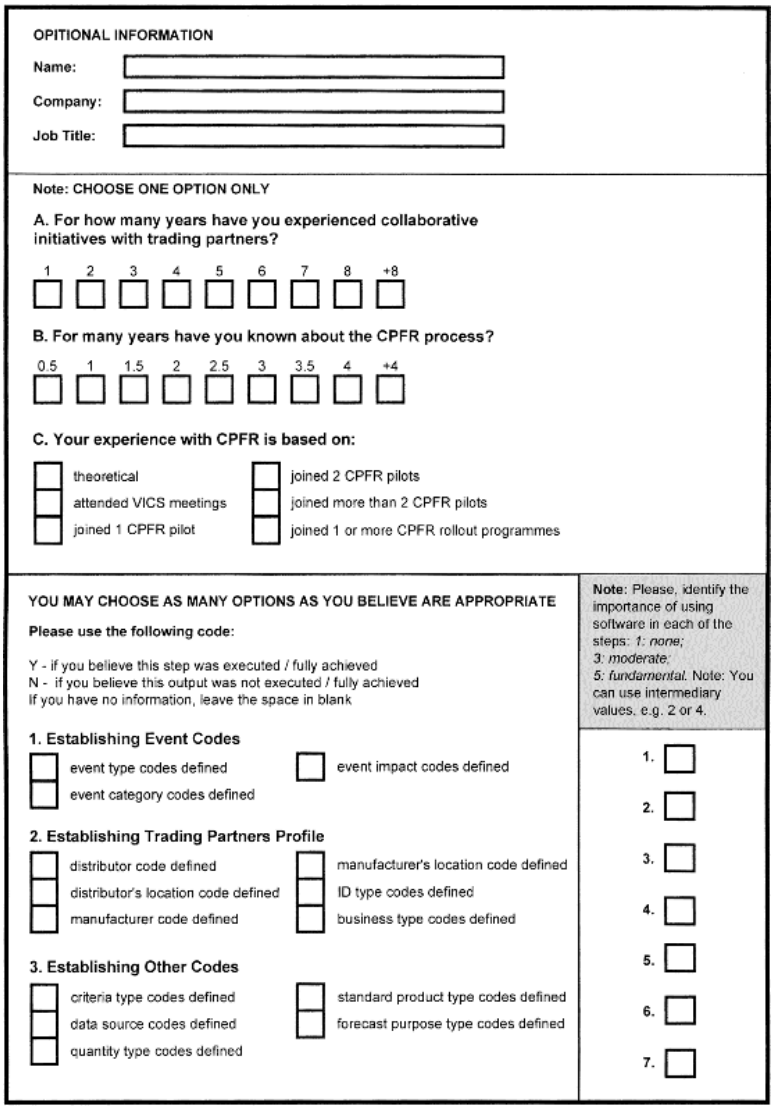


Figure 9. Importance of software to the CPFR process



OPITIONAL INFORMATION

Name:

Company:

Job Title:

Note: CHOOSE ONE OPTION ONLY

A. For how many years have you experienced collaborative initiatives with trading partners?

1 2 3 4 5 6 7 8 +8

B. For many years have you known about the CPFR process?

0.5 1 1.5 2 2.5 3 3.5 4 +4

C. Your experience with CPFR is based on:

- theoretical
- attended VICS meetings
- joined 1 CPFR pilot
- joined 2 CPFR pilots
- joined more than 2 CPFR pilots
- joined 1 or more CPFR rollout programmes

YOU MAY CHOOSE AS MANY OPTIONS AS YOU BELIEVE ARE APPROPRIATE

Please use the following code:

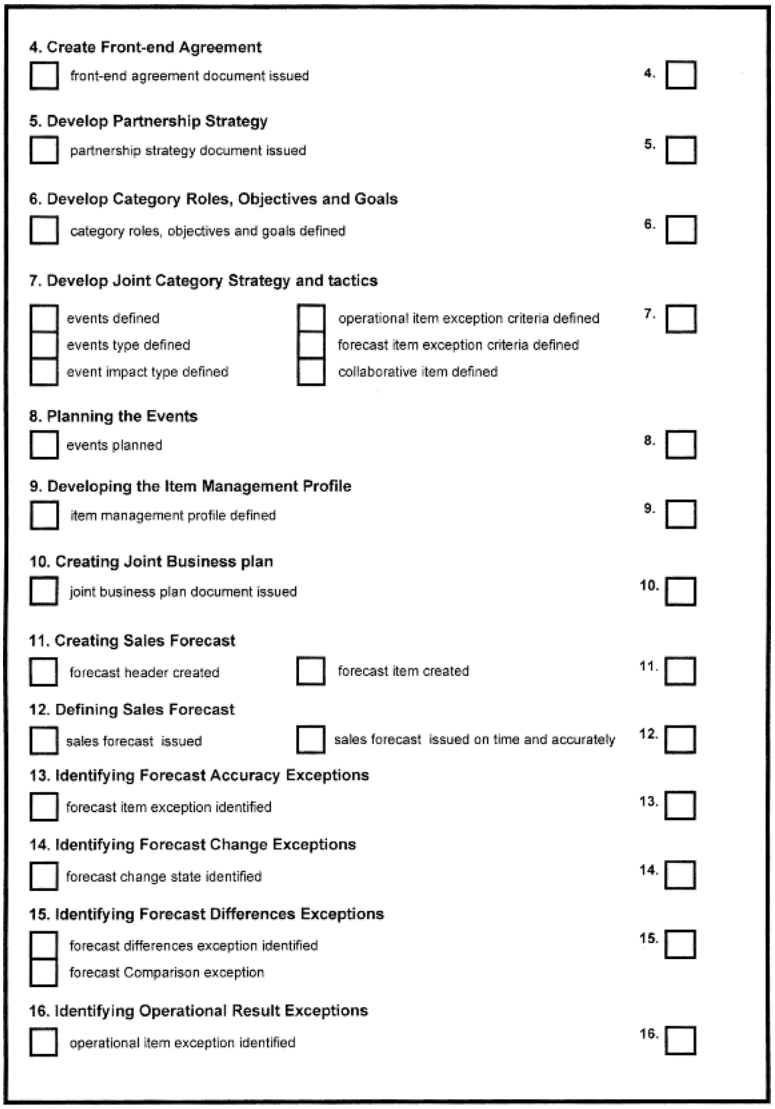
Y - if you believe this step was executed / fully achieved
N - if you believe this output was not executed / fully achieved
If you have no information, leave the space in blank

1. Establishing Event Codes
   - event type codes defined
   - event category codes defined
   - event impact codes defined
2. Establishing Trading Partners Profile
   - distributor code defined
   - distributor's location code defined
   - manufacturer code defined
   - manufacturer's location code defined
   - ID type codes defined
   - business type codes defined
3. Establishing Other Codes
   - criteria type codes defined
   - data source codes defined
   - quantity type codes defined
   - standard product type codes defined
   - forecast purpose type codes defined

Note: Please, identify the importance of using software in each of the steps: *1: none; 3: moderate; 5: fundamental.* Note: You can use intermediary values, e.g. 2 or 4.

1.
2.
3.
4.
5.
6.
7.

Figure A1.


4. Create Front-end Agreement
front-end agreement document issued
4.
5. Develop Partnership Strategy
partnership strategy document issued
5.
6. Develop Category Roles, Objectives and Goals
category roles, objectives and goals defined
6.
7. Develop Joint Category Strategy and tactics
events defined
events type defined
event impact type defined
operational item exception criteria defined
forecast item exception criteria defined
collaborative item defined
7.
8. Planning the Events
events planned
8.
9. Developing the Item Management Profile
item management profile defined
9.
10. Creating Joint Business plan
joint business plan document issued
10.
11. Creating Sales Forecast
forecast header created
forecast item created
11.
12. Defining Sales Forecast
sales forecast issued
sales forecast issued on time and accurately
12.
13. Identifying Forecast Accuracy Exceptions
forecast item exception identified
13.
14. Identifying Forecast Change Exceptions
forecast change state identified
14.
15. Identifying Forecast Differences Exceptions
forecast differences exception identified
forecast Comparison exception
15.
16. Identifying Operational Result Exceptions
operational item exception identified
16.
Figure A2.

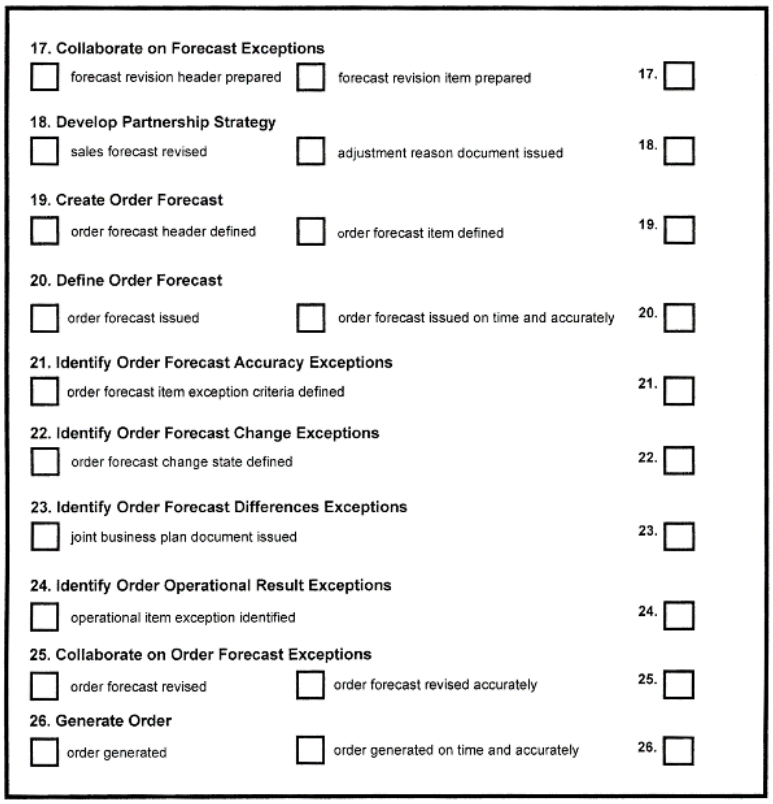


Figure A3.

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