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DEVELOPMENT OF MANUFACTURER-RETAILER RELATIONSHIPS THROUGH COLLABORATIVE MANAGEMENT: A CASE STUDY

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Nowadays enterprises are facing many challenges such as global competition and thin profits. Consequently, enterprises have changed their focus from cost reduction and quality improvement to quick customer response and innovative services. In recent decades, enterprises have developed advanced industry initiatives to improve efficiency by supply chain management. Effective supply chain management is not achievable by any single enterprise, but instead requires a virtual entity of integrated supply chain partners. They have the insightful commitment of real-time information sharing and collaborative management. Under such a circumstance, an initiative of collaborative management, Collaborative Planning, Forecasting, and Replenishment (CPFR), has recently been developed and implemented in the industry. In this paper, a case study of CPFR implementation in Rexon, Taiwan is conducted to provide a reference to other enterprises. Rexon's primary purpose of implementing CPFR is to strengthen its retail partnership, improve the accuracy of demand forecasts, and reduce inventory cost and other related operational costs.

Keywords: Supply chain management; collaborative management; CPFR.

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1. Introduction

Nowadays many companies are forced to improve operational efficiency, and to maintain globally competitive advantage by implementing supply chain management (SCM). SCM integrates and controls materials, funds, and related information in the supply chain process from the acquisition of raw materials to the delivery of finished goods to the end customers [Coyle *et al.* (2003)]. In the cooperative structure of supply chain, enterprises may need to purchase materials and components from suppliers, procure logistics services from third-party logistics providers (3PLs), acquire production capacity from original equipment manufacturers (OEMs), or buy information services from application service providers (ASPs). In such a business model, the trend of specialization among enterprises is growing ever noticeable and thus creates the need for enterprises to develop a collaborative management mechanism.

Supply chain collaboration allows enterprises to share information with their trading partners in order to reduce materials costs, inventory, shortages and expediting while improving customer satisfaction [Simchi-Levi *et al.* (2003)]. The efficiency and competition of global businesses are enormously dependent on the collaboration and coordination with their suppliers and customers [Hieber (2002)]. The actors along a supply chain work jointly in a collaborative management environment, where they follow common objectives, share undistorted information and possess mutual commitment. Meanwhile, they maintain the organizational autonomy of each single actor [Terzia and Cavalieri (2004)].

Most of the products manufactured in Taiwan are exported to the global business community. For Taiwan's enterprises, scarce resources, fierce global competition and rapid technological advancement in the global industry give rise to the need for effective supply chain in quality. In recent years, China has become the manufacturer for the world. Low production cost and standard technology have led to the emergence of thin profit. In the era of global logistics, the challenges facing Taiwan's enterprises include not only domestic competition but also the threats from foreign companies. Recently, one of the key issues to the survival of actors on the supply chain is effective integration into a virtual entity by breaking the enterprises' borders.

Recently, enterprises have detected that while customer demand does not fluctuate to a great extent, the upper-stream enterprises may overstate the variability, which is called bullwhip effect [Lee *et al.* (1997)]. The primary factors causing the amplification of variability include demand forecasting, lead time, order batching and price fluctuations [Simchi-Levi *et al.* (2003)]. The increase of variability on the supply chain forces the up-stream partners to maintain an overly high level of inventory. Although the demand radically fluctuates, inventory and shortages can be cut through information sharing and collaboration on the supply chain.

Supporting global logistics strategy, Taiwan's enterprises have developed supply chains that include not only domestic factories and warehouses, but also many trading partners including international manufacturers, transportation companies and distribution centers. Enterprises along the supply chain should collaborate to maximize the profit that can be gained by the enterprises themselves and by the

entire chain. Collaborative Planning, Forecasting, and Replenishment (CPFR) provides a Web-based collaborative standard to supply chain by which retailers and manufacturers can share such information as customer demand, forecasting method, and forecasting results through Internet [VICS (2002)]. By implementing CPFR, the strategic partners jointly plan and establish communication and coordination mechanism to solve any problems that may occur in interface between them. McCarthy and Golicic [2002] indicated that collaborative forecasting can bring in considerable improvement in company and supply chain performance including improved responsiveness, product availability assertion, decreased inventory and related costs, and increased revenues. Collaborative forecasting with supply chain partners has also been recognized as basis to CPFR.

CPFR defines the standards of collaborative operational process and information sharing in detail, which can help partners to effectively increase forecasting accuracy, and thus improve inventory control and management. CPFR with supply chain partners has been recognized as contributing to improved business performance. Recently, several American and European companies have implemented CPFR (see http://www.cpfr.org/) whereas only a few in Taiwan have introduced CPFR.

Under the influence of global collaborative management, Taiwan's enterprises have started learning and applying collaborative management. Rexon, a Taiwan-based corporation, is the first manufacturing company in Taiwan that introduced CPFR with its global retail partners. Therefore, in this paper, a case study of Rexon's implementation of CPFR with its strategic retail partners is conducted to explore the application of collaborative management, followed by post-mortem analysis of CPFR implementation.

This case study analyzes and discusses CPFR implementation by Rexon in various dimensions involved hoping to provide other enterprises a valid reference. The focus points of the analysis are exploring the background of introducing CPFR into Rexon, and understanding the process of CPFR implementation in Rexon. In this case study, the data are collected through interviews and interactions with Rexon's CPFR project team.

2. CPFR

2.1. *Concept of CPFR*

To share demand, forecasting and inventory information with suppliers and customers is the first step of supply chain coordination, and it can considerably improve supply chain operation and reduce cost. Thomas and Griffin [1996] classified supply chain coordination into three areas: buyer-vendor coordination, production-distribution coordination, and inventory-distribution coordination. The lack of coordination results in conflicts among the supply chain's actors responsible for supply, for production, and for distribution.

In recent decade, enterprises have developed numerous industry initiatives such as efficient consumer response (ECR), quick response (QR), and vendor managed inventory (VMI) to improve efficiency by integrating supply chain processes. There initiatives aim to create efficiency and effectiveness through integration of supply

chain activities and processes [Coyle *et al.* (2003)]. QR focuses on bettering the efficiency of the supply chain through inventory reduction. ECR is a time-based and customer-driven initiative for replenishment to increase consumer satisfaction and decrease cost through inventory visibility and quick inventory turn. In VMI, suppliers determine the proper inventory levels and inventory policies for retailers. VMI has two potential benefits of reducing bullwhip effect: One is reduced decision-making hierarchy, and the other is reduced delay in information transmission [Disney and Towill (2003)]. Suppliers should show that they can manage the entire supply chain through advanced information systems [Simchi-Levi *et al.* (2003)].

Collaborative Planning, Forecasting, and Replenishment (CPFR) is a recent initiative for supply chain integration and collaboration. CPFR includes a set of guidelines published by Voluntary Interindustry Commerce Standards (VICS) Association [VICS (2002)] to resolve the problems encountered in SCM for large retailers. Through a more advanced process of information sharing regarding sales plans, promotion campaigns, forecasts and inventory levels between trading partners, CPFR tries to improve the abovementioned industry initiatives. CPFR increases information visibility along the supply chain through information sharing among partners, significantly reduces the variability of the supply chain by collaborative forecasting and replenishment, and makes sure that products at appropriate price reach customers in right quantity at right time.

The recent SCM research [e.g. Gunasekaran *et al.* (2004)] reveals that effective SCM can improve customer service and reduce cost. From the survey conducted by Gunasekaran *et al.* [2004], most of the respondents affirm that effective SCM can generate financial benefits and enhance market share. In the recent SCM initiatives, Richard [2001] believed that CPFR can help retailers' promotion fit manufacturers' replenishment better. The survey conducted among the consulting firms in industry directory shows that 120 companies who have implemented CPFR have reduced inventory by 10% on average and increased the accuracy of forecast by 20%.

In global logistics, enterprises without collaborative schemes will be marginalized and thus lose their competitive advantage. Parks [2001] also pointed out that CPFR can successfully improve the cooperative relationship between retailers and manufacturers and produce significant benefits, for instance, decreased errors in forecasting and better allocation of inventory. In addition to improving the relationship with customers, CPFR can also provide some typical benefits from implementation, for instance, increased profitability, reduced inventory level, shortened cycle time, more efficient transportation planning, decreased shortage, better promotion planning, and improved customer service [McCrea (2003)].

2.2. *CPFR process*

In CPFR, the complete collaboration process is divided into three stages: planning stage, forecasting stage, and replenishment stage [VICS (2002)], and these three stages are further divided into nine steps based on functions. The selection of steps in collaborative process depends on the capability of partners, role of supply chain, and information source. Moreover, the frequency of CPFR can be determined in

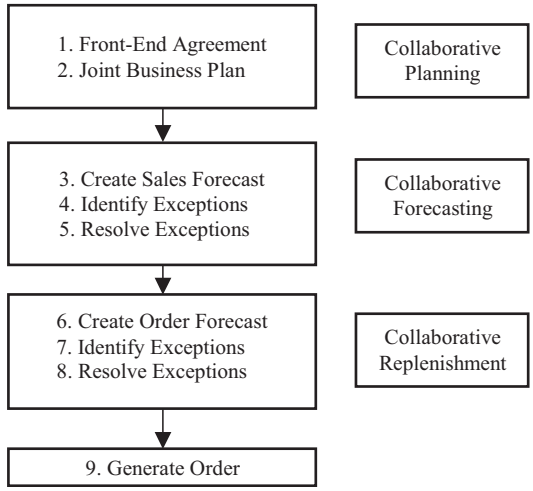

Fig. 1. CPFR process model [VICS (2002)].

individual cases. CPFR's basic process flowchart is shown in Fig. 1 [VICS (2002)]. The nine steps are illustrated as below:

Step 1 — Create front-end agreement

The retailer and the manufacturer agree upon implementation principles and related stipulation to establish a collaborative relationship, and thus enter into a Collaboration Agreement. The future collaborative relationship between the two parties is developed on the basis of Collaboration Agreement.

Step 2 — Create joint business plan

The two participating parties agree upon replenishment strategies, communicate managing strategies and operational plan, share operational goals and strategies at various stages, and jointly develop partnership strategies and cooperation plan. The joint business plan built upon shared information can improve the quality of forecasting, and strengthen the communication and coordination between collaborative partners along the supply chain.

Step 3 — Create sales forecast

At this step, shared demand information is used to support sales forecast. Sales forecast is usually first created by either the retailer or the manufacturer, and then communicated to the other party. After coordination, the resulting sales forecast becomes the common guidance for mutual subsequent order forecasting.

Step 4 — Identify exceptions for sales forecast

This step focuses on identifying the products that do not satisfy the criteria in sales forecast. These criteria are determined by comparing order forecast and supply

capacity, from which, a list of exceptions is derived. Exceptions for sales forecast can be identified through determined mutual sales conditions; for example, retail inventory and sales forecast accuracy.

Step 5 — Resolve/collaborate on exception items for sales forecast

This step involves resolving sales forecast exceptions by querying shared data, email, telephone conversations, meetings, and so on and submitting any resulting changes to the sales forecast. The increased real-time collaboration enabled by CPFR fosters effective joint decision-making between the retailer/distributor and the manufacturer and increases confidence in the eventual committed order.

Step 6 — Create order forecast

This step integrates the sales forecast, promotion performance information, inventory strategy, historical data of shipment, and current production capacity constraints obtained from Step 3 and generates order forecast to support demand forecast for sales and the joint business plan created at Step 2. The short-term use of order forecast is to generate orders while the long-term application exists in planning.

Step 7 — Identify exceptions for order forecast

This step is similar to the step of identifying exceptions for sales forecast. Exception items for order forecast are explored based on mutually determined conditions, for example, the service level of manufacturers to retailers and order fill rate.

Step 8 — Resolve/collaborate on exception items for order forecast

Similar to the step of resolving/collaborating on exception items for sales forecast, this step involves the process of investigating order forecast exceptions through querying of shared data, email, telephone conversations, meetings, and so on and submitting any resulting changes to the order forecast.

Step 9 — Generate order

This step converts order forecast into committed order. Whether the retailer/distributor or the manufacturer creates the order depends on the capability, system, and human resources in place to carry out this step. No matter who generates the order, the focus is that the quantity of this committed order must meet the forecast.

The steps embraced in the collaboration between partners can be decided by mutual discussions. The retailer or the vendor will play a leading role in sales forecast, order forecast, and order generation in CPFR model after collaborative operation is established. The leading party is determined by capability, resources, and information system. Therefore, CPFR process model can be divided into four scenarios of A, B, C, and D, as shown in Fig. 2.

Scenario	Sales forecast	Order forecast	Order generate
Scenario A	Buyer	Buyer	Buyer
Scenario B	Buyer	Seller	Seller
Scenario C	Buyer	Buyer	Seller
Scenario D	Seller	Seller	Seller

Fig. 2. Key CPFR scenario lead role [VICS (2002)].

Scenario A stresses replenishment order management, where the retailer leads forecast and order generation. In Scenario B, the retailer leads demand planning. In this scenario, VMI is applied and the vendor is responsible for order generation. In Scenario C, the retailer is responsible for forecasting. In Scenario D, the vendor leads demand forecast and order generation.

3. The CPFR Case

3.1. *Rexon's background*

Rexon is headquartered at Dalih Industrial Park, Taichung County, Taiwan. Although Rexon is a mid-sized company in Taiwan, it has offices or manufacturing factories in the US, UK, Japan, Germany, France, and China, with a complete vertically integrated system. Rexon is a manufacturer of power tool and fitness, and it supplies more than 300 product items to more than 70 countries around the world. Rexon emphasizes on product research and development, quality, and innovation.

Recently, Rexon is devoted to introducing e-business system including SAP ERP system, collaborative product comment (CPC) system, balanced scorecard (BSC), business process improvement (BPI), change management (CM), enterprise information portal (EIP), and BSC-performance management (BSC-PM) aiming to increase its global competitiveness.

Before CPFR was introduced, Rexon's forecast and order generation were led by its retailers. Since the information and process of both sides had not been effectively integrated, Rexon did not build production planning according to actual customer demand, and thus was unable to quickly respond to customer demand and resulted in excessive operational costs. The replenishment process that Rexon had before CPFR was introduced is illustrated as follows (refer to Fig. 3):

(1) Retail partners send orders to Rexon's customer managers in the US, through electronic data interchange (EDI);
(2) Customer managers check the production capacity, shipment schedule, and raw materials of Taiwan Rexon by email or fax;
(3) Customer managers reply to retail partners with the quantity to be delivered and shipment date;

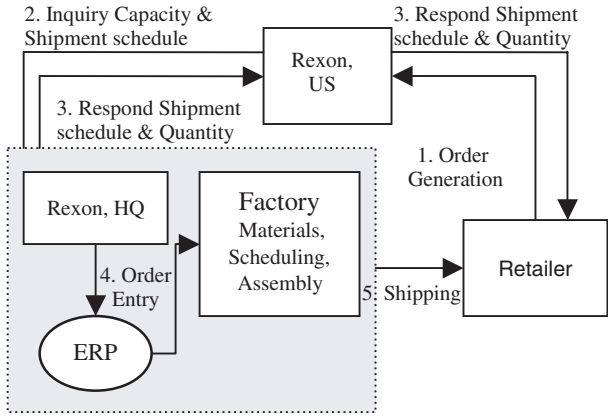

Fig. 3. Rexon's previous process.

(4) After Rexon enters order information into ERP system, manufacturers start set up materials, arranging workflow, manufacturing, and delivery;
(5) Free on Board (FOB) delivery is adopted; therefore, the retailer arranges shipment after the goods have passed over the ship's rail.

Before CPFR was introduced, the lead time for Rexon to set up materials was as long as a month. Overstock of parts and components occurred often. Inaccurate forecast and uncertain demand usually caused excessive safety stock by Rexon in North America.

3.2. *The CPFR plan*

In 2001, Rexon started its plan of "strategic partnership collaboration system" and CPFR implementation. In 2003, its retail partners proposed CPFR implementation. The reason for Rexon to implement CPFR is that the demand in North America shows significant seasonality. During sales peak season from August to October, demand increases drastically, which requires Rexon to expand production capacity, whereas during off-peak season, excess production capacity occurs, which results in problems with employee and product line allocation.

Under such a circumstance, Rexon needs more accurate demand forecast to effectively solve the capacity-balancing problem facing the manufacturers in Taiwan and to promptly meet customers' requirements. Furthermore, Rexon expects to enforce its collaboration relationship with retail partners and reduce inventory cost and other related operational costs incurred by both parties through CPFR. Using CPFR as the basis for corporate restructuring, Rexon also hopes to lift the barrier for other competitors to enter the market.

Figure 4 schematically illustrates the supply chain of Rexon. From this figure, the lead time of raw materials procurement at Rexon takes longer than one month, hence, in order to reduce the lead time, more inventory of materials is required. In addition, its retail partner requests that Rexon build a warehouse for safety stock in North America to avoid shortage under uncertain demand. The request

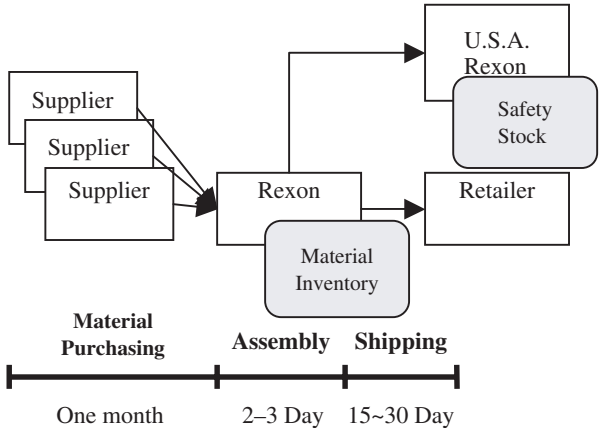

Fig. 4. The architecture of Rexon's supply chain.

increases Rexon's inventory of final products. On the other hand, its retail partner may stack up stock in the store due to inaccurate forecast. Based on the above, both Rexon and its retail partner respond to the uncertainty embedded in demand by increasing inventory level. The problem can be resolved effectively by CPFR.

The objectives of Rexon's CPFR project are as below:

(1) To apply CPFR mechanism to reduce inventory cost and shortage cost, increase return on investment (ROI), as well as improve;
(2) To increase the accuracy of sales and order forecasts to improve productivity and customer satisfaction;
(3) To meet international collaborative business process standards, improve strategic partnership and customer loyalty, and increase competitive advantages.

3.3. *The CPFR scope*

The scope of Rexon's collaboration covers six product categories. The planned implementation covers all the chain stores of its retail partner in the US, Rexon, Taiwan and Rexon, US. Its retail partner provides the information of Point of Sale (POS) at distribution centers in all areas, and coordinates the operations based on the inventory and shipment information provided by Rexon's SAP ERP system.

Rexon's CPFR project team is comprised of project committee, CPFR project group, and consultants (as shown in Fig. 5). The responsibilities and functions of all team members are described as below:

- **Project Committee**
  The committee is responsible for the overall project collaborative process including project monitoring and control, BPR (business process re-engineering) critical decision-making, and establishment of key performance indicators (KPIs) and reward system.

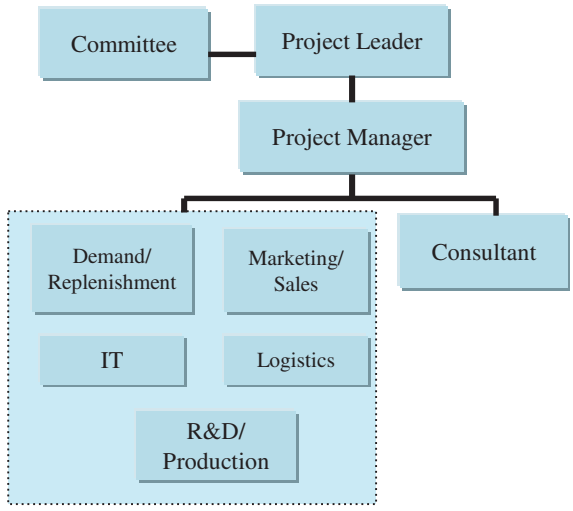

Fig. 5. Rexon CPFR project team.

- **Project Leader**
  The project leader is responsible for the planning and analysis of both previous and new processes of demand planning, forecasting, and replenishment. Additionally, the leader communicates with retailers in the US, on project implementation for consensus on promotion/demand planning, sales/order forecast, and inventory management.

- **Project Manager**
  The project manager is responsible for control of project implementation quality and time, communication and coordination with all departments concerned. He also assists in analysis of related previous and new operational processes engaged in the project to serve project collaborative operation process.

- **Marketing**
  Marketing assists consultants with process planning, promotes the introduction and implementation of new sales process.

- **Sales Management**
  This department is responsible for implementation of new sales process.

- **Demand Planning/Replenishment**
  It drives the introduction and implementation of new demand planning and replenishment planning processes, for example, integrated process of demand planning and sales forecast for new products, replenishment planning process.

- **Research and Development**
  It drives the introduction and implementation of new product research and development and sales forecast process, for example, product development process.

- **Production**
  It encourages the introduction and implementation of capacity balancing process, for example, the process of converting demand forecast to production plan.
- **Logistics**
  It assists in the implementation and promotion of order fulfillment, replenishment, and inventory management.
- **Information Technology**
  It focuses on project and system integration including SAP ERP system and the US, retailer collaboration system.
- **Consultants**
  Consultants conduct CPFR process analysis including assessment at preparation stage, procedures, data to be shared, and the cycle and frequency of collaborative forecast.

3.4. *The collaboration scenario*

At the initial stage, Rexon and its retailers will select Scenario A to introduce collaboration (as shown in Fig. 2), in which, the retailers lead order forecast, replenishment forecast, and order generation for collaborative products. However, Rexon hopes to run collaborative operation in Scenario B after the implementation for a certain period of time. In other words, the leading role in the order generation will be shifted to Rexon by applying the VMI model. As Rexon is responsible for the inventory planning and replenishment policies of retailers, on one hand, Rexon's production capacity planning becomes smoother. Demands for some categories of Rexon's products are seasonal; however, production capacity can be aggregated through better planning and forecasting. On the other hand, retailers' trust in Rexon will increase and the entry barrier for other competitors will be raised.

3.5. *The CPFR procedures of Rexon*

In developing CPFR operational process, Rexon and its retailers first completed business process mapping, through which, both parties gained better understanding of each other's business process and concluded with an integrated process. The predetermined collaboration period is one year, which will be adjusted basing on the frequency of sales forecast and order forecast. The following is the collaboration process after CPFR was implemented (refer to Fig. 6):

(1) The frequency of sales forecast is once a week, determined by the retailer according to the calculation of POS systems at various distribution centers in the US Sales forecast is then transmitted to CPFR sharing platform and received by Rexon for subsequent planning of production and shipment.
(2) The frequency of order forecast is once a week. Rexon shares the information of inventory at headquarter, inventory and shipment schedule at North American office, and sales forecast provided by SAP ERP system. The retailer provides sales forecast, inventory at distribution centers, and store inventory. Then both parties generate order forecast based on the information above.

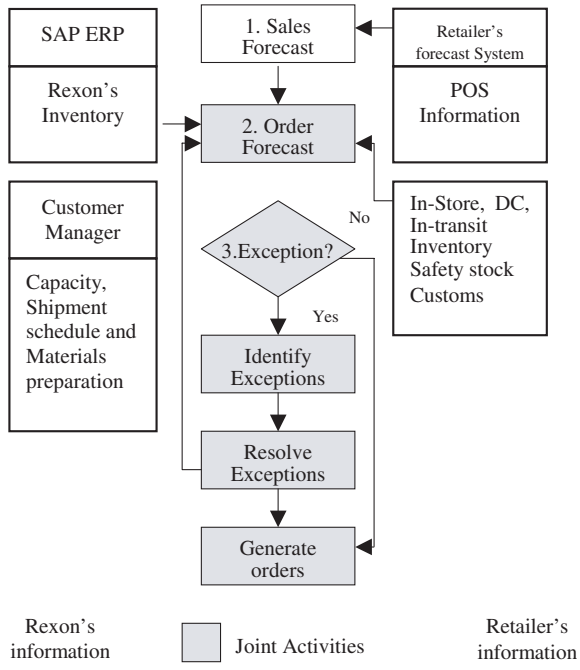

Fig. 6. Rexon's CPFR procedure.

(3) If the forecast variability from both sides falls within the acceptable range of exceptions, replenishment is then done on the basis of forecasted order. Otherwise, CPFR sharing platform will automatically generate warnings of exception for a joint solution by both sides.
(4) After receiving the exception warning, both sides will decide if coordination in order forecast by phone or conference is required based on order forecast variability. In addition, the adjustments will be used as historical data in future order forecast.
(5) The predetermined period when forecast is locked is ten weeks since Rexon requires lead time to set up production and shipment schedule. During this period, order forecast is converted into actual order and the order agreed upon cannot be further modified. This allows Rexon to freely set up materials, schedule production, and arrange shipment, with committed order, and thus reduce any additional waste of time and money.

3.6. *Information system deployment model*

The information model between Rexon and its retailer is hub-and-spoke structure (as shown in Fig. 7), in which collaborative information is handled through third-party transaction platform. In the future, AS2 [VICS (2002)] will be used as the standard of information transmission. This platform can gather the information between the different internal systems of both sides. In such a structure, both sides

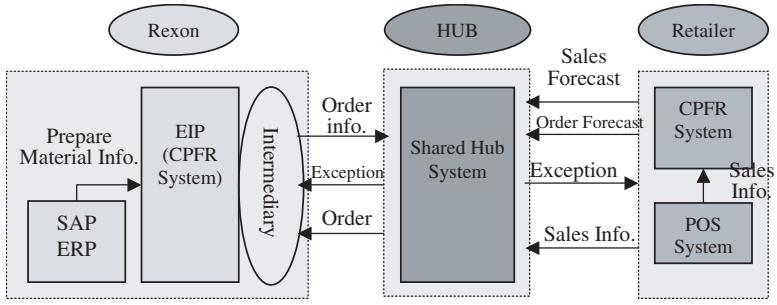

Fig. 7. The hub-and-spoke information Model.

can easily get into the shared platform through the Internet to check inventory and operational performance, as well as modify business rules or event management function.

In the near future, Rexon will use intermediary software to automatically transmit the information from shared platform to Rexon's information portal (EIP). Moreover, Rexon will apply EIP as the collaborative system to handling forecast information, sales information, inventory, and exception items. Through such a shared platform, the increased visibility to information between each other will certainly position both parties for more appropriate decision-making in replenishment planning.

4. Managerial Implications

4.1. *Implications in CPFR implementation*

Rexon expects to increase forecasting accuracy through CPFR to reduce the overall inventory level among strategic partners, and set up materials in advance based on joint plan to reduce lead time and thus more quickly respond to customer demand. Furthermore, Rexon uses CPFR implementation as the foundation for restructuring in order to raise the barrier for competitors to enter the market. The managerial implications drawn from CPFR implementation by Rexon include the following three points:

(1) *CPFR is a standardized but flexible process*

The earlier industry initiatives such as QR and ECR primarily focus on information sharing, but not on collaboration. CPFR clearly defines collaboration process among strategic partners. Even though CPFR is a standardized process, it still maintains operational flexibility, for example, forecasting hierarchy, scenario selection, and concrete steps of the process, etc.

Taking Rexon for example, after collaboration was undertaken for a period of time, Scenario A was overwritten by Scenario B where the responsibility of order forecast and order generation was removed from retailers and given to Rexon. It shows the orientation towards the replenishment model of VMI. This meant a significant breakthrough to Rexon's supply chain operation.

Before implementing CPFR, Rexon's production was not planned according to actual customer demand due to the lack of information or information distortion. Additionally, Rexon does not have the information of retailers' promotion or seasonal effects. Once demand swings, the resulting duplicate orders and last-minute order cancellation cause increase in surplus inventory, persisting shortage, and thus raise of inventory holding cost, warehousing cost and shortage cost.

(2) *CPFR provides in-depth information sharing*

Most of the enterprise's internal information is usually considered as confidential business data; consequently, enterprises are usually reluctant to share the information with partners. However, in CPFR business model, both parties engaged share real-time sales and inventory information to enable enhanced collaboration.

In such a collaborative system, Rexon had access to its retail partners' POS sales data and the inventory information of distribution centers. Based on the information, Rexon was able to increase forecasting accuracy to realize effective production arrangement and efficiently respond to customer demand.

(3) *CPFR encourages effective collaboration*

Enterprises used to guide their operations by maximizing their own profit and minimizing their own inventory. However, in an integrated supply chain operation, enterprises must develop close collaborative relationships between each other to maximize the profit of the overall chain and minimize the inventory of chain as a whole with joint efforts, emphasizing on the concept of "chain thought" in the integrated system.

In the power tool and fitness manufacturers like Rexon, in addition to the efforts on improving quality and research and development, tight collaboration with retailers is required to improve performance and to increase earnings. It should include not only data exchange, but also further collaboration to enhance the strategic relationship with retailers and thus raise entry barriers for competitors. Most enterprises in Taiwan are OEMs or export-oriented. Rexon's experience of CPFR implementation provides the industry a good reference.

(4) *CPFR KPIs monitor the integrated performance*

The main purpose of KPIs is to evaluate the overall CPFR process of Rexon and its retailers, and keep track of the overall performance of the project. Furthermore, appropriate plans and decisions can be made based on the analysis and assessment of indicators. KPIs are a result of joint selection by partners concerned. Rexon's KPIs include inventory level, forecasting accuracy, service level and mutual profit.

After the implementation of CPFR, Rexon's order cycle time has been significantly cut down from one month to three weeks, and the inventory level is reduced by 40%. Since production capacity is appropriately aggregated through better planning and forecasting, the production-leveling ratio (overtime labor cost/direct labor cost) is reduced by 10%. Rexon is currently evaluating the collaborative management with its partnership manufacturers. The expectation is to develop CPFR of

dual-circle and three-tier (supplier-manufacturer-retailer) to achieve effective integration of upstream and downstream vertical value chain. This CPFR system can not only meet market demand and new product development but also satisfy customer needs more rapidly, and thus create a win-win-win situation for Rexon, its retailers, and consumers.

CPFR can not only reduce lost sales and inventory as well as increase forecasting accuracy, but also create the link to retail POS data, price, advertisement, and timing of promotion. Rexon was able to understand and learn how its retail partners plan and promote their brands through CPFR, which in turn helped strengthen the managerial basis of Rexon's Own Branding and Manufacturing (OBM).

4.2. *Difficulties in CPFR implementation*

The critical success factor of CPFR implementation is the effective integration of employees, processes and information technology. Meanwhile, Rexon encountered many difficulties in introducing CPFR.

With regard to information technology, system deployment can be peer to peer (P2P) or hub and spoke. Rexon's initial design was direct connection to collaborative data with its retailers through P2P. However, its retailers have a wide array of vendors. Considering interface and system complicacy, both parties decided to adopt hub and spoke for system deployment. The drawback of hub and spoke is that more human involvement is required to handle such collaborative operations as sales and order forecast exceptions since information is stored in shared platform system.

However, in order to increase operational efficiency and expand the implementation of CPFR in the future, Rexon decided to add a middle ware that enables Rexon to receive exception information automatically. The information transmission from shared platform to Rexon's middle ware created extra expenses related to the use of shared platform.

Employees had more or less resistance inevitably due to concerns with position replacement resulting from new technology, increase in workload, discomfort with process innovation, and learning new technology. Therefore, appropriate education and training must be provided through effective internal communication to help employees understand the operational process, benefits, and working model of CPFR.

5. Conclusions

In recent years, an increasing number of enterprises in the world have implemented CPFR. With latest practices by enterprises and continuous improvement, CPFR will grow to be more complete and its applications will expand. Based on the case study of Rexon, this paper discussed the actual implementation of CPFR in a Taiwan's company and its operational process. After CPFR was introduced, Rexon was able to, under collaborative plan, share information and collaborate on forecast and replenishment. In turn, based on effective forecast, Rexon could reduce the inventory level of the supply chain, shorten the overall lead time, and respond to customer demand more rapidly, and thus reduce mutual costs and increase mutual

profits. Furthermore, Rexon will collaborate with its manufacturers to expand the operational scope of CPFR. Rexon intends to continuously adjust forecast and implementation to ensure higher accuracy of operations under collaboration and maximize the functionality of the overall industry chain.

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References

Coyle, J. J., Bardi, E. J. and Langley, Jr., C. J. (2003). The management of business logistics: A supply chain perspective, 7th edition. Thomson Learning, Ohio.

Disney, S. M. and Towill, D. R. (2003). The effect of vendor managed inventory (VMI) dynamics on the Bullwhip Effect in supply chains. *European Journal of Purchasing & Supply Management*, **85**(2): 199–215.

Gunasekaran, A., Patel, C. and McGaughey, R. E. (2004). A framework for supply chain performance measurement. *International Journal of Production Economics*, **87**: 333–347.

Hieber, R. (2002). *Supply Chain Management: A Collaborative Performance Measurement Approach*, VDF, Zurich.

Lee, H., Padmanabhan, P. and Whang, S. (1997). Information distortion in a supply chain: The bullwhip effect. *Management Science*, **43**(4): 546–558.

McCrea, B. (2003). CPFR comes of age. *Supply Chain Management Review*, March/April, 65–67.

McCarthy, T. M. and Golicic, S. L. (2002). Implementing collaborative forecasting to improve supply chain performance. *International Journal of Physical Distribution & Logistics Management*, **32**(6): 431–454.

Parks, L. (2001). WWRE (World Wide Retail Exchange) rolls out data synchronization and CPFR programs. *Drug Store News*, **23**(9), (http://www.findarticles.com/cf_0/m3374/9_23/76881716/p1/article.jhtml).

Richard, K. (2001). Exchanges race to promote collaboration services. *B to B*, **86**(3), (http://www.btobonline.com/cgi-bin/article.pl?id=5029).

Simchi-Levi, D., Kaminsky, P. and Simchi-Levi, E. (2003). *Designing and Managing the Supply Chain*, 2nd edition, McGraw-Hill, Irwin, NY.

Terzia, S. and Cavalieri, S. (2004). Simulation in the supply chain context: A survey. *Computers in Industry*, **53**(1): 3–16.

Thomas, D. J. and Griffin, P. M. (1996). Coordinated supply chain management. *European Journal of Operational Research*, **94**(1): 1–15.

VICS (2002). *Collaborative Planning Forecasting and Replenishment*, Version 2.0, Voluntary Interindustry Commerce Standards Association.

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