Research on RosettaNet-Based Collaborative Supply Chain Forecasting*

Liu Yongjun[1], Zhou Xiaoping [1], Chen Jianhua[2]
1School of Management, Wuhan University of Technology, Wuhan, P.R.China, 430070
2School of Logistics, Wuhan University of Technology, Wuhan, P.R.China, 430070
(E-mail:liuyongjun_163@163.com, zhouxiaoping240@163.com, markcjh@126.com)

Abstract Collaborative forecasting is one of the most important processes in supply chain coordination to better plan capacity requirements and replenishment. RosettaNet standards provide automation of the strategic forecasting, order forecasting, replenishment planning and exception management processes. Obviously, it is an effective way to implement collaborative forecasting based on RosettaNet. This paper describes collaborative supply chain forecasting processes and analyzes the functions of each level and step. Furthermore, the suitable RosettaNet partner interface processes (PIPs) have been chose to match the processes of collaborative forecasting. Finally, the authors present an overall picture about how the processes of collaborative forecasting are executed based on RosettaNet and Web services within supply chain composed of customers, retailers, manufacturers and suppliers.
Key words Supply chain coordination; Collaborative forecasting; Coordination strategy

1 Introduction

In the current turbulent business environment, one way for enterprises to increase inventory turns, reduce cost, respond quickly to exception events and improve customer service is to implement efficient and effective supply chain coordination. Especially, enterprises are increasingly focusing on collaborative forecasting as efficient as possible. Collaborative forecasting is the process of sales prediction for distributed partners affected by inventory, promotion, season, cycle, trend, irregularity, and time period, which can be interactively communicated, monitored, and help supply chain partners to mutually generate the most accurate forecasts so that the upstream partners' production schedule and material purchasing can be controllable and stable. Collaborative forecasting can achieve better supply/demand match across the supply chain, improve forecast quality and capacity utilization, decrease uncertainties, increased inventory turns and finally increase customer satisfaction through assured supply. Xie et al. apply privacy preserving collaborative forecasting with dynamic exponential smoothing to implement supply chain collaboration in order to avoid revealing any participant's data [1].Tammy et al. develop a conceptual framework of demand forecasting process to postulate a comprehensive range of forecast granularity specifications, identify the aggregate and disaggregate proposed forecast items and recommend forecast output with exploratory time series analysis and consensus approach[2].

Collaborative forecasting is very data intensive. It involves the sharing of real-time demand forecast information within the supply chain partners, and the order planning can be derived from collaborative forecasting. For the upstream partners, production planning and material purchasing planning can be generated in the consideration of capacity, inventory or other factors. Shu et al. put forth that Spring Festival transportation, shutting down for examinations and repairs and minor repairs play an important part in supply chain sales forecasting. They present the relevant empirical studies in different hierarchies and domains [3].Collaborative forecasting also incorporates an exception mechanism that alerts supply chain partners when performance thresholds or tolerances have been exceeded. Any changes in the work schedule will be communicated and adjusted for within the supply chain. In the process of collaborative forecasting, supply chain partners communicate interactively, creating a closed loop of communication.

The implementation of collaborative forecasting depends on the use of Internet-based technologies which breaks down the barriers and exchanges information within supply chain. Furthermore, a standard that enables the communications between different information systems is needed. Huang et al. proposed autonomous modular collaborative forecasting system based on the Back-Propagation neural Networks (BPNs) which can well perform the Stock-Keeping Units forecasting for the upcoming

* This research was supported by "the Fundamental Research Funds for the Central Universities"（2010-lb-033）.

management of the Stock-Keeping Units inventory [4]. Chen & Guo employ Data Warehouse and the ASP.net technology to implement the Power Marketing Decision Support System and put forward the realization of entire system architecture. They apply the forecasting models for distributed collaborative forecasting, including Quadric Exponential Smoothing prediction model, Curve Fitting, Multiple Linear Regression Model and the Gray Model which have been packaged into Web services of application layer [5]. Umair and Ben propose the collaborative forecasting model based on web services to integrate legacy systems across the whole supply chain and utilize intelligent agents for communication between supply chain partners [6]. Currently, RosettaNet standards have been the effective standards that can increase forecasting accuracy, help better plan firms capacity requirements and replenishment activities.

In this paper we discuss how to implement collaborative supply chain forecasting on the base of RosettaNet PIPs. First we introduce the RosettaNet standards and analyze the detailed processes of collaborative forecasting across supply chain in section 2. We then describe how to match RosettaNet PIPs with collaborative forecasting activities in section 3.1. Finally, we present the executive process of collaborative supply chain forecasting based on RosettaNet and Web services in section 3.2.

2 RosettaNet PIPs and Collaborative Forecasting

2.1 Overview of RosettaNet standards

Managing the supply chain requires a collaborative environment and streamlining of business processes from which efficiencies can be derived. Ideally, all partners within supply chain should adopt universal standards for conducting business-to-business. Many electronic and semiconductor manufacturing companies dedicated to creating common extensible markup language (XML)-based supply chain process standards and support RosettaNet as a open standard for various processes [7].

RosettaNet is a non-profit consortium aimed at developing and promoting global industry SCM standards processes. RosettaNet focuses on developing dictionaries, frameworks and partner interface processes (PIPs) for system-to-system business exchange. Under the RosettaNet framework, a dictionary contains the vocabulary used in its dialog of PIPs. From a process-oriented view, RosettaNet PIP presents a good interface for system-to-system exchange by clustering the core business process of a typical supply chain into eight clusters, each with operational segments that contain corresponding PIP. RosettaNet group has developed nearly 90 automated PIPs [8].

2.2 Collaborative forecasting process

The RosettaNet collaborative forecasting standards support automation of the strategic forecasting, order forecasting, replenishment planning and exception management processes. The collaborative forecasting processes can be described as Figure 1.

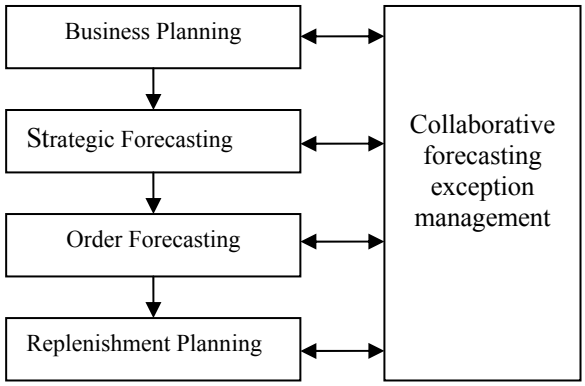

Figure 1 Collaborative Forecasting Process

First of all, it is necessary to create the multi-party TPA (Trading Partner Agreement) among supply chain in order to arrive at agreement on what the actual collaboration processes and terms are between the trading partners and a develop mutual trust and roadmap for the future of joint business planning. Usually, business planning is typically done to align long-term business plans among the trading partners. The process of business planning consists of agreeing on the priorities and goals for supply chain coordination, assessing the performance of supply chain coordination, matching the demand and supply at the technology level, monitoring the activities of planning, forecasting and replenishment and handling exception.

Strategic forecasting is generally presented monthly or quarterly to plan mid-term strategic capacity needs and supply according to historical order or delivery information. Considering the order demands, setting inventory targets, lot sizing and purchasing activities and matching the demand and supply may be conducted at aggregated location level and higher product family level rather than orderable part number. Strategic forecast message coming from the customer to the supplier and forecast reply message is sent back to the customer from the supplier.

Order forecasting is typically presented weekly or monthly at the orderable part and ship-to levels to collaboratively align supply and production plans. Collaborative forecasting process occurs when order forecasting is combined with a forecast response. Generally, order forecasting processes fall into two broad categories: non-consignment processes and consignment processes. In non-consignment processes, title transfer occurs when the supplier ships product out of his warehouse. On the contrary, in consignment processes, title transfer occurs when product is consumed by the customer. Consumption of consignment product is typically at the point of shipment out of the consignment warehouse.

Replenishment planning is presented what and when materials are required by the MRP module based on the information of order forecasting, bill of materials, current stock levels, safety stock, inventory reorder settings, orders not yet received and back orders. The processes of replenishment planning support actual daily physical shipment releases at the orderable product and ship-to level.

Finally, the collaborative forecasting exception management is used to identify exception types and exchange exception information within multiple trading partners. The processes cross all these steps and levels of collaborative forecasting. They enable monitoring of collaborative forecasting performance and real-time alerting of trading partners on KPI exceptions.

3 RosettaNet-based Collaborative Forecasting Process

3.1 RosettaNet PIPs matching with collaborative forecasting activities

RosettaNet aims to align the business processes of supply chain partners which include collaborative forecasting. The segment 4A enables standardization of collaborative order and sales forecasting between supply-chain partners. The PIP4A1 has been specifically developed to support strategic forecasting, which is defined as mid- to long-term forecasting of sales, capacity, demand, or marketing data. The PIP4A5 is used to submit a Forecast Reply Notification to a Forecast Owner. The knowledge from forecast response can be used to improve the next generation of the customer's forecast. The PIP4A6 supports the process where an exception identifier notifies an Exception Recipient of many different types of exception conditions within a collaborative forecasting process, such as comparison exceptions, threshold exceptions, incident exceptions, metric exceptions, information exceptions.

In the strategic forecasting process, PIP4A1 is used to notify the mid-term capacity requirements and PIP4A5 is done to reply the notification. Product structure information may also be shared by PIP2C8 Notify of Bill of Material. Furthermore, capacity equivalency information can be queried by PIP7B3 Request Capacity Equivalency or PIP7B4 Distribute Capacity Equivalency. The order forecast and replenishment planning processes can be merged into a single process by exchanging a frequent enough schedule with either PIP4A2 Notify of Embedded Release Forecast or PIP4A3 Notify of Threshold Release Forecast and responding with PIP4A5 Notify of Forecast Reply. PIP4A2 supports the customer managed inventory process and PIP4A3 supports the vendor managed inventory process. PIP4A4 Notify of Planning Release Forecast is used to submit a forecast notification to a forecast recipient and PIP4D1 Notify of Material Release triggers the supplier's shipment. The material release identifies product quantities to be shipped to the delivery location.

3.2 Implementation process of collaborative forecasting

In our scenario, we consider a specific supply chain composed of customers, retailers, manufacturers and suppliers and each partner has its own internal information systems. For example, retailers have sales forecast systems and logistics/distribution management systems, manufacturers has order forecasting systems and vendor management inventory systems, suppliers has efficient replenishment systems and supplier management inventory systems. We can describe the implementation process of collaborative forecasting as figure 2 on the basis of server supporting RosettaNet and Web services. Retailers record the sales of Customers by means of POS and moreover forecast the demand information of Customers, send strategic forecasting notification to manufacturers according to PIP4A1. Manufacturers convert strategic forecasting into material demand forecasting and send the notification to upstream suppliers according to PIP4A1. After receiving the forecasting notification, suppliers and manufacturers orderly submit a forecasting reply notification to downstream

partners according to PIP4A5. In the process of coordination replenishment, retailers and manufacturers send purchase order request forward to upstream partners according to PIP3A4, the purchase order respond will be submit backward to downstream partners according to PIP3A7. In a word, the forecasting and replenishment information are changed synchronously within supply chain rather than between two partners. Obviously, consumers are the center of implementation of collaborative forecasting, coordination plan is based on the forecast of customers demand and customers' requirement

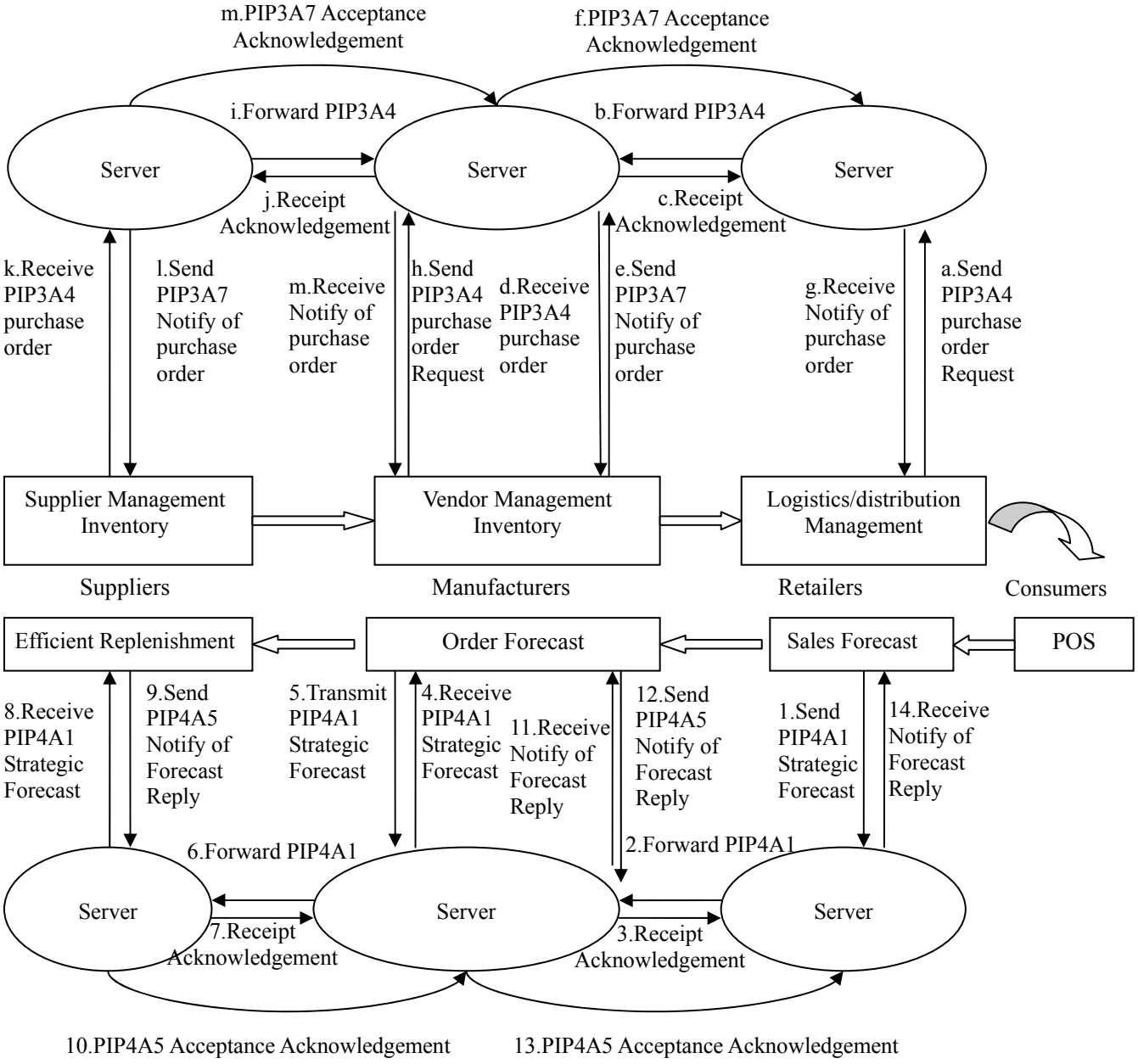

Figure 2 Implement Model of Collaborative Forecasting Based on RosettaNet

is met by means of coordination replenishment. Within supply chain, each partner can share the forecasting information and update them instantly and dynamically, communication barriers and information conflict will be gotten rid of.

4 Conclusions

Collaborative forecasting has been a subject to research how to improve the efficiency and effectiveness of interaction among trading partners within supply chain and satisfy the customer's

accurate demand. This paper discusses the architecture of collaborative forecasting processes which include strategic forecasting, order forecasting, replenishment planning and exception management processes. Collaborative forecasting processes are reified and decomposed from the perspective of implementation. Those sub-processes support each other and transmit the two-way forecasting information among them, creating a closed loop of communication. On the other hand, RosettaNet standards have been the effective standards to increase forecasting accuracy and better plan capacity requirements and replenishment through breaking down the barriers among supply chain partners and automation of collaborative forecasting processes. The segment PIP 4A enables standardization of collaborative order and sales forecasting among supply chain partners. Thus, some suitable RosettaNet PIPs are chose to match the processes of collaborative forecasting at different levels and steps. In the end, we design a supply chain scenario and describe how to implement the overall processes of collaborative forecasting when customers, retailers, manufacturers and suppliers coordinate through their own internal information systems.

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