Increased communication improves supply chain flow

A study at Tetra Pak Packaging Material Lund AB

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Abstract

This paper addresses the important issue of communication in the supply chain and how increased information flow can lead to potentially shorter and more predictable lead times. The study which this paper is based on was conducted at Tetra Pak Packaging Material in Lund (TPPM) during the fall of 2005. The company was occasionally unable to satisfy customer needs, despite of fully used storage facilities. The situation in focal point was associated with a product which was purchased from an external supplier and then directly sold to customer without further refining. Investigations revealed that the warehouse capacity was not the problem, while demand without further refining. The supplier could produce articles to stock. In addition this momentary demand contribute to high stock levels. As a result, ordered quantities were stored for long periods of time before a time based demand was specified. This led to high stock levels. Our suggestion to solve the problem was spelled communication. By sharing more specific demand information at an early state, the supplier could produce articles to stock. In addition this will give TPPM the opportunity to order products based on confirmed time specific demand, unlike today’s ordering routine.

1. Introduction

Tetra Pak’s packages have a variety of different openings. The cheapest and most common reclosable opening is called ReCap. The production of opening devices is carried out by external suppliers. The supplier providing the producing unit in Lund, Tetra Pak Packaging Material Lund AB (TPPM), with ReCap is using all its capacity. As a consequence, the smallest disruption in the production of ReCap causes problems with deliveries, especially during high season. ReCap is available in two models, three different sizes and thirteen different colors. The differentiated range is customer promoting but at the same time it is requiring effective procurement and warehousing processes. Historically the warehouse situation for ReCap at TPPM has been problematic, where articles that does not represent the momentarily demand contribute to high stock levels. As a result the overall stock has, from time to time, exceeded the allocated storage space. Despite these high levels Tetra Pak has been unable to serve customers at all time. A big contributing part of the warehousing and procurement problem has its core in the customers ordering procedure. Many of the significant customers, mostly in Eastern Europe, are lacking long-term planning. This leads to problems when retaining efficiency in the supply chain is a vital component to uphold a high level of customer service. The purpose of this study was therefore to analyze the flow of ReCap from need identification to satisfaction. A secondary purpose was to generate appropriate measures to reduce the problems associated with the described flow.

This paper will start with a short explanation about theoretical framework and methodology used, followed by a mapping of the studied system. There after the problem is analyzed and our conclusions are stated.

2. Theoretical review

There are many different frameworks to describe and analyze flows in the supply chain. We have chosen a framework presented by Persson et al (1998) because it gives a clear picture of the involved activities and pinpoints potential areas of improvements. According to Persson et al (1998) a response cycle describes an activity between a customer and a supplier. A supply chain consists of a series of response cycles. The response cycle model describes suitable areas to map, in order to render more effective logistical processes, see Figure 1. In the model’s general form, three different areas can be distinguished. The two first describe the administrative and structural context, which deals with information and structural matters in the supply chain. The third area handles the response cycle between two parties.

The response cycle context wants to highlight a few characteristics that are critical for creating effective supply chain processes. The critical characteristics are lead time, uncertainty, frequency and demand patterns. The lead time consist of an administrative and a physical part. It describes a general order cycle from demand identification to satisfaction. The most common uncertainty factors are uncertainties in the flow of material, need, production processes and control and follow up processes. Frequency describes with which intensity ordering is done. An example of a demand pattern is seasonal variation.
R3. The quantitative data have been closely investigated, mainly originate from the Tetra Pak business system, SAP information of possible importance. The quantitative data exclusively been of informal nature, to access all practical warehouse operations. The interviews have been performed with several relevant persons in the supplier’s producing unit in Gislaved Sweden and at TPPM’s facility in Lund Sweden and at the supplier GP. All order activities and other day-to-day communication routines are disregarded in the relation between the producing unit TPPM and the external supplier GP. All order activities and other day-to-day activities are supervised by the product company. The general communication routines are disregarded in the relation between the producing unit TPPM and the external supplier GP. All order activities and other day-to-day activities are supervised by the product company.

Table 1 Persson’s nine principles

<table>
<thead>
<tr>
<th>Number</th>
<th>Principle</th>
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<tbody>
<tr>
<td>1.</td>
<td>Reduce or redistribute lead times</td>
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<td>2.</td>
<td>Reduce or adapt to uncertainties</td>
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<tr>
<td>3.</td>
<td>Redistribute or increase frequencies</td>
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<tr>
<td>4.</td>
<td>Eliminate or adapt to expected patterns of demand</td>
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<td>5.</td>
<td>Simplify structures, systems and processes</td>
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<td>6.</td>
<td>Differentiate</td>
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<td>7.</td>
<td>Postpone</td>
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<tr>
<td>8.</td>
<td>Improve the information processing and the decision support systems</td>
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<tr>
<td>9.</td>
<td>Strengthen the internal and external integration</td>
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</tbody>
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Figure 1: A response cycle between two parties and the three different influential contexts.[1]

The structural context penetrates the response cycles range of decision elements, dependencies between different decision elements and how well the demand can be specified.

The choice of control principal, control tool and degree of process orientation are three factors that characterize the administrative context.

Persson et al (1998) states nine main principals to make logistical processes more efficient. In Table 1 the principals are listed.[1]

3. Methodology

The study has adopted the system approach in order to illustrate the importance of different parts in the studied system and their internal relations. The conducted empirical research has its foundation in both qualitative and quantitative sources. The qualitative data includes observations at TPPM’s facility in Lund Sweden and at the supplier’s producing unit in Gislaved Sweden. The interviews are performed with several relevant persons in the ReCap supply chain, from order processing to practical warehouse operations. The interviews have exclusively been of informal nature, to access all information of possible importance. The quantitative data mainly originate from the Tetra Pak business system, SAP R3. The quantitative data have been closely investigated to exclude any information containing random or systematic errors.

4. The system mapping

The targeted system relations mainly consist of order processing and logistic issues. Logistical issues comprise of warehouse operations together with inbound and outbound transportation. The order processing activities associated with ReCap and other Additional Materials are, for TPPM’s market segments, incorporated in the Swedish market company, through Supply Chain Office (SCO). The term Additional Material is used to describe all components delivered together with the packaging material. Even though the order process, defined by organization, is carried out by the Swedish market company, it has strong connections to TPPM. The system chart can be seen in Figure 2.

Figure 2 The system chart

By far the most frequently used supplier for ReCap at TPPM is GP Plastindustri in Gislaved (GP). To gain size benefits, all external supply is controlled and carried out through the involved product company at Tetra Pak. In the case of ReCap, the supervising product company is Tetra Pak Carton Ambient. This company is in charge of all activities involving aseptic packaging, including filling machines, packaging material and associated activities. Aseptic packaging is simplified packaging which through a special packaging material and highly controlled filling, gains characteristics which makes the product able to store for long periods of time. A major task regarding ReCap is to canalize specific customer demand to a supplier with appropriate capacity to deliver. In a practical context this means that specific markets are supplied to the greatest extent from the same supplier, when this is possible. To avoid grab mentality among different market companies, the product company has been forced to allocate production capacity at the suppliers. GP has today little space for capacity increases. All capacity is used all year around, to satisfy the demand for their products. To offer short lead times most products are made to stock, but some low quantity articles are made on customer order to avoid the risk of being stuck with unwanted articles. As mentioned earlier, the connection to all suppliers are supervised by the product company. The general communication routines are disregarded in the relation between the producing unit TPPM and the external supplier GP. All order activities and other day-to-day...
activities are performed without interference from the product company.

At TPPM the storage capacity for ReCap is approximately 270 pallets. The average weekly outbound deliveries are 150 pallets, which corresponds to the turnover stock. Taken in consideration that outbound deliveries are evenly distributed over the workdays, the storage should be more than enough. As described in the introduction, some of the storage concerns apply to the customer’s ordering habits. Most problems relate to polish customer’s ordering routines. In addition, polish customers benefit from shorter lead times than most other customers, due to negotiated terms of delivery. Regarding lead time, this means that the polish market have three days apart from the normal condition of five days. The ordering process is triggered by a sales order from the customer, via the represented market company, to SCO. The sales order includes a complete material description of all material needed to create the final package. A sales order contains a long term demand and is not associated with a specific delivery information, although conditions of purchase states that an order should be ready for shipment two weeks after submission. In most cases, the sales order is divided into several delivery orders that specify delivery, both regarding date and quantity. In today’s system the sales order also, in most cases work as the basis of the TPPM order of ReCap. The only exception regards two articles with high and evenly distributed demand. When sales order and delivery orders often do not agree in time, volumes of ReCap are stored at TPPM, without legitimate reasons, until the customer agree on delivery. This means that TPPM keeps a customer stock and all stored quantities are related to specific customers.

5. Problem analysis and suggestions

We chose to use Persson’s nine principles for more efficient logistical processes as a base for our analysis. Although some principles are hard to distinguish, we have tried to separate the different principles. All principles except for number six and seven are applied in the analysis.

First principle

The first principle deals with the reduction of lead time. In our case shortened lead time, in particular between GP and TPPM, will lead to less uncertainty and speculation in the ReCap ordering process. The benefit of reduced lead times mostly applies to articles produced in low volumes, since the production strategy for these products are “make to order”. To be able to reduce the specified lead time, the amount of information has to increase between SCO and the supplier, both in amount and quality. This is possible because of the special line of communication that exists between TPPM and the supplier. Specifically early indications of future demand have to be transferred to the supplier. Earlier demand information is a basic condition for the supplier to be confident enough to apply the strategy “make to stock”,

to the entire production. To be able to meet these requirements a new ordering procedure has to be created. In this, all information regarding sales orders will be transferred to the supplier. A major benefit of using the new ordering routine is that all demand with lead time greater than four days can be delivered to TPPM based on delivery orders. This means that no products should be delivered to TPPM without a time scheduled demand. An exception is the polish market, which according to previous statements benefit from a shorter, three day, lead time. To recognize the articles, and what storage strategy should be applied to each of them, an ABCXYZ-analysis was conducted. The result can be seen in Figure 3. The analysis shows that most products are preferably stored at a central position in the supply chain according to the theoretical background in this paper. The figure also shows that that a few articles have high, even demand, which makes them good for local storage. An example of this is article 3.

Figure 3 A ABCXYZ-analysis performed on the complete range of ReCap

To use differentiated strategies for different products or product groups is a part of principle six, described by Persson. We on the other hand suggest that all products or product groups is a part of principle six, described by Persson. We on the other hand suggest that all products are incorporated in the ordering routine and therefore stored centrally at the supplier, to gain a more flexible relationship with TPPM.

Second principle

In our study the first and second principle can be applied to the above described actions. In addition the second principle, reduction of uncertainties, applies to the development of a safety stock. A safety stock at TPPM should among other things contain demanded quantities, which can not be included in the stated ordering routine. This corresponds to the old customer stock. There are several methods to calculate safety stock, in variable degree of sophistication. Apart from current safety stock methods, appropriate articles and their mutual distribution in a safety stock, can be revealed by a combination of the general ABC study together with an assessment of important customers and their demand behaviors. In our study, experiments were performed with several methods to show TPPM and SCO what effects different methods has on the size and distribution of the safety stock.
Third principle

According to Persson’s third principle more efficient logistical flow, is created by increased and redistributed delivery frequencies. We discovered that the new ordering routine made it possible to deliver products based on delivery orders. Considered that a full transport carries approximately 120 ReCap pallets, at least two inbound deliveries are needed to meet the average weekly demand of 150 pallets. We calculated that a good transport solution was to use two weekly deliveries, only carrying time scheduled demand, to avoid unnecessary stock. Considered that the demand is evenly distributed throughout the week, the two transports should carry equal quantities. Our transport analysis showed that there is no economical loss if the quantities are divided evenly. Instead the calculation showed that an optimal economical solution was to have the two inbound deliveries consisting of 72 respectively 78 pallets, as Figure 4 reveals. In Figure 4 it can also be seen that the economical gains are very small. We therefore suggest that the inbound deliveries, turnover stock, only should carry quantities that correspond to confirmed demand until next inbound delivery.

Fourth principle

One of the main themes in our analysis is to increase and specify the information flow, from customer to supplier. Regarding Persson’s fourth efficiency principle, which handles demand patterns, this surely applies. By giving the supplier accurate and updated information about demand, it is easier for the supplier to produce and deliver products when they are demanded, not before and not after. This thought is one of the pillars of the supply chain collaboration philosophy, CPFR (Collaborate Planning, Forecasting and Replenishment). As the name indicates, key factors of efficient supply chains lie in collaborative actions. Apart from forecasting, this relates to stock levels, which are updated throughout the supply chain when a purchase indication is noticed.

Fifth principle

To be able to reach a more efficient flow, simplifications are important. According to principle five, this relates to both structural matters and work processes. In our case study, simplifications implicate the work processes associated with ReCap at Tetra Pak. By introducing more firm routines in the purchasing actions, reduced amount of time will be spent performing them. In addition, routines will reduce the dependency on specific key actors, since work processes no longer will be built on individual performance.

Eighth and ninth principles

Principle eight and nine has already been mentioned in earlier paragraphs, since these relates to more openness in the supply chain, both inside and outside Tetra Pak. Besides stronger supplier relationship, the companies within the Tetra Pak organization have to increase the amount and quality of communication.

6. Conclusions in short

Our suggestion and recommendation can be divided in two main parts, increased communication and the introduction of new routines. These recommendations are necessary to move stock levels to a more central position. The stock at TPPM should only consist of an appropriate safety/customer stock and a turnover stock that relates to the specified demand until next inbound delivery. This is in line with the conducted ABCXYZ-analysis. The analysis showed that all articles, but two, preferable are centrally stored. We however suggest that all articles are stored centrally. The reason for this is that the supplier already stores the two articles in question. Because Tetra Pak does not have such a warehouse, our solution to store at the supplier seems like a reasonable alternative. There are considerable downsides for the supplier associated with this suggestion, while production to stock means a substantial risk. The risk is reduced if TPPM compensates GP for the inconvenience. This compensation should represent potentially unsold quantities and will not a big burden for TPPM, since they already today take the cost of unsold quantities. To be able to reduce stock levels at TPPM and move these quantities up the supply chain it is important to reduce lead times, which is in harmony with Persson’s first principle. This is done by sharing more qualitative information, with the supplier, consisting of updated and specific future demand together with the establishment of routines to communicate the extended information flow. One of these routines is an ordering routine. This routine describes what considerations should be taken in account during the ordering process and what information should be communicated to the supplier. By creating routines, order process activities will reduce in time. In addition dependency of specific employees will diminish, when knowledge is bound to the company instead of human resources.

Our calculations show that two inbound deliveries will manage the weekly turnover stock. The most cost efficient solution is that each delivery should contain approximately equal amounts, as seen in Figure 4.

The storage capacity at TPPM is today used to 100% or more. Our intention is to only use 80% of this space, to retrieve a better and more manageable warehouse situation. In account that one inbound delivery by far falls short of the intended stock level, a safety stock can be
introduced. The purpose of the safety stock is to protect against unforeseen events and therefore reduce uncertainty. The safety stock is preferable dimensioned based on demanded quantities, important customers demand patterns, the ABCXYZ-analysis and registered orders. To exemplify one important factor to consider we conducted an analysis of the polish market and found that the four biggest customers represent 70 % of the total demand on that market. By analyzing their individual demand it was clear that these customer’s demand distribution was quite different from the total demand on specific articles.

7. Secondary thoughts

Our analysis was performed to improve the supply chain flow of the additional material ReCap. Tetra Pak has other similar additional materials that also are bought from suppliers and directly sold to customers without any value adding is performed. Therefore our suggestions might be applicable for these materials as well. We suggest that further analysis is performed to investigate this possibility.

The conducted analysis on the polish market could be extended to other important markets to retrieve a better total picture. This better picture could then be used when the safety stock is outlined. Our intention with this analysis was not to design a safety stock but to show how such a safety stock could be designed. An important note is that the specific article quantities kept in the safety stock should always be under revision so that it represents the momentary demand and situation.

8. References