Advanced Planning in
Supply Chains

Illustrating the Concepts Using an SAP® APO Case Study

by Hartmut Stadtler, Bernhard Fleischmann, Martin Grunow, Herbert Meyr, Christopher Sürie

With 79 Figures and 45 Tables

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Preface

Listening to a Stradivari played by an expert is a real treat, but if it is played by a beginner…

In a figurative sense this also applies to implementing and making use of an advanced planning system (APS) in industry. Much frustration with APS is due to a misconception and incompetent utilization of APS. Often companies have not been aware that APS require different skills compared to transactional systems known as enterprise resource planning. Especially in complex decision situations in which many alternative activities have to be combined in order to construct a feasible, high-quality plan for a supply chain APS can unfold their full potential.

This book aims at providing the necessary knowledge needed to make the best use of APS in industry. It is intended especially for a quantitative master course in “Supply Chain Management”, “Industrial Engineering” or “Management Science”. To lower expectations a little we only provide the necessary background information of the concepts and capabilities underlying today’s APS as well as the look-and-feel of one APS, namely SAP®’s Advanced Planning and Optimization (APO). This should at least enable you to become a valuable member of an experienced APS implementation team.

Preparing the content of this book started more than a decade ago when we made first attempts together with our students to test various modules of APS from different software vendors. We are indebted to these students and hence have prepared a list of names for our acknowledgements (printed at the end of this book). We would also like to express our sincere gratitude to several experts from SAP Deutschland AG, especially Katrin Diesing, Berthold Hege, Mathias Göbelt, and Clemens Kriesel for providing valuable advice regarding the use and description of SAP APO on top of their daily duties. From the very start Heinz Braun promoted our project, e.g. by providing access to the SAP APO software for our students and research assistants as well as initiating contacts with experts from the development team of SAP APO – this was great! Thomas Pöhler, datango AG, Berlin, has to be mentioned, too, for teaching us how to make the best use of the datango e-learning software which was used to create the interactive learning units accompanying our book.

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We would also like to thank our co-authors which have helped us writing some chapters. Their names are indicated at the start of these chapters.

Last but not least we would like to mention Christopher Haub for recording the interactive learning units accompanying our book as well as Julian Wulf for his relentless efforts in preparing the .tex files for the Springer publisher.

Now it is up to you to make the best use of our book and the interactive learning units – we wish you great success!

Bernhard Fleischmann  Martin Grunow  Herbert Meyr
Augsburg  München  Hohenheim

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Hamburg  Walldorf  in July 2011
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Introduction

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This chapter provides a motivation for reading and studying our book, introduces the structure of the accompanying learning units and finally presents an overview of chapters.

Why Should You Read and Study this Book?

Business management is concerned with making the best use of a company’s scarce resources like labor, materials, and machinery when creating value for their customers. Today, even medium-sized companies source globally, produce in various plants and serve customers all over the world.

But how can a planner combine the vast number of available activities while taking into account potential bottlenecks and market opportunities such that short-term and long-term objectives of the company are met?

One answer is to make use of an advanced planning system (APS), a software suite consisting of a number of interrelated modules each intended for a specific planning task. Due to the reluctance of companies to share information inter-organizationally, today’s APS primarily support planning of intra-organizational supply chains (SCs) (see Fig. 1). These are a network of organizational units (like plants, warehouses, transportation facilities) which are linked by various activities aiming at producing value in the form of products and services for a single company’s customers (see Sürie and Wagner 2008, for further definitions and the references given there). Coordination of plans of individual SC partners each making use of its own APS can then be achieved either by personal negotiations or by an additional software tool for collaborative planning.

APS are advanced in the sense that they make use of the latest information technology, computer facilities as well as standard or special purpose solvers for generating solutions to various decision problems arising in the supply
chain – and most importantly coordinating solutions in order to prevent local optimal. Also, it is advanced compared to enterprise resource planning (ERP) systems (for a detailed description see Jacobs et al. 2011) which do not provide adequate planning capabilities (e.g. they do not consider capacity restrictions adequately). APS are available from various software vendors. Although, each APS has its special features, advantages, and drawbacks one can identify a general architecture, which is based on the principles of hierarchical planning. Hence, knowing the concept, structure, and functionality of one APS will enable you to get acquainted with other APS relatively easily.

To ease understanding we have prepared a case study of a company – named Frutado – in the consumer goods industry (with some simplifying assumptions). We will provide a detailed description of Frutado’s planning tasks and the corresponding customization for a specific APS – the Advanced Planning and Optimization offered by the SAP AG, Walldorf (SAP APO). We will introduce the concepts and models underlying the different modules of SAP APO and provide the necessary insights such that you will be able to design and judge appropriate APS implementations for other companies. Note that a learning software has been created with the help of the datango software (datango AG, Berlin). Learning units can be downloaded free of charge from either one of SAP’s Competence Centers or from www.frutado.net (or .de).
Interactive Learning Units

The interactive learning units mentioned above have been developed and implemented in SAP APO and recorded with the datango software. This software generates a description of procedures by taking a screenshot of the particular application after each entry. Merely an internet browser is needed in order to replay the different units. Note, that the learning units use the German “,” in real numbers instead of the correct English decimal point.

The recorded learning units are a necessary and helpful addition to this book and can be used in two different modes; a demo and a practice mode. The demo mode presents all the activities of the Frutado case by showing all mouse clicks and entries that are needed to work with SAP APO and fulfill the planning tasks of each module. So called “bubbles” describe the meaning of a particular screen and the associated entry (see Fig. 2). Each screen is shown for a predetermined time, but can also be paused or sped up at any time. It is also possible to jump to any screen in a learning unit. This may be helpful, if the user wants to avoid repetition.

![Example of a learning unit used in the demo mode.](image)

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The other mode – the practice mode – enables some exercises to be done without the access to an actual SAP APO system. This interactive mode requires the user to replay the planning tasks by executing the identical actions as in the demo mode. If the user cannot remember an exact sequence, help is given. As the underlying software only simulates SAP APO, the practice mode merely confirms whether mouse clicks and entries are correct.

Starting the educational software the user can either choose a learning unit by selecting it from the navigation tree (see Fig. 3) or a recommended order can be followed, which allows a logical sequence. After a description of the Frutado case and a short general introduction to APS, the tutorial-folder contains the different planning modules. For each module there is a folder with the different learning units, that always include a short description of the respective contents and the learning objective.

The essential planning tasks of the Frutado case are shown in a “basic stream”. The preparation of information and the execution of planning tasks that are vital to the Frutado case (i.e. that are needed as input for other planning modules) are shown in this section. Here, the sequence of the learning units is important and should not be changed.

A deeper insight into the possibilities of a certain module is provided within the “in-depth stream”. Here, supplementary information is provided...
on the application of each module, which is not necessary to execute and understand the learning modules and planning logic of the other planning modules. Following the sequence of the learning units in the “in-depth stream” is a recommendation, but not a necessity.

In order to begin your lessons simply use the navigation tree to click on the module of your choice. It is recommended to begin with the Demand Planning module. To start a learning unit in the demo mode select a lesson and click on the demo icon at the top right of your screen. In order to use the practice mode click on the practice icon next to the demo icon.

Overview of Chapters

This book consists of three parts I, II, and III. In Part I the Frutado case as well as the basic ideas and principles underlying today’s advanced planning systems (APS) are introduced.

Part II is the main part with six chapters, each addressing a specific module of SAP APO. These chapters all follow a similar structure: First, the theoretical background is explained (on a master course level), making references to textbooks and research papers. Second, a short introduction and overview of specific learning units regarding Frutado’s planning task are included.

Part III discusses issues related to the implementation of an APS. The content of each chapter is outlined briefly below:

PART I

The first chapter describes the characteristics of the sample firm, the Frutado company. The Frutado supply chain and the corresponding planning tasks are presented.

Instead of generating an overall (monolithic) planning model of the Frutado supply chain, planning is divided into several distinct planning functions according to the Supply Chain Planning Matrix. The planning functions are linked following the principles of Hierarchical Planning. These two concepts are introduced in Chapter 2.

Chapter 3 provides an introduction to SAP APO, focusing on the elements required for the Frutado case. The first part introduces SAP APO in the context of IT systems and briefly describes its modules. In the second part data flows within the system are analyzed, both from a technical as well as a business process perspective. Third, general terms and principles of modeling in SAP APO are explained with focus on system architecture, master data elements, transactional data, and the user interface. Finally, the SAP APO solution for the Frutado case is sketched.

PART II

A practical starting point of planning activities is demand planning, which is introduced for business environments in Chapter 4. Its application to
the Frutado case is shown by using the Demand Planning module of SAP APO. The basic principles and methods of forecasting are described, which are necessary to understand the Frutado implementation. Furthermore, the data, planning tasks, and results of Frutado’s demand planning module are explained.

Based on medium-term demand forecasts Chapter 5 shows how to generate master plans for the Frutado supply chain. Medium-term planning as discussed in the literature is the starting point. A solution technique well suited for the introduced planning task is mathematical programming. Hence, a basic linear programming (LP) model for the Frutado supply chain is presented as well as some extensions resulting in a mixed integer programming (MIP) model. These are solvable with the help of the SAP Supply Network Planning (SNP) optimizer.

If setup times or setup costs are significant, but have not been addressed in master planning, then this will be the next planning step (Chap. 6). Lot-sizes have to be determined and production orders have to be loaded on the machines or work stations, put in a sequence each having a specific start and finish time. The result can be displayed in a Gantt-chart. Sequencing and scheduling can either be done by simple priority rules, simple heuristics or more elaborate meta-heuristics, like genetic algorithms (GA). Since a GA is also favored in SAP’s Production Planning/Detailed Scheduling module, basic ideas of GAs are presented and a numerical example is given.

The Global Available-to-Promise module (Chap. 7) matches short-term customer orders with supplies so as to maximize customer satisfaction. It uses the idea of rule-based searching methods for available product quantities (ATP-Quantities) in the process of order promising. The allocation of ATP-Quantities to customer segments and the surveillance function of the order fulfillment, the so called Event Driven Quantity Assignment, are explained.

Chapter 8 addresses the deployment of products from plants to customers and thus may revise the medium-term distribution plan (see master planning) on the basis of the information about the realized customer orders. The available supply will often either be less than the customer orders (supply shortage) or greater than customer orders (supply surplus). First, a framework for classifying different types of deployment situations is developed. The Deployment module of SAP APO uses fair-share rules to derive a distribution plan, such that the effect of a shortage is split among all or some of the customers. In the opposite case of supply excess, so-called push rules are employed.

In Chapter 9, transportation planning and vehicle scheduling is treated, i.e. the short-term planning problems of transportation processes. Transportation routes are determined and vehicle resources are scheduled with respect to different types of constraints such as requested delivery dates and transportation capacities. The results of this chapter are the planned shipments. First the planning problems are typified using the latest literature on vehicle routing. A mathematical formulation of the Frutado supply chain’s
short-term transportation and vehicle scheduling problem is given and it is shown, how this problem can be modeled and solved using the Transportation Planning/Vehicle Scheduling module of SAP APO.

PART III
Finally, in Chapter 10 we will discuss issues related to the implementation of an APS. Furthermore, we will point out the strengths and limitations of (current) APS.

Bibliography

Part I

The Frutado Case and Foundations of Advanced Planning
Chapter 1

The Frutado Case

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1.1 The Frutado Company

The fictitious company Frutado has been designed in a master thesis (Lebreton 2001) at the University of Augsburg. The Frutado case was derived from a real case and has been used many times for teaching and research (see for instance Mauch 2010).

Frutado is a medium-sized manufacturer of beverages with the headquarter situated in Augsburg, Germany. Originally specialized in the production of fruit juices, the company has expanded the range of products and the capacities by taking over two competitors in the mid 90s. It now produces fruit juices as well as ice teas at three sites, located in Augsburg, in Ludwigshafen, and in Magdeburg. Each site consists of a production plant and an adjacent distribution center (DC).

The production process consists of blending the beverages and filling them in various formats. Only the filling stage, which takes place on automated continuous flow lines, is considered in the Frutado case. The filling lines are potential bottlenecks, whereas the blending step is not critical. In each of the three plants, two parallel filling lines (FL) are available. Each filling line is applicable for a certain group of products only, due to its technical equipment.

The production department is working around the clock from Monday to Friday in three shifts per day and 15 shifts per week. In case of bottlenecks, up to three additional Saturday shifts can be used at extra overtime costs. As each filling line has to process several products, change-overs occur. They take between 10 minutes and 2 hours as setup time and cause setup costs, between 10 and 500 $, depending on the sequence of the products.
The product range comprises 13 types of fruit juices and 6 types of ice teas. The fruit juices are produced without preservatives and have a limited storage life. In order to guarantee a sufficient shelf life to the retailers, the duration in Frutado’s stock must not exceed three weeks. The ice teas, in contrast, are not perishable. Some products show a seasonal demand with a strong peak in summer, some are designed as special drinks for the cold season and have a peak demand in winter, others have a rather flat demand over the whole year. Most products can be produced at a single plant only. A few products can be produced at two or even three plants. In order to distribute the full range of products from each DC to the customers, the DCs must be fully assorted and cross shipping between the sites is necessary.

Immediately after production, the finished products are either stored into the DC at the same site or shipped to one or two of the other DCs. Cross shipping from DC to DC is undesired, because it entails duplicate handling in the DCs and may cause unnecessary transports. Nevertheless it is used as an emergency action in case of unforeseen shortages.

The customers of Frutado are retailers and restaurants with 60 delivery points altogether, mainly in Southern and Eastern Germany. The delivery points are simply called “customers” in the following. There is a fixed allocation of 20 customers to every DC. The transports from the plants to the DCs and between the DCs are done in trucks of 18 tons. For the deliveries from a DC to its customers trucks of 18 tons and of 9 tons are available, which operate in tours linking several customers. All vehicles are owned by Frutado and the transports are organized by the Logistics department. Figure 1.1 shows the structure of Frutado’s supply chain and Figure 1.2 illustrates the geographical locations of the DCs and the customers.
The Frutado Case

Figure 1.1
Supply chain of frutado with distribution centers (DC), plants, and filling lines (FL)

Figure 1.2
Geographical location of the DCs and customers
1.2 The Current Planning System

So far, the planning system of Frutado is based on the concept of Material Requirements Planning (MRP) (see Heizer and Render 2011, Chap. 14) and can be roughly described as follows: For every DC region, a sales manager is responsible for estimating the future sales and establishing a sales plan for three months. These sales plans are the input for the self-developed MRP software, which allocates the sales volumes to the plants and aggregates them month by month into production orders (POs). For those products which can be produced in several plants, the Frutado management has fixed priorities in the following way: Each plant should satisfy the demand of its own DC for the local products. If a product can be produced in exactly two plants, the third DC should be supplied by that plant which minimizes the production and transport costs. In each plant, the production planner transforms the POs into schedules for the two local filling lines. Usually he splits the monthly POs into weekly cycles and tries to keep a sequence with low setup times. Unfortunately, the overload of some lines, frequent stock-outs, and the pressure of the Logistics department, who wants to fulfill the current customer orders, enforce him to improvise more often than not. In particular, reallocations of the production between the plants often have to be agreed by phone. As a counter-measure, the production planner tends to produce in advance whenever there are free capacities.

As a result, the operations are far from running in an efficient way and cause high stocks, unnecessary high costs of production and extra shifts and a low service level for the customers. Finally, Frutado’s management has decided to reorganize the planning system fundamentally. First, they established a new Supply Chain Department, responsible for the coordination of all operations from the procurement up to the fulfillment of the customer orders. Second, this department is in charge of selecting and implementing an advanced planning system.

1.3 Data Analysis

As a first step, the Supply Chain Department analyzed the operational data of the last year. Table 1.1 shows the partition of the total yearly sales volume of 95 Million liters over the 19 products and the three DC regions. The DC 3 (Magdeburg) has to supply the largest demand (47%), followed by DC 1 (Augsburg, 32%) and DC 2 (Ludwigshafen, 21%). The product mix, however, does not show significant regional differences.

To analyze the seasonality of the demand, even two years of past demand data have been used. Figure 1.3 (adapted from Christ 2003) shows the demand curves for three groups of products with summer season, winter season, and steady demand, respectively.

Table 1.2 presents the result of an ABC classification of the products and the allocation of the products to the production sites and lines. The three A products together represent 66% of the total sales volume, whereas the
ten C products share only 10% of it. A similar partition can be observed regarding the customers: For each DC region, the first four “A customers” are responsible for 60-75% of the demand of all customers. Regarding the days of the week, however, no significant differences can be found.

The right-hand part of Table 1.2 shows the production coefficients for the possible allocations of the products to the filling lines. The inverse of these coefficients is the throughput of the line, which ranges from 1,700 to 12,500 liters per hour. The fastest lines FL 5 and FL 6 are mainly used for the A products.

The priority rules for allocating the sales volumes to the plants, as explained in Section 1.2, concern the three A products, produced in Plants 1 and 3, and the B Products 6, 7, and 13, produced in Plants 1 and 2. For the supply of DC 3 with the latter products, the cost difference between Plants 1 and 2 is low. As FL 2 in Plant 1 has a very high load, DC 3 is supplied from Plant 2. For the A products, the most recent filling line FL 6 has by far the lowest production cost, because it requires less workers. Therefore, it

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<td>Ice Tea</td>
<td>1105</td>
<td>722</td>
<td>1612</td>
<td>3439</td>
</tr>
<tr>
<td>Total</td>
<td>31258</td>
<td>21166</td>
<td>42250</td>
<td>94673</td>
</tr>
</tbody>
</table>

Table 1.1
Sales volume last year in [1000 liters]

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Cumulated Percentage of Sales</th>
<th>ABC Class</th>
<th>Production Possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cumulated Plant 1</td>
<td>Plant 2</td>
<td>Plant 3</td>
</tr>
<tr>
<td></td>
<td>Augsburg</td>
<td>Ludwigshafen</td>
<td>Magdeburg</td>
</tr>
<tr>
<td></td>
<td>FL 1</td>
<td>FL 2</td>
<td>FL 3</td>
</tr>
<tr>
<td>3 Juice</td>
<td>26.3% A</td>
<td>0.22</td>
<td>0.1</td>
</tr>
<tr>
<td>5 Juice</td>
<td>51.8% A</td>
<td>0.23</td>
<td>0.2</td>
</tr>
<tr>
<td>6 Ice Tea</td>
<td>66.0% A</td>
<td>0.26</td>
<td>0.12</td>
</tr>
<tr>
<td>6 Ice Tea</td>
<td>79.9% B</td>
<td>0.53</td>
<td>0.54</td>
</tr>
<tr>
<td>13 Juice</td>
<td>75.1% B</td>
<td>0.57</td>
<td>0.58</td>
</tr>
<tr>
<td>12 Juice</td>
<td>79.2% B</td>
<td>0.51</td>
<td>0.08</td>
</tr>
<tr>
<td>17 Ice Tea</td>
<td>83.2% B</td>
<td>0.45</td>
<td>0.44</td>
</tr>
<tr>
<td>19 Ice Tea</td>
<td>86.9% B</td>
<td>0.53</td>
<td>0.44</td>
</tr>
<tr>
<td>7 Juice</td>
<td>89.9% B</td>
<td>0.4</td>
<td>0.5</td>
</tr>
<tr>
<td>1 Juice</td>
<td>92.6% C</td>
<td>0.4</td>
<td>0.46</td>
</tr>
<tr>
<td>2 Juice</td>
<td>94.8% C</td>
<td>0.46</td>
<td>0.38</td>
</tr>
<tr>
<td>8 Ice Tea</td>
<td>98.8% C</td>
<td>0.6</td>
<td>0.55</td>
</tr>
<tr>
<td>9 Ice Tea</td>
<td>99.3% C</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td>15 Juice</td>
<td>99.6% C</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>16 Juice</td>
<td>100.0% C</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.2
ABC classification of the products and production coefficients [hours per 1000 liters]
Based on these priorities, it is possible to calculate the average utilization by multiplying the sales volumes per DC (see Table 1.1) with the production coefficients of the prioritized lines. The resulting production hours of the lines per year are shown in Table 1.3. These figures do not yet contain the setup times, which can be estimated as the total setup time in the optimal sequence through all products of a line. For the current weekly production cycles, this is shown as “setup time per week” in Table 1.3. The total load per year is composed of the production and the setup times. Related to the total available working time per year of about 6120 hours, the average utilization of every line is shown in Table 1.3. It reveals a high overload of FL 2 and FL 6 and a rather high utilization of FL 1 and FL 4. These averages do not take the seasonality of the demand into account. In peak seasons, the utilizations will even be higher.

Thus, the production management is often forced to deviate from the nor-
mal product allocation. Discharging FL 6 by shifting production to FL 5 can be done easily by local decisions in Plant 3, but bottlenecks on the other filling lines require short-term agreements between the plants and the Logistics Department.

Questions and Exercises

1. The sequence-dependent setup times on FL 6 are given in Table 1.4 in form of a from/to matrix. Verify the setup time per week on FL 6, as shown in Table 1.3 (4 hours) by searching for a cyclic sequence with lowest total setup time. Note that the precise result is 3.833 hours.

2. Verify the total yearly occupation of FL 6, as shown in Table 1.3, using the data of Tables 1.1 and 1.2 and the allocation rules explained above.

1.4 Purpose of the Frutado Case

The Frutado case is aligned with the operations along the supply chain. It has been designed in view of the following three purposes:

- Teaching Supply Chain Planning:
  The Frutado case demonstrates the various planning tasks within a
company and reveals their interdependencies. It provides examples for practicing planning methods and analyzing the results.

- Research in Supply Chain Planning:
The Frutado case permits to compare planning concepts which differ in the way how the planning tasks are combined in a planning system and how they are linked by information flows.

- Test of Advanced Planning Systems:
The Frutado case helps to understand the implementation and the use of an APS in a company. It can also be used to compare different APSs.

In order to achieve these objectives, it was necessary to include all essential operations of a company with detailed data into an integral case. This requirement had two important implications:

First, it was necessary to restrict the example company to a specific industry sector, because the planning tasks differ essentially in diverse industries (see Meyr and Stadtler 2008, for a classification). It is one of the weaknesses of the classical MRP concept, that it neglects these differences. For the Frutado case, the consumer goods sector was selected, more precisely the food and beverages industry. This sector has been less investigated than the mechanical engineering sector which is often assumed tacitly, if planning tasks are described. The characteristics of the consumer goods industry that are considered in the Frutado case are explained in the following section.

Second, a compromise had to be found between the objectives of designing a realistic example company and modeling all operations in detail. In order to keep the model transparent for teaching and research purposes, simplifications were unavoidable. The number of products and of customers is much smaller than in reality, and the production process is simplified.

Thus, the resulting company, Frutado, is not a detailed model of a real company or of a typical consumer goods company. But it is an integral model of typical supply chain operations and planning tasks in a consumer goods company.

1.5 Characteristics

The supply chain of a consumer goods manufacturer, in particular in the case of foods and beverages, shows the following characteristics, which appear in the Frutado case.

Products

The company produces standard products on stock. The production is driven by forecasts of the future demands, which may exhibit seasonal variations. The products have a rather simple structure, they are composed of a few
raw materials according to recipes. However, by varying the ingredients and the packing formats, the result may be a large number of end product varieties and stock keeping units (SKUs). This is a so-called divergent product structure. Often the products are perishable with a shelf life of some weeks only.

In the Frutado case, the number of products has been fixed to only 19, for the sake of simplicity, as explained in the previous section. This number is untypically low for a consumer goods company.

**Production Process**

The production process consists of only 1-2 stages, often characterized as “Make and Pack”. It takes place on highly automated mass production lines generating a continuous flow of output. There may be several production lines working in parallel which can be dedicated to a certain product group or general-purpose lines. As high automation is only economic in case of high utilization, the capacity of the lines is usually tightly limited.

As a rule, the number of products is much larger than the number of parallel lines. Therefore a production line has to process a number of products one after the other. Product changeovers require setup of the lines, for instance for cleaning the line or tuning it to another packing format. This causes unproductive setup times and setup costs, which may depend on the sequence of the products before and after the changeover.

Therefore, the production typically takes place in a sequence of batches or lots of the different products. The interval between two consecutive lots of a certain product is needed for producing the other products. Therefore, the replenishment lead time for the finished product contains part of this interval, in spite of the very short production time per unit of the product.

**Distribution**

Mostly, a consumer goods producer has several production sites with different ranges of products. Then, the finished products are brought together in a first distribution step, to one or a few distribution centers (DCs) which keep stocks of all products. Typically, the DCs are situated at or near a factory.

The destinations of the distribution are the retail outlets. In a traditional distribution system in Germany, the manufacturer delivers up to the outlets. However, recently, the big retail chains have installed their own central warehouses or stockless cross-docking points, from where they organize the deliveries to the outlets by themselves. Then, these retail centers are the final destinations for the manufacturer’s distribution. This concept has reduced the number of delivery points for the manufacturer considerably. In the Frutado case, only 60 “customers” are considered which may represent retail centers or outlets. Again, this number is untypically low, even in case of retail centers, for the sake of simplicity.
The shipments from the factories to the DCs take place on the basis of demand forecasts. Often, they are synchronized with the production in order to avoid duplicate stock keeping. The deliveries from the DCs to the retail delivery points are on order, with very short lead times of 24-48 hours, enforced by the retailers. The allocation of the delivery points to the DCs is fixed for organizational reasons over a medium-term horizon.

Procurement

Given the relatively small number of raw materials, compared to the finished products, the procurement function is easier than the distribution. Usually, the number of suppliers is rather low, and the lead times are short and reliable. There may be complicating factors, however, in case of natural raw materials for food and beverages, which can show a fluctuating quality and seasonal availability, due to harvest periods and, consequently, fluctuating prices. But this is not considered in the Frutado case. There, the procurement function is disregarded, and it is assumed that the required raw materials are always available.

Questions and Exercises

1. Which processes of the Frutado company are made to stock and which are made to order?

Bibliography


Lebreton, B. (2001) Aufbau einer Modellfirma und ihre Implementierung mit J.D. Edwards Active Supply Chain, Diplomarbeit, University of Augsburg, Germany
