Sandeep Pradhan

Demand and Supply Planning with SAP® APO

Demand and Supply Planning with SAP® APO

- Learn how to model and optimize your demand and supply planning processes with APO DP and APO-SLP
- Understand how to plan and manage different products and supply chain planning scenarios
- Master SAP APO functions, usability, customization, and master data parameters

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Introduction

SAP Advanced Planning & Optimization (SAP APO) is one of the key modules within SAP Supply Chain Management (SAP SCM), which has come a long way in gaining Advanced Planning and Scheduling (APS) market maturity and popularity. The tool provides the capability to support a company’s sales and operations planning process with a set of functions that balance market demand with supply chain constraints. The Demand Planning (which we’ll refer to throughout the book as APO-DP) functionality within SAP APO provides advanced forecasting and demand planning tools that enable companies to capture changes in demand signal and patterns as early as possible. Similarly, Supply Network Planning (which we’ll refer to as APO-SNP) provides tactical supply planning capabilities with integration to purchasing, manufacturing, distribution, and transportation and creates a feasible plan in a constraint supply network environment. The objective of this book is to provide an in-depth introduction to the APO-DP and APO-SNP functions, applications, and customizations.

This book is written based on the current SAP SCM 7.02 (containing SAP APO 7.0 with Enhancement Pack 2) release and provides coverage in using APO-DP and APO-SNP functionalities for basic and advanced planning concepts. While the basic planning focuses on how to configure and model the demand and supply planning cycle in SAP APO, the advanced planning provides insight into enhanced functionalities (seasonal planning, subcontracting, etc.), which support unique business scenarios. SAP APO, a user-decision support tool, is best explained with a business case study, which is the approach this book has adopted, using a fictitious company example. The book demonstrates how a fictitious computer manufacturing company named ABC Technology goes about initiating a supply chain transformation project to improve its supply chain planning process with APO-DP and APO-SNP capabilities. Throughout the book, a constant balance of theory and practice is adapted to ensure that you have a good grasp of the discussed topics. Besides explaining the functional and technical aspects of APO-DP and APO-SNP, the book also devotes some time to data conversion activities and an implementation approach for a typical SAP APO project.
Introduction

The overall goals of this book are to:

- Explain the industry best practices for demand and supply planning business processes
- Introduce SAP APO in the form of APO-DP and APO-SNP as a planning tool for business planners
- Explain the basic planning concepts and teach readers how to configure and model the planning process in SAP APO
- Deep-dive on the real-life business scenarios that will flush out the SAP APO functionalities (APO-DP and APO-SNP)
- Use a case study example to explain difficult topics
- Explain technical operational concepts in SAP APO
- Discuss an implementation approach for SAP APO

Who This Book Is For

This book is aimed at supply chain practitioners who are concerned with learning the concept of demand and supply planning and would like to implement and configure SAP APO Demand Planning and Supply Network Planning functionalities. The target audience for this book is the supply chain managers, supply chain planners, project managers, and consultants who are interested in this topic.

Basic knowledge of the supply chain management processes and a sound understanding of the supply chain planning, material management, production planning, and transportation business processes is required to understand the business scenarios explained in this book.

What This Book Covers

The book can be broadly divided into three sections. The first section (Chapter 1 through Chapter 7) explains how APO-DP and APO-SNP can fit in the company’s sales and operations planning process by supporting weekly and monthly planning cycles. This section explains how to model your supply chain and configure and set up the system. The second section (Chapter 8 through Chapter 14) touches on cross-functional areas, such as inventory planning, optimization engines, reporting, collaboration, and industry solutions, which are integral parts of SAP APO. The final section (Chapter 15 and Chapter 16) explains the SAP APO Core Interface
(CIF) and technical concepts and provides some data conversion guidelines for SAP APO project success.

The chapters can be further broken down as follows:

- **Chapter 1**
  This chapter provides a theoretical introduction to supply chain planning based on various literatures. It also discusses leading practices for the sales and operations planning process and uses the Supply Chain Council’s supply chain operation reference (SCOR) model to articulate the demand and supply planning business process decomposition. An introduction is provided to the fictitious company that’s faced with current planning challenges. An overview of SAP Supply Chain Performance Management is also provided to formulate a company’s supply chain scorecard metrics.

- **Chapter 2**
  This chapter starts by describing the Advanced Planning and Scheduling (APS) concepts and then introduces SAP Advanced Planning & Optimization (SAP APO). A brief overview of SAP APO Demand Planning (APO-DP) and SAP APO Supply Network Planning (APO-SNP) is provided, along with key functions and planning characteristics. The chapter ends with technical architecture and a brief explanation of SAP liveCache technology.

- **Chapter 3**
  This chapter provides practical guidelines for implementing the SAP APO package. Besides highlighting the implementation methodology (with the example of global template rollout), the chapter also focuses on explaining the importance of change management, business benefits, and business readiness towards steering a successful SAP APO implementation.

- **Chapter 4**
  This chapter teaches you basic customization and master data modeling steps in APO-DP and APO-SNP. Besides showing how we can design planning books for business users, this chapter also provides detailed information on the statistical forecasting process and supply chain modeling steps for supply network planning.

- **Chapter 5**
  This chapter is devoted to explaining the basic interactive planning activities for performing demand and supply planning cycle activities in APO-DP and APO-SNP. The focus of this chapter is on providing the building blocks
for the business user to start navigating the system and using basic SAP APO functionalities (for example, forecasting, supply planning runs, simulation, and alerts) in an interactive manner for preparing demand and supply plans.

- **Chapter 6**
  This chapter demonstrates the advanced functionalities in SAP APO Demand Planning. You will learn how promotion planning, lifecycle management, seasonal planning, bill of material (BOM) forecasting, product and customer segmentation, customer forecast management, and demand alerts can be customized and set up in APO-DP.

- **Chapter 7**
  This chapter demonstrates the advanced functionalities in Supply Network Planning and explains how APO-SNP can be customized and modeled to solve many complex supply chain business scenarios. Various APO-SNP functionalities that support tactical (i.e., safety stock planning, interchangeability, subcontracting, direct shipment, shelf life, and aggregated planning) and operational (i.e., Transport Load Builder (TLB), stock balancing, and warehouse capacity evaluation) planning processes are explained in both theory and practice (i.e., customization and setup).

- **Chapter 8**
  This chapter describes the collaborative planning process setup between internal and external business partners to reach a consensus on balance demand and supply plans. Using the examples of Vendor Managed Inventory (VMI) and collaborative planning, forecast, and replenishment (CPFR), this chapter shows how SAP APO collaborative planning capabilities can be modeled in the system for effective demand and supply collaborations.

- **Chapter 9**
  This chapter provides comprehensive information regarding the SAP APO’s internal SAP NetWeaver Business Warehouse (BW) staging, extracting, transformation, and reporting processes. It also explains the BW data model for demand and supply planning and outlines how SAP NetWeaver BW business content can be leveraged to activate some of the SAP standard reporting in the areas of forecast accuracy, global inventory, and global capacity.

- **Chapter 10**
  This chapter demonstrates how we can configure APO-SNP optimizer to solve complex supply chain optimization problems. The chapter provides an explanation of how mathematical models (i.e., linear and mixed integer programming)
can be formulated in the APO-SNP optimizer planning engine to solve typical distribution and allocation supply chain problems.

- **Chapter 11**
  This chapter explains the capable-to-match (CTM) functionality in APO-SNP for demand and supply matching in the supply chain. It also explains the customization and master data steps required for setting up the CTM planning engine to respect business rules around demand and supply priorities.

- **Chapter 12**
  This chapter focuses on designing inventory modeling in SAP APO for supply chain optimization. The chapter outlines a methodology for setting up different inventory models and demonstrates various tools in SAP ERP and SAP APO for effective inventory management.

- **Chapter 13**
  This chapter provides an introduction to characteristics-based planning in SAP APO and explains the concept with detailed customization and master data setup in the SAP ERP and SAP SCM systems. It also describes how we can perform characteristics-based forecasting and supply planning. The functionality of SAP APO Production Planning and Detailed Scheduling (PP/DS) is also highlighted in this chapter as it forms a part of the integrated solution in SAP APO.

- **Chapter 14**
  This chapter provides an example of SAP APO integration with an SAP industry solution and uses an Apparel and Footwear (AFS) example to demonstrate how the complexity of the industry can be matched with an integrated solution of SAP ERP AFS and SAP APO. It also describes how SAP APO functionalities, such as seasonal planning and aggregated planning, can be used to support AFS industry business requirements.

- **Chapter 15**
  This chapter explains the technical concepts within SAP APO, beginning with Core Interface (CIF), which provides the interface foundation of keeping the execution (SAP ERP) and planning (SAP SCM) systems synchronized. The chapter guides the audience in setting up CIF and monitoring and troubleshooting errors.

The second part of the chapter examines various stages of the upgrade process and some of the key functional activities that need to be performed to bring the system back to its original state. The chapter also describes the process chain for scheduling routine background jobs.
Introduction

Chapter 16
This chapter explains the SAP APO technical concepts in the form of data conversion activities using the Legacy System Migration Workbench (LSMW) and various technical enhancements. Examples are provided to show that we can use LSMW for master data and transactional data integration. This chapter also provides numerous business scenarios and technical enhancement solutions, where SAP APO native functionality needs to be enhanced to support unique business requirements.

The Appendix contains a glossary of the acronyms used in the book. In the beginning of each chapter, a supplementary mind map diagram is presented to depict the learning objective of the topic.

Acknowledgements
I would like to offer my special thanks to my wife, Imelda Linggawidjaja; my daughter, Jessica Anna; and my parents, for giving me the time and encouragement to write this book.

Finally, I would also like to convey my sincere thanks to editor Laura Korslund and the Galileo Press team with whom I have now worked on three amazing projects. Also, my special thanks to Frank Layer (author of Production Planning with SAP APO, SAP PRESS 2010) for becoming the technical reviewer for this book and providing valuable corrections and comments.

Sandeep Pradhan
Denver, Colorado – October 2012
As we mentioned, the characteristics and concepts of APS are supported by SAP Advanced Planning & Optimization (SAP APO), the core component within SAP Supply Chain Management (SAP SCM). SAP APO provides many capabilities and functions that exist within APS, which we’ll explain in the next section.

2.2 Introduction to SAP Advanced Planning & Optimization

SAP APO is used for planning, optimizing, and scheduling supply chain processes across the entire supply network. The supply chain network consists of internal locations (e.g., manufacturing plants and distribution centers), external sourcing locations (e.g., vendors and subcontractors), and external delivery locations (e.g., VMI customers).

SAP APO integrates with the SAP ERP execution system where the planning results are executed. SAP provides standard real-time Core Interface (CIF) for seamless integration between the SAP APO (planning) and SAP ERP (execution) components. Figure 2.4 depicts how the supply chain processes are supported by SAP APO modules for planning and SAP ERP for execution.

Figure 2.4 Supply Chain Processes Supported by SAP APO and SAP ERP
Next we’ll explain the various planning modules available in SAP APO and then define the task structure in APO for demand and supply planning. We’ll also provide a brief overview of the use of SAP APO.

### 2.2.1 Core Planning Modules

SAP APO provides five core modules that focus on planning and execution. Based on the business initiative and requirements of a company, you can implement all the modules in a phased approach or select only a module or two that deliver the highest value to the business. These core planning modules within SAP APO are the following:

- **Demand Planning (APO-DP)**
  Provides advanced forecasting and demand planning tools that enable companies to capture changes in demand signals and patterns as early as possible.

- **Supply Network Planning (APO-SNP)**
  Provides tactical supply planning capabilities with integration to purchasing, manufacturing, distribution, and transportation and creates feasible plans for these areas in a global supply network environment. Different optimization engines are available, which run on hard- and soft-constraint supply chain models. Balances supply chain costs with service levels.

- **Production Planning and Detailed Scheduling (PP/DS)**
  Provides manufacturing planning capabilities to plan materials and critical resources concurrently. Provides optimization solvers for sequencing and scheduling factory short-term plans.

- **Global available-to-promise (global ATP)**
  Provides not only basic available-to-promise checks, but also enhanced and extended decision support features to model different supply chain order fulfillment business scenarios. Integrates with production planning and detailed scheduling and SAP ERP seamlessly to provide real-time ATP dates. The aim of global available-to-promise is to determine whether an incoming order can be promised for a specified customer request date. Global ATP enhances the response time for order promising and the reliability of order fulfillment. It directly links
available resources, including both material and capacity, to customer orders and enhances the supply chain performance. The process helps with improving on-time delivery performance, sufficiently increasing stock to buffer inventories, and planning system integration.

- **Transportation Planning and Vehicle Scheduling (TP/VS)**
  Provides transportation planners to optimally plan the capacity of transportation modes (e.g., trucks) and schedules the routes for lower transportation costs. Provides functionality of shipment consolidation, route determination, carrier selection, multi-pick, and multi-drop.

### Example

ABC Technology plans to implement APO-DP, APO-SNP, and PP/DS to support its manufacturing and distribution planning process, for balancing its demand and supply. Also built within SAP APO is the Supply Chain Cockpit (SCC), which will provide ABC Technology business users a with a GUI to manage the supply chain network, with the exception of management (alerts) and key performance indicators (KPIs) interfaced with SAP NetWeaver Business Warehouse (SAP NetWeaver BW). Via SCC, the business users can navigate to different SAP APO applications to resolve supply chain situations.

### 2.2.2 Task Structure

To support a monthly sales and operations planning process within the company, a structure of planning tasks needs to be organized to be performed by demand and supply planners. This allows the company to transition the tactical plan to an operational plan, effectively causing fewer supply chain disruptions situations (for example, inventory stock outs). A business example of the supply chain planning tasks structure for a consumer goods company is shown in Figure 2.5.

The demand planners use the APO Demand Planning module for the consensus demand planning process. The supply planner models the supply chain in the APO-SNP module. APO-SNP calculates the distribution, deployment/load plan, and rough-cut capacity plan to check the feasibility of the demand and supply balance. The PP/DS module creates short- and medium-term manufacturing plans, taking input from the supply plan. SAP APO and SAP ERP integrate seamlessly on the master and transactional data flows between the two systems. Aligned within the planning tasks is the SAP APO planning horizon and granularity, as seen in Figure 2.6.
Figure 2.5 Planning Task Structure Using SAP APO

Figure 2.6 Supply Chain Planning Tasks: Horizon and Granularity
Companies usually structure their planning tasks on a weekly cycle. Planning repetitively on a weekly basis allows the companies to react more closely to the current inventory and order fulfillment situations. See the following chronological list of the weekly activities primarily performed on background batch jobs with user interaction as checkpoints to the overall process.

1. **Generate forecast**
   This process is performed in the APO-DP module with the planning horizon on monthly, weekly, or daily buckets. Daily buckets will be applicable for a supply chain with fast turnaround of products or when the product shelf life is critical.

2. **Net requirement calculations and rough-cut capacity check**
   This process is performed in the APO-SNP module with the planning horizon on monthly, weekly, or daily buckets. The process creates feasible plans for procurement, replenishment, distribution, and production.

3. **Manufacturing detailed capacity check**
   This process is performed in PP/DS module with the planning horizon on daily or hourly buckets. The process creates a shop floor execution plan.

4. **Replenishment**
   This process is performed in the APO-SNP module with the planning horizon on weekly or daily buckets. The plan provides visibility of the stock covers at distribution centers and gives alerts of stock out situations.

5. **Build transport loads**
   This process can be performed by either the APO-SNP Transport Load Builder (TLB) or TP/VS module with the planning horizon on daily or hourly buckets. The process creates transport loads for shipping to customers or transferring to internal distribution centers.

---

**Example**

ABC Technology focuses on creating a feasible master production schedule plan, which will roll into the operational distribution of goods. On the other hand, the retail distribution focuses on the vendor procurement and replenishment processes with the exception of the stock balancing process to keep the inventory flowing in the supply chain.
2.2.3 Business Benefits of Using SAP APO

The benefits of improved demand and supply planning using SAP APO can include enhanced revenue, reduction in costs, and improvement in asset management (see Figure 2.7). These benefits are achieved with better forecast accuracy, inventory availability for orders, and proper utilization of the company's supply chain resources (e.g., manufacturing and transportation).

![Figure 2.7 Benefits of Improved Demand and Supply Planning Using SAP APO](image)

These three areas can be further broken into supply chain improvement areas, as explained in the following list:

- **Increase revenue**
  - Improve time to market and effectiveness of new product launches
  - Improve in forecast accuracy with proper consensus demand plan process
  - Improve customer fill rates by having the right product in the right place at the right time
  - Improve forward-looking visibility to in-market sales demand to understand supply requirements
- Improve scalability of planning processes, systems, and organization (e.g., support acquisitions and organic growth)

- **Improve margin**
  - Differentiate service based on customer and/or product
  - Improve allocation of inventory during periods of scarce supply
  - Leverage excellent service in price negotiations

- **Reduce purchasing costs**
  - Enable low-cost country sourcing through improved visibility and stability of supply needs
  - Improve supplier collaboration (i.e., longer term visibility to supply needs) and managing of supplier capacity to improve service and reduce costs
  - Improve make-versus-buy decisions based on better visibility to supply requirements and internal and external constraints

- **Reduce production costs**
  - Better use of company’s global production capacity, enabling the operations strategy, through optimal sourcing
  - Improve overall supply reliability to master plan and integration with lean, pull-based production processes
  - Improve visibility of supply requirements for better long-term capacity planning
  - Improve use of contract manufacturers via improved visibility of supply–demand imbalances and outsource requirements

- **Reduce logistics costs**
  - Reduce out-of-territory shipments and premium freight charges
  - Improve visibility of total network inventory to serve the customer (i.e., reduce overall cost to serve)
  - Enable a more efficient consumption, pull-based inventory replenishment process

- **Improved inventory management**
  - Reduce total finished goods inventory required; achieve service levels through improved demand and supply planning
Reduce excess and obsolete provisions/costs through improved product-launch and phase-out planning (linked to use-up strategies)

Improve product portfolio management to manage complexity

Optimize deployment of inventory across the distribution network

Optimize customer consignment inventory through improved visibility of demand and improved replenishment process

**Improve fixed asset management**

Improve inputs to sales and operations planning process to longer-term capacity planning

Improve make versus buy decisions based on improved visibility of demand and understanding of supply constraints and alternatives

Improved transportation planning to improve asset productivity

SAP ERP also offers planning functions that can be compared with SAP APO functions (see Figure 2.8). Table 2.2 illustrates a further difference. This comparison is helpful to the clients who have implemented planning functions in SAP ERP and are looking to implement SAP APO in the near future. The comparison helps the project team member relate the current business process with the new SAP APO business processes.

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<tr>
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<th>SAP APO</th>
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<tr>
<td>Flexible Planning</td>
<td>Demand Planning</td>
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<tr>
<td>Demand Management</td>
<td>Supply Network Planning</td>
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<td>Distribution Requirements Planning</td>
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<tr>
<td>Material Requirements Planning</td>
<td>Production Planning / Detailed Scheduling</td>
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<td>Capacity Requirements Planning</td>
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**Figure 2.8** Planning Functions in SAP ERP and SAP APO
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<th>SAP APO</th>
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<tr>
<td>Demand Planning</td>
<td>Flexible Planning module:</td>
<td>APO-DP module:</td>
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<tr>
<td></td>
<td>▶ Creates sales forecast at the user-defined level (e.g., product and customer)</td>
<td>▶ Creates sales forecasts at any product- or customer-hierarchy level</td>
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<td></td>
<td>▶ Several time buckets through batch conversion</td>
<td>▶ Different time buckets can be used simultaneously with data views.</td>
</tr>
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<td></td>
<td>▶ Data manipulation rules via ABAP development</td>
<td>▶ Easy manipulation of data via macros</td>
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<tr>
<td></td>
<td>▶ Limited model size</td>
<td>▶ Unlimited model size possibility</td>
</tr>
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<td></td>
<td>▶ Provides basic statistical forecast models</td>
<td>▶ Multiple statistical forecasting models available</td>
</tr>
<tr>
<td></td>
<td>▶ Limited data storage</td>
<td>▶ Data storage technique different via liveCache</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Better interactive planning for business planners</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Exception management via alerts</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Simulations possibility</td>
</tr>
<tr>
<td>Supply Planning</td>
<td>Distribution Requirement Planning module:</td>
<td>APO-SNP module:</td>
</tr>
<tr>
<td></td>
<td>▶ Infinite planning output</td>
<td>▶ Various optimization possibilities with planning tools—heuristics (infinite), capable-to-match (infinite, rules-based), and optimizer (finite, cost-based)</td>
</tr>
<tr>
<td></td>
<td>▶ Planning done per plant</td>
<td>▶ Interactive planning in a spreadsheet-type user interface that can be customized to user needs</td>
</tr>
<tr>
<td></td>
<td>▶ Planning results in table format with fewer layout customization possibilities</td>
<td>▶ Planning performed and displayed in various time buckets (e.g., daily, weekly, monthly)</td>
</tr>
<tr>
<td></td>
<td>▶ Predefined exception messages that can be switched on or off</td>
<td>▶ Basic and advanced safety stock calculations</td>
</tr>
<tr>
<td></td>
<td>▶ Planning with minute precision</td>
<td>▶ Plans procurement, production, and distributions; feasible plans based on soft and hard supply chain constraints</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Aggregated planning possibility across the network</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Vendor Managed Inventory and collaborative supply management can also be modeled</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▶ Performs production rough-cut capacity check</td>
</tr>
</tbody>
</table>

**Table 2.2** Difference between SAP ERP and SAP APO Planning Functions
### Functions

<table>
<thead>
<tr>
<th>Functions</th>
<th>SAP ERP (MRP II/DRP)</th>
<th>SAP APO</th>
</tr>
</thead>
</table>
| Manufacturing Planning | Production Planning module:  
  ▶ Unconstrained planning (infinite) with capacity planning as secondary step  
  ▶ Single production plan approach  
  ▶ Planning for internal work center resources  
  ▶ Production orders are dispatched to create loads on work centers  
  ▶ Performs materials resource planning run for MPS (master production schedule) materials first and then for raw materials | PP/DS module:  
  ▶ Material and capacity planning possible  
  ▶ Easy-to-use planning views, allowing planners to view material quantity and capacity simultaneously  
  ▶ Unconstrained (infinite) or constrained (finite) planning can be modeled for manufacturing resources  
  ▶ Multi-plant production can be modeled based on product availability and priorities  
  ▶ External locations (e.g., subcontractors and vendors) can also be modeled  
  ▶ Optimizer available for scheduling and sequencing of production plans with the objective of lower manufacturing costs  
  ▶ Various planning algorithms and scheduling techniques available  
  ▶ Scheduling board tool for planners to manage daily production schedule |

Table 2.2  Difference between SAP ERP and SAP APO Planning Functions (Cont.)

After this overview of SAP APO, we’ll look at the planning capabilities of SAP APO in the next section.

### 2.3  SAP APO Planning Functions

Before we look at the planning functions within SAP APO, it is good to study the four categories of input data SAP APO uses to operate and its logic toward processing. This input data feeds the mathematical model in APO, and the data accuracy results in better SAP APO planning output. As shown in Figure 2.9, the four categories are:

- **Supply chain context**  
  This data defines the physical scope of the supply chain with locations, bills of materials, routing, and the lead times across the supply chain network.
Shelf life is the length of time within which a specific product, such as consumer foods, beverages, pharmaceutical drugs, chemicals, and many other perishable items, needs to be consumed before it is considered unsuitable for sale, use, or consumption. In some countries, a best before, use by, or freshness date is required on packaged perishable foods. Shelf life planning functionality helps these companies prevent waste and stock out situations in their supply network. Shelf life is common not only among consumer foods and beverages, but also in pharmaceutical and other industries.

Note

While APO-SNP supports the shelf life feature, a close integration is required with SAP ERP physical batches to make the overall process successful.
In the following sections, we’ll go over master data, transactional data integration, customization, alerts, and business scenario testing related to maintaining a proper shelf life practice.

### 7.3.1 Shelf Life Master Data

You need to maintain the master data for shelf life in both the SAP ERP and SAP SCM systems. Most of the material master data is maintained in SAP ERP and then transferred to SAP SCM (APO) system via the Core Interface (CIF). To maintain the master data in SAP ERP, access SAP ERP Transaction MM02 and navigate to the General Plant Data/Storage view. The field definitions (as shown in Figure 7.19) in SAP ERP are as follows:

- **Minimum Remaining Shelf Life**
  Minimum number of days the product should have for selling to the consumer.

- **Total Shelf Life**
  Total shelf life of the product from production until the expiration date.

- **Period Indicator**
  Identifies time unit of measure for minimum **Remaining Shelf Life** and **Total Shelf Life** fields.

- **Rounding Rule for Shelf Life**
  Rounding rule for placing the expiration date at the beginning or end of the period.

- **Storage Percentage**
  Identifies the minimum shelf life the product needs to hold during shipping from one location to another.

As with SAP ERP, maintain the following fields in SAP APO via CIF (see Figure 7.19) or via Transaction /SAPAPO/MAT1 [located in the Properties view]):

- **Planning with Shelf Life**
  Determines whether shelf life functionality is considered for this product. Set by CIF, a value is maintained in the **Total Shelf Life** field in SAP ERP.

- **Shelf Life**
  Filled via CIF from **Total Shelf Life** field in SAP ERP. Value is maintained in days.
Figure 7.19  Shelf Life in Material Master (SAP ERP) and Location Product /SAPAPO/MAT1 Master Data Maintenance

- **Maturation Time**
  Quality time period between the production of the material and its use. Currently not filled via CIF. Value is maintained in days.

- **Required Minimum Shelf Life**
  Minimum shelf life a stock/receipt element must have to cover a demand. Filled via CIF from field Minimum Remaining Shelf Life from SAP ERP. Value is maintained in days.

- **Required Maximum Shelf Life**
  Maximum shelf life a stock/receipt element must have to cover a demand. Currently not filled via CIF. Value is maintained in days.

- **Rounding Rule**
  Filled via CIF from fields Rounding Rule for Shelf Life and Period Indicator for Shelf Life in SAP ERP.

- **Percentage Remaining Shelf Life**
  Filled via CIF from field Storage Percentage from SAP ERP.

### 7.3.2 Shelf Life Transaction Data

The shelf life information for a physical stock is stored in a *batch*. A batch in SAP ERP contains all the characteristics information about that inventory: the date of manufacture, the shelf life expiration date, and the available from date (day after end of maturation time). These attributes can be entered manually during the goods
receipt (SAP ERP Transaction MIGO) of the inventory either from the manufacturer or external supplier.

The warehouse personnel enter the date of production for the batch and system based on material master to determine the shelf life date. If the shelf life expiration date is missing, it is calculated from the date of manufacture and the total shelf life from master data.

An example of a batch is shown in Figure 7.20, with the production date and shelf life expiration date. A material needs to be activated for batch management in the material master (SAP ERP Transaction MM02) for batch creation. The batch information can be accessed either via batch SAP ERP Transaction MSC2N or via batch information cockpit (BMBC).

The batch information from SAP ERP is transferred to SAP APO via CIF; you can view it in Transaction /SAPAPO/RRP3 in the SL Date 2 field. The SAP APO Shelf Life Expiration Date (SLED) behaves differently based on the SAP ERP batch status, stock type, and Quality Management (QM) usage decision. Table 7.1 shows the APO SLED calculation under different combinations.
<table>
<thead>
<tr>
<th>Batch Status</th>
<th>Stock Type</th>
<th>Quality Usage Decision</th>
<th>APO Shelf Life Expiration Date (SLED)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unrestricted</td>
<td>In Quality Inspection</td>
<td>Pending</td>
<td>Planned (inspection lot end date and product master total shelf life)</td>
</tr>
<tr>
<td>Unrestricted</td>
<td>Unrestricted</td>
<td>A</td>
<td>Actual (from batch master)</td>
</tr>
<tr>
<td>Unrestricted</td>
<td>Blocked</td>
<td>N/A</td>
<td>Actual</td>
</tr>
<tr>
<td>Unrestricted</td>
<td>Return</td>
<td>N/A</td>
<td>SAP APO doesn't consider return stock</td>
</tr>
<tr>
<td>Restricted</td>
<td>In Quality Inspection</td>
<td>None</td>
<td>Planned (material document posting date + product master total shelf life) – rare instance when material is put in restricted status while in quality inspection (QI)</td>
</tr>
<tr>
<td>Restricted</td>
<td>Restricted</td>
<td>None</td>
<td>Planned (material document posting date + product master total shelf life) – rare instance when material is moved to another location prior to usage decision</td>
</tr>
<tr>
<td>Restricted</td>
<td>Restricted</td>
<td>A</td>
<td>Business scenario where material is moved to another location after a Quality Management (QM) usage decision</td>
</tr>
<tr>
<td>Restricted</td>
<td>Blocked</td>
<td>N/A</td>
<td>Actual</td>
</tr>
<tr>
<td>Restricted</td>
<td>Return</td>
<td>N/A</td>
<td>SAP APO doesn't consider return stock</td>
</tr>
</tbody>
</table>

Table 7.1  SAP APO SLED Integration with SAP ERP Batch Management

To transfer the batch shelf life dates from SAP ERP to SAP APO, the integration model needs to have active characteristics, classes, and batches. The integration model (CIF) is created/generated and activated in SAP ERP Transactions CFM1 and CFM2.

Shelf Life Integration: Relevant SAP Notes

- SAP Notes 391018 and 751392 explain integration of batches into SAP APO from SAP ERP. Other relevant notes regarding shelf life are:
  - Note 810694: Shelf life with initial production date not transferred
  - Note 1028924: CIF classification: Deletion of characteristic value
  - Note 1366888: Deleting values in batch classification
  - Note 78235: Revaluing reference characteristics in batch classification
  - Note 979779: Deleting values in batch classifications
Example

In addition to other business processes, ABC Technology has also activated the shelf life for its procurement process. The users can now view the shelf life information in purchase requisition and purchase orders.

The purchase requisitions and purchase orders also contain the shelf life information, which is transferred to SAP APO for planning. Figure 7.21 shows the purchase requisition and purchase order fields where the shelf life data is populated.

![Purchasing Document Shelf Life Data](image)

**Figure 7.21** Purchasing Document Shelf Life Data

### 7.3.3 SAP ERP Batch Integration

Let’s look at the basic configuration for batches in SAP ERP to support the batch integration with SAP APO.

**Characteristics and Class**

There are six characteristics of importance for batch integration:
- **LOBM_APO_SL_MIN**: Minimum shelf life/maturity (in seconds)
- **LOBM_APO_SL_MAX**: Maximum shelf life/shelf life (in seconds)
- **LOBM_APO_SL.UTC**: Reference time stamp of batch
- **LOBM_VERAB**: Availability date
- **LOBM_VFDAT**: Expiration date, shelf life
- **LOBM_HSDAT**: Date when batch was produced

![Change Class: SAP ERP Class](image1)

![Change Class: SAP APO Class](image2)

**Figure 7.22** Shelf Life Class Definitions in SAP ERP and SAP APO

The characteristics need to be assigned to the class with the class type 023 (batch). Only the characteristics with organizational areas are transferred to SAP APO. As Figure 7.22 shows, the SAP APO shelf life class is shown in SAP ERP and SAP APO,
whereby only the first three characteristics with organizational area are transferred. The characteristics are accessed via Transaction CT04, while the class can be accessed via Transaction CL02.

Before the class is transferred from SAP ERP to SAP APO via CIF, we need to perform class organization customization in SAP APO. Follow the SAP APO Transaction O1CL, select /SAPAPO/VERKEY (Version 000), and enter class type 230 in the ORGANIZATION AREAS class type (see Figure 7.23).

![Figure 7.23](image)

**7.3.4 Shelf Life Key Figures**

APO-SNP provides standard planning book 9ASNP_SHLF for performing shelf life planning. The planning book provides four basic key figures for shelf life calculation but lacks in planning the projected wastage quantity during the heuristics run. However, this issue can be mitigated by adding a new key figure and macro for the PROJECTED WASTAGE QUANTITY to TOTAL DEMAND key figure. This will enable
businesses to plan for a projected wastage quantity and not run into stock out situations.

Also, we can define a days of Supply (Shelf Life) key figure to take into account stock that is not expiring. The key figures are calculated via a macro with an embedded SAP function module. The definition of the first four standard and two custom key figures are as follows:

- **Expiry Qty** displays the total quantity of the batches that will expire in a given month without regard to demand.
- **Projected Wastage Qty** displays the remaining quantity of the expiring batches after considering pegged demand consumption prior to expiry.
- **Stock on Hand (Shelf Life)** displays the quantity of inventory remaining after considering demand consumption and the shelf life of all batches on hand (i.e., the total inventory not expiring in that month after demand has been fulfilled).
- **Supply Shortage (Shelf Life)** displays the shortage quantity in the case in which the stock on hand (shelf life) is not sufficient to fulfill demand.
- **Additional Demand (Shelf Life)** equals the projected wastage and is the key figure used to consume the expiring material out of inventory and enable shelf life planning.
- **Days of Supply (Shelf Life)** calculates days of supply using stock on hand (Shelf Life), therefore considering only stock that is not expiring.

The **Projected Wastage Quantity** key figure calculation is based on the dynamic pegging function. This function automatically links requirements for a location product with suitable stock or receipt elements. If there is any change in planning, a new dynamic relationship is created and adjusted with the new plan. Figure 7.24 shows an example of dynamic pegging with a FIFO (first in first out) relationship where the receipts elements are pegged with requirements elements as per the earliest date sequence.

**Business Scenario**

Let’s see how the shelf life planning comes into play in interactive planning. Figure 7.25 shows a business scenario for a consumable product of which there are 200 units of receipt elements, but the demand requirements of 200 units are placed in a different bucket for consumption. One of the demand elements is placed in a bucket after the expiration date of 100 units of receipts. In a standard situation, the
planner will get an alert about the wastage and will react to the situation accordingly. An alternative solution for automating the business scenario is to capture the additional demand (shelf life) and populate the total demand key figure with the use of an SAP APO macro to keep the wastage key figure to the TOTAL DEMAND key figure.

In this way, during the next APO-SNP planning run, 100 units will be proposed to make the demand and supply plan balanced. Next, the planner can run SNP heuristics interactively by executing one of the three heuristics methods by clicking the LOCATION, NETWORK, or MULTILEVEL icon in the interactive planning book.
Figure 7.26 shows the post-heuristics run in which the demand is fulfilled by a new receipt element leaving the wastage of 100 units.

### 7.3.5 Shelf Life Propagation

*Shelf life propagation* is defined as the capability to dynamically peg the requirement and receipt after the SNP planning run. The transportation and production durations are factored into the propagations. You can access this feature via Transaction /SAPAPO/SNP10 or report /SAPAPO/RSNP_SHLF_PROP. Running the shelf life propagation program will ensure that all the receipts and requirement elements are properly matched and that the wastage is calculated based on the current situation.

### 7.3.6 Shelf Life Alerts

Shelf life planning alerts help the planner react to supply situations due to shelf life expiration issues. SAP APO provides standard alerts in both APO-SNP and Production Planning/Detailed Scheduling (PP/DS) related to shelf life. The alerts are accessed in the Alert Monitor via Transaction /SAPAPO/AMON1.

**Note**

Refer back to Chapter 5, Section 5.7, for information on how to set up the Alert Monitor.
The alerts in APO-SNP alerts available in both dynamic and database form are:

- **Supply Shortage Shelf Life**
- **Projected Waste Quantity**

The shelf life functionality works on specific restrictions to adhere to the requirement and receipts pegging relationship. These restrictions are as follows:

- Maturation time of supply before due date of demand element
- Expiration of supply after minimum required shelf life of demand element
- Expiration of supply before maximum required shelf life of demand element

The following list provides the few PP/DS standard alerts that look at the above restrictions and alert the business planner of the supply planning situations:

- Maturation time not completed (requirement/receipt)
- Shelf life too short (requirement/receipt)
- Shelf life too long (requirement/receipt)
- Receipt without pegging relationship with expiration date

### 7.4 Planning Strategies and Forecast Consumption

Planning strategies play an important role in determining whether the net requirements are used for planning purposes or triggering of production or are consumed using existing customer requirements (for example, sales orders).

**Note**

A *planning strategy* in SAP ERP is known as a *requirement strategy* in SAP APO.

For every planning strategy, we define the consumption process by the combination of requirement types from Demand Management and Sales Order Management in SAP ERP. *Consumption strategies* help in determining how requirement quantities and dates are compared to actual customer requirements to perform forecast consumption. In the consumption process, the system compares planned independent requirement quantities and dates with actual customer requirements. The requirement types entered when maintaining planned independent requirements is compared with the customer requirement types specified in SAP ERP Customizing.
Note on System Upgrades

You need to de-initialize the APO-SNP planning area during the upgrade process; otherwise you risk the loss of all time series data in the APO-SNP planning area. An alternative solution would be to design a BW cube data model for loading all the time series key figure data before upgrade and then re-importing it after the system upgrade process.

9.6 SAP NetWeaver BW Business Content

SAP NetWeaver Business Warehouse provides business content for standard industry reports. The business content delivers a preconfigured set of roles and tasks that are relevant information models. These information models include all the technical objects, such as workbooks, queries, info sources, data sources, InfoCubes, key figures, characteristics, update rules, and extractors.

However, there isn’t much SAP NetWeaver BW business content available for APO-DP or SNP. Most of the supply chain reports are built by individual companies directly in SAP NetWeaver BW based on their unique business rules and
requirements. A few good standard reports that are available in SAP NetWeaver BW include forecast accuracy, global inventory, and global capacity.

### 9.6.1 Access Standard Business Content

You can access standard business content in the BW Administrator Workbench (more details on this transaction in Chapter 4, Section 4.2) by executing Transaction RSA1 under the BI content functional area. As Figure 9.21 shows, the BI content has three screens. The first screen (1) is where you determine the view of the objects either by object types or other options. Selecting **My Object Type** provides flexibility to identify the SAP NetWeaver BW query or InfoProvider you want to activate. The middle screen (2) is where you select the objects you want to activate. The last screen (3) provides different installation settings and also contains the overview of the objects you have selected.

![Figure 9.21 Business Content Screens](image-url)
9.6.2 Install Standard Business Content

Let’s go over the different steps to install the standard business content.

Identify Business Content Object Type

First, identify the business content object by object type. As Figure 9.22 shows, we want to activate the forecast accuracy query (forecast vs. actual sales). By using SELECT OBJECT, you can select the query you want to install. The user accesses this screen using Transaction RSA1 and clicking the BI CONTENT path in left screen. The query is then further located by clicking the QUERY ELEMENTS option.

![Figure 9.22 Collection of All BW Objects for a Standard Query Activation](image)

Grouping

The next step is grouping, which is performed by dragging and dropping the object from the left side to the right side in Figure 9.22. Before performing this activity, make sure to select whether you want to collect all the associated objects on the data model automatically or manually. The automatic option is the default setting.
Also, some of the objects may be single source (SAP NetWeaver BW) dependent, while others may have multiple source system (SAP SCM and SAP NetWeaver BW) dependency. The use of business content helps in this equation because the multiple-system (for example, SAP SCM and SAP NetWeaver BW) objects can be packaged to make a specific business object (for example, reporting InfoCube) work. Also, most of the contents are already built, and the user just has to activate the collected objects and see if the content output provides the result output.

During the grouping, an option is provided to select the source system linked with the objects. The example in Figure 9.22 shows all the collected objects when the query is selected for activation.

**Install and Activate**

The last step is to install and activate the standard business content once all the required SAP NetWeaver BW objects are collected. You can execute the installation and activation directly from the SAP NetWeaver BW administrator workbench by using the INSTALL icon, as shown in Figure 9.22. The installation process can start once we have transferred all the collected SAP NetWeaver BW objects. During the installation, all tables, objects, structures, programs, and dependent components will be activated. The installation process can be simulated to identify any errors using INSTALL in simulation mode. Other options are to install in the background and transport request creation.

The Supply Chain Council provides standard metrics for business performance measurement under SCOR. Let’s look at this in next section.

### 9.6.3 Supply Chain SCOR Metrics

The Supply Chain Operation Reference (SCOR) model offers the possibility to model a company’s business processes. Companies can leverage existing predefined metrics to form their business scorecard. This scorecard can be at both the operational and executive levels for better monitoring of business performance.

SCOR provides performance metrics, which the company can associate as characteristics. As Figure 9.23 shows, the SCOR metrics provide measurement in all process areas of planning, sourcing, manufacturing, inventory management, and customer delivery. The measurement can be at the strategic, tactical, or operational level.
The five performance attributes measured in SCOR are:

- **Supply chain agility**
  This attribute gives information about whether and how fast a supply chain responds to demand/supply market changes.

- **Supply chain responsiveness**
  This attribute provides information about the speed at which a supply chain provides its product to the customer.

- **Supply chain asset management**
  With the help of this attribute, a supply chain can be analyzed in terms of effectiveness in managing assets for demand satisfaction.

- **Supply chain cost**
  All costs incurred along supply chain processes are taken into the calculation.

- **Supply chain reliability**
  The attribute looks at the performance of product delivery (correct product, correct place, and correct time).
SCOR metrics consist of three levels. (Currently SCOR has 570 metrics in version 9.0.) These metrics are defined in such a way that the company has diverse control and easy access to information needs.

### 9.6.4 Level 1

Level 1 contains high-level strategic metrics. These metrics may cross multiple business processes along the supply chain, as they do not relate to one core processes of SCOR Level 1. These metrics are suitable for the management level to monitor business performance. Figure 9.24 shows the classification of Level 1 metrics grouped under customer-facing and internal-facing. Customer-facing is primarily focused towards measuring external business partners (for example customers) while internal-facing is relevant to measure internal business process (manufacturing, for example).

In the following subsections, we'll explore the seven key SCOR scorecard metrics that help in translating company strategic goals into measurable targets, measuring effectiveness across end-to-end business processes, and proactively identifying bottlenecks and pin-pointing root causes.

### 1: Perfect Order Fulfillment

A *perfect order* is defined as an order that meets all of the following five standards:

- An order is considered complete if the products ordered are the products provided and the quantities provided match the quantities ordered (percentage of orders delivered in full).
- An order is considered on time if the location, specified customer entity, and delivery time are met upon receipt (delivery performance to customer by commit date).
- An order is considered in perfect condition if the product delivered has no manufacturing or packaging errors and is accepted by the customer (perfect condition).
- An order is considered to have shipment transaction accuracy if all the shipment documentation related to the order is accurate, complete (with the correct price and quantity) and on time (shipment transaction accuracy).
An order is considered to have EDI transaction accuracy if the customer-facing EDIs mentioned in the list run error-free (EDI 859, 855, and 810) (EDI transaction accuracy).

2: Order Management Cycle Time

Order fulfillment cycle time is defined as the time taken from customer authorization of a sales order to customer receipt of the product. The major segments of time include order entry, manufacturing, distribution, and transportation.
3: Demand Management Accuracy

Demand management accuracy is a measure (as a percentage) of how accurately sales figures are forecasted. Mean Absolute Percentage Error (MAPE) is the industry-wide accepted tool to measure supply chain forecast accuracy.

4: Upside Supply Chain Flexibility

Upside supply chain flexibility measures the amount of time it takes the supply chain to respond to an unplanned increase in demand from forecast without incurring service or cost penalty. It measures the total time taken (in days) from generating the manufacturing order to its shipment.

5: Inventory Turns

Inventory turns measure how many times the company inventory is sold or replaced during a financial year. Since inventory (both finished goods and components) has low liquidity, a high inventory turnover ratio would indicate that the company is using its inventory assets well. It is the ratio of cost of goods sold to average inventory.

6: Total Supply Chain Management Cost

Total supply chain management cost measures controllable and uncontrollable costs associated with the plan, source, make, deliver, and return supply chain processes.

7: Return on Working Capital

Return on working capital is a measurement comparing the depletion of working capital (cash in hand) to the generation of sales over a given period. The metrics provide some useful information about how effectively a company is using its working capital to generate sales.

9.6.5 Level 2

Level 2 metrics are diagnostics metrics. They identify the root cause in the supply chain where corrections are required with proactive action. These metrics are important for business owners who own a particular end-to-end function in the company. Some of the metrics are represented in percentage form (for example, what percentage of orders was fulfilled today). An example is shown in Figure
9.25, illustrating how the supply chain metric in Level 1 depends on various Level 2 metric calculations.

**Figure 9.25**  Decomposition of Level 1 to Level 2 Metrics

### 9.6.6  Level 3

Level 3 metrics contain the configuration metrics and are more descriptive. One example is the number of occurrences in which excessive inventory is returned and followed. These metrics enable SCOR users to define improvement opportunities and follow implementation of identified actions. An example is shown in Figure 9.26, in which the Level 2 metrics are decomposed to Level 3 metrics.
Figure 9.26  Decomposition of Level 2 to Level 3 Metrics

Example

ABC Technology currently uses numerous Excel spreadsheets and gathers information from different sources to manage its reporting needs. With the implementation of SAP APO, it hopes to streamline its demand and supply planning-related metrics and KPIs to better manage its business. With the integration of SAP APO and SCOR, it has selected a few metrics and KPIs to build operational scorecards and one executive scorecard.

9.7  Summary

SAP APO plays a pivotal role in providing a subset of demand and supply planning data. The chapter introduces supply chain performance management and highlights various SAP NetWeaver BW integration scenarios with SAP SCM for reporting purposes. The chapter also explained how data is extracted from SAP APO and explained the steps to implement standard business content and SCOR.

The next chapter focuses on the SNP optimizer. This planning engine attempts to deliver the most cost-effective plan by balancing demand with supply chain penalties.
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