

Reading Sample

Chapter 1 provides an introduction to the book as a whole, from the goals of the book to its structure and content. Chapter 2 discusses the organizational structures of SAP ERP, gives an overview of Production Planning and the three main production types, and briefly summarizes the use of Product Costing (CO-PC) and the SAP calendar, as they relate to Production Planning.

"Introduction"



"Organizational Structures in SAP ERP"



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The Author

Jawad Akhtar

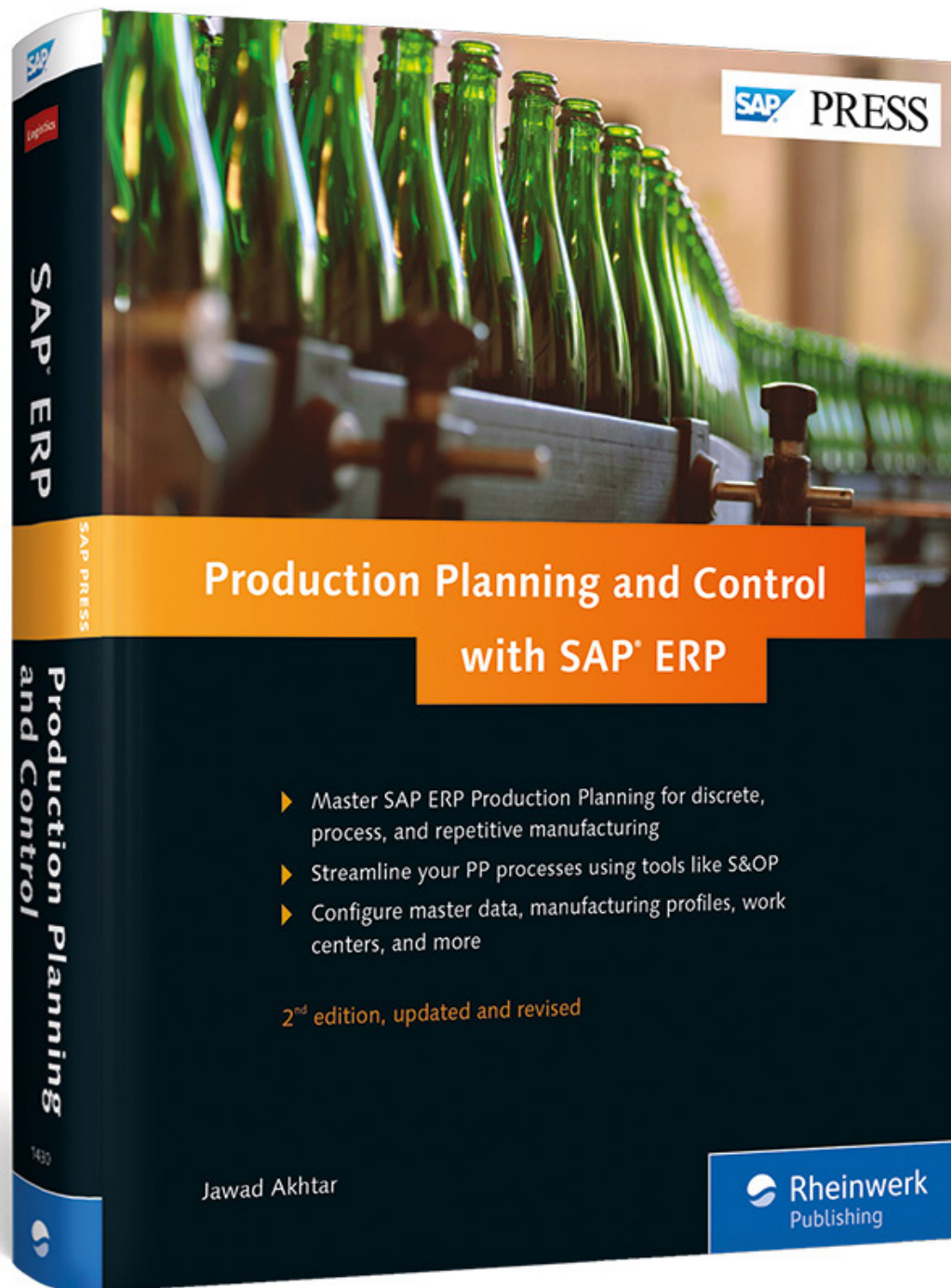
Production Planning and Control with SAP ERP

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1 Introduction

A company that is in the business of manufacturing a product and selling it to customers goes through the rigor of production planning and then production execution. SAP ERP Production Planning (referred to as PP throughout the book) plays a critical role in the logistics functions of the company to accomplish just this. This component enables the company to benefit from historical data to prepare a forecast that can then be used in sales and production planning. From an initial sales plan or sales orders from customers, to the highly integrated and complex chain of interdependent activities in logistics in the SAP ERP system, the PP component reflects its strength, both in planning and execution. It seamlessly integrates with sales, procurement, quality, maintenance, projects, human capital, finance, and controlling functions of the company. It also integrates with SAP Manufacturing Execution (SAP ME), as well as with SAP Manufacturing Integration and Intelligence (SAP MII).

1.1 Goals of This Book

The first goal of this book is to provide you with the step-by-step approach to configure and implement three different production types in PP: discrete, process, and repetitive manufacturing.

The book lays the initial foundation in the form of configuration and then explains how the configuration impacts actual business processes. The configuration to business process approach is maintained throughout the book.

The next goal is to provide comprehensive coverage to the PP workflow tools available. Further, there are significant "hidden" or lesser-used functionalities in PP that you can integrate even when (and long after) your SAP ERP system implementation is complete. These tools are covered to bring greater optimization to your business processes and greater return on your investment in the SAP ERP system.

The book offers several real-life examples and other modeling hints and tips to help you decide which option best meets the business needs of the company. Screenshots are used extensively and are duly supported by in-depth coverage of concepts and terminologies. SAP ERP 6.0 EHP 8 is used in the screenshots. The menu paths or transaction codes are given to perform each step. Where possible, a deliberate attempt is made to use the SAP's Internet Demonstration and Evaluation System (IDES), so you can configure and implement a solution in a training client. Where specific or unique data is used, all necessary prerequisites and hints are given to enable you to set up the data or meet the prerequisites before attempting to run a business process. While this book can only cover so much of a topic, we highly encourage you to explore and try out a large number of options, icons, menu paths, and other pointers to continue the process of self-learning and eventually become an expert in PP.

In this book, we also cover several cross-component functionalities that enable you to leverage their strengths not only in PP but also in other logistics components that are implemented in your company. For example, you can use the classification system, digital signature, Early Warning System (EWS), flexible planning standard analysis, information systems, and reporting in many other logistics components. In other words, this book goes beyond the PP component to help in optimizing business processes in other logistics components.

1.2 Target Audience

This book is intended for all readers who use PP in the SAP ERP system, such as the component's team leader, project team members in an SAP ERP system implementation, integration managers, production planners, or production controllers working in operational positions in the company. Because this book covers three different production types—discrete, process, and repetitive manufacturing—it tends to benefit those readers who are either transitioning or intending to transition from companies using different production types. Additionally, if the company is embarking on production and capacity expansion, then this book can help by facilitating the creation of the new enterprise structure needed in the SAP ERP system to support the expansion. Finally, this book can be an invaluable reference to SAP ERP system consultants and even business process owners who are considering the transition to a consulting career and need a comprehensive understanding of the required concepts and fundamentals.

1.3 Structure and Content

This book takes a deep-dive approach to deliver in-depth and comprehensive coverage of discrete, process, and repetitive manufacturing in SAP ERP. It begins by covering the enterprise structure that you need to set up in the PP component, which also reflects the interdependencies of the enterprise structures of other components. The configuration basics that you need to know for each production type are covered next. Similarities and differences in various production types are highlighted to enable you to comprehensively differentiate one from the other. The configuration of each production type is then put to actual use, in which we show the impact of the configuration on the business processes. You must understand a business process in a comprehensive way before modeling and configuring it in the SAP ERP system.

The book then transitions to cover the PP workflow tools available. You'll also learn how to optimize your production processes by using several latent features that are often not as frequently used to bring about business processes improvements. This book moves toward conclusion by covering the reporting capabilities, including the flexibility to create self-defined queries. Finally, the book concludes by broadly covering the integration of PP with some of the other SAP ERP components.

In summary, the following structure is used:

In Part I of this book, starting in **Chapter 2**, we cover the broad outline of the entire book and why you should implement a specific functionality or how it will benefit your business processes. We'll discuss the enterprise structure that you'll need to set up in PP, which at the same time also depends on the enterprise structures of other components. The enterprise structure forms the backbone of the SAP ERP system, in which all the important business processes of the company are mapped. Eventually, reporting also takes important elements from the enterprise structure.

In Part II of this book, we move forward with covering the configuration basics that you need to set up for each production type. However, the primary focus of the three chapters in this part is on the configuration basics only, whereas the actual and practical use of configuration basics are covered with the business

processes in Part III. **Chapter 3** covers the configuration basics of discrete manufacturing, **Chapter 4** attends to the configuration basics of process manufacturing, and **Chapter 5** covers the configuration details for repetitive manufacturing.

Part III of this book discusses the PP workflow by each production type, and we make logical connections to the business processes of each production type for which we undertook the configuration in the relevant chapters of Part II. **Chapter 6** provides an in-depth coverage of the business processes of PP in discrete manufacturing. **Chapter 7** brings out the similarities and differences between discrete and process manufacturing, but remains primarily focused on the process industry-specific functionality known as Process Management. Process Management then matures to a user-friendly functionality known as Execution Steps (XSteps). XSteps can also be used in discrete manufacturing. In the same chapter, we also cover how to use the process manufacturing cockpit. The focus of **Chapter 8** is on the important business processes of repetitive manufacturing, in which, once again, we make consistent and logical links to the configuration chapter.

Part IV of this book covers the PP workflow tools. **Chapter 9** focuses on sales and operations planning (S&OP), in which we cover product group, flexible planning, and standard analysis in flexible planning. Forecasting as an invaluable planning tool is also covered in this chapter. **Chapter 10** is on SAP Demand Management, in which we cover planning strategies and production methods such as make-to-order (MTO) and make-to-stock (MTS). Material requirements planning (MRP) is covered in **Chapter 11**, in which we discuss the planning calendar and also MRP areas. In **Chapter 12**, you'll see how you can use MRP to successfully execute Long-Term Planning (LTP) to simulate what-if planning scenarios.

Part V is all about optimizing PP. **Chapter 13** covers special procurement types, such as subcontracting, phantom assembly, procurement or production at another plant, withdrawal from another plant, consignment, and pipeline materials. In **Chapter 14**, we show you how to manage the capacity requirements planning (CRP) in your SAP ERP system, including its evaluation and leveling. **Chapter 15** covers the versatile and dynamic functionality of the classification system, which is cross-modular and finds several applications not just in PP, but also in other logistics components. The co-products and by-products that the actual production process generates find comprehensive coverage in **Chapter 16**. Next, in **Chapter 17**, we show you the benefits of implementing the digital signature functionality in your business processes to eliminate or reduce the manual signature and approval process. Digital signature is also cross-modular.

The last part, Part VI, is all about monitoring and evaluating PP. In **Chapter 18**, you'll learn how to quickly set up alerts in your SAP ERP system with the Early Warning System (EWS) to closely monitor important deviations to your business processes and make quick decisions and actions. You can also set up EWS in other logistics functions, if needed. In **Chapter 19**, you'll learn the features, functionalities, menu paths, navigation tools, and many options available to run a large number of standard reports available in SAP ERP. The concepts you'll develop here will enable you to expand your knowledge horizon to explore standard reports available in other logistics components. In this chapter, we also cover how you can quickly create your own reports by using the SAP Query tools. Finally, in **Chapter 20**, we give you some "flavors" to the complex and highly interconnected world of PP integration with other logistics functions. Here, we provide five examples in which PP integrates with SAP ERP Materials Management (MM), SAP ERP Quality Management (QM), SAP ERP Project Systems (PS), and SAP ERP Plant Maintenance (PM). We also provide a roadmap you can use to ensure effective planning and comprehensive monitoring of cross-components integration during your SAP ERP system implementation project.

In the appendix, you'll find a comparison table of the production types (discrete, process, and repetitive), and a glossary of some of the more important terms used in PP.

While this book is certainly a significant expansion to the areas and functionalities that the PP offers, note that we don't cover the following in detail:

- ▶ Variant configuration
- ▶ Distribution resource planning
- ▶ Kanban

Note

Kanban is now covered in the E-Bite titled *Configuring Kanban in SAP ERP MM and PP*, which is available at www.sap-press.com/4013.

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Let's now move on to Chapter 2, where we'll discuss the internal organizational structure of SAP ERP from a PP perspective.

SAP ERP Production Planning is a direct and in-depth reflection and mapping of the business processes that a company either currently follows as a part of industrial operations or will transition to when the implementation of the SAP ERP system is complete. We'll start your journey with a discussion of the organizational structure of all the core components.

2 Organizational Structures in SAP ERP

In this chapter, we'll help you get an overall understanding of how business functions and the SAP ERP system interact and work together. After you understand the basics, we'll slowly move into some specific details on how Production Planning (PP) works in the SAP ERP system. We'll then overview the three main types of manufacturing, which are a large focus of this book.

From a PP perspective, the important organizational units are company code, plant, and storage location. In the following sections, we'll review the structure as it applies to PP. We'll discuss the importance of the organizational units and explain how they work together to accomplish the organizational, legal, and reporting requirements of the company. We'll also explain the SAP calendar, which is an essential part of maintaining your entire system schedule.

2.1 Breaking Down the Structure into Units

During an SAP ERP system implementation, one of the first and highly intensive activities undertaken is the finalization of the organizational structure. This involves having inter-modular and intra-modular discussions and deliberations to ensure that SAP ERP can cover the legal aspect of the company's organizational structure, as well as attend to component-specific reporting needs. In other words, the business process owners, business analysts, and SAP ERP system consultants review the existing organizational structure of the company and then simultaneously begin mapping it in the SAP ERP system.

A practical approach to adopt while finalizing the organizational structure in the SAP ERP system is to ensure that the organizational structure isn't so generic that it loses its significance and prevents the business process owner from extracting the required information from the system, nor is it so minute or detailed that it becomes cumbersome to collate and consolidate the information. You should also keep a forward-thinking view of your organizational structure. If you foresee that you'll need certain organizational elements in your SAP ERP system in the future, for example, it's better to have them available in the system than to add them at a later point.

The organizational structure in the SAP ERP system is equally applicable to all manufacturing types—discrete, process, or repetitive. Take a look at Figure 2.1, which shows the client as the highest level of the organizational structure in the SAP ERP system. The profitability analysis of the company is performed at the *controlling area* level, and the cost center and profit center accountings are performed at that level as well.

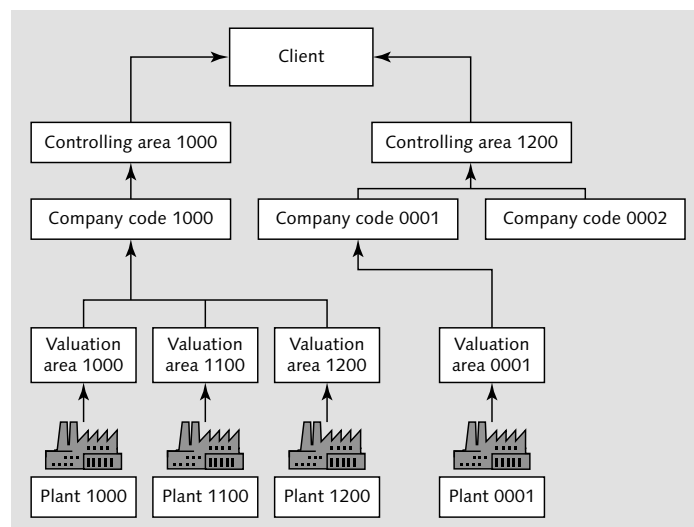


Figure 2.1 Organizational Structure in SAP ERP

A company can consist of several legal entities, each including separate, individual financial statements that must be prepared at the end of the financial year. This is reflected as a separate *company code* for each legal entity.

The *valuation area* represents the level at which the company values its material stock consistently. It's part of the logistics area of the SAP ERP system. A one-to-one relationship exists between the valuation area and the plant. For example, a material at one plant may have a different standard price than at another plant.

The diagram shown in Figure 2.2 represents the *organizational unit* of PP, wherein the company code attains the highest level. Within each company code, there can be one or multiple *plants*. Within each plant, there can be one or multiple physical and virtual *storage locations*.

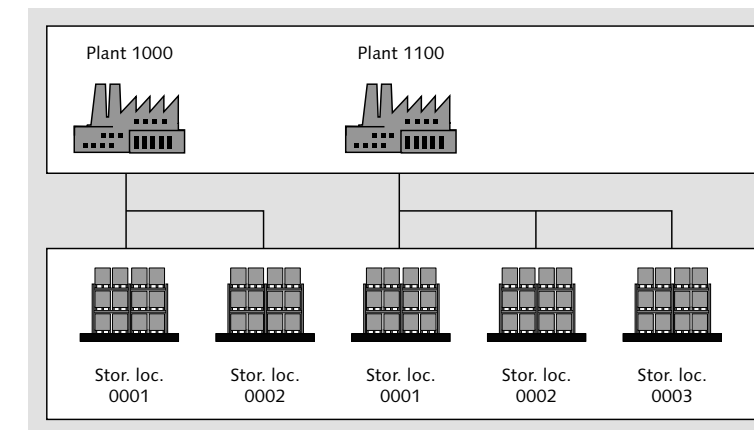


Figure 2.2 Production Planning and Control Organizational Unit

Note

See Chapter 11, where we cover further organizational units such as the MRP area and how it works.

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In the next sections, we'll explain each unit in greater detail.

2.1.1 Client

A *client* represents the highest element of the SAP ERP system's organizational structure. Often, the client represents a company or a group of companies, within which there are several independent company units. An SAP ERP system can contain several clients in logical units. The additional organizational elements and the master and transaction data are created and managed within a client.

From the SAP ERP system's landscape perspective, you normally have three clients (systems): development (DEV), quality assurance (QAS), and production (PRD). The actual configuration of the SAP system takes place in the DEV system, which is then transported to the QAS system for testing and training. The final configuration eventually moves to PRD, which is the final and live system on which the business process owners of the company make real-time live entries.

2.1.2 Company Code

The company code is the level below the client in the SAP ERP system, and it reflects the level at which the company legally reports income statements and balance sheets. It's an organizational element (unit) of SAP ERP Financials (FI). You can have a separate company code for each line of business—for example, textile and chemicals—as long as the two are legally separate entities. Similarly, separate company codes can exist if the company has operations in foreign countries.

To create a company code or to make changes to the existing one, follow the configuration (Transaction SPRO) menu path, ENTERPRISE STRUCTURE • DEFINITION • FINANCIAL ACCOUNTING • EDIT, COPY, DELETE, CHECK COMPANY CODE • EDIT COMPANY CODE DATA (see Figure 2.3).



Figure 2.3 Company Code



Note

In this book, whenever we refer to Transaction SPRO, it implies that the next step you need to take is to click on REFERENCE IMG or press [F5], followed by the menu path given. Wherever possible or available, we've also given the relevant configuration transaction code to facilitate your configuration efforts.

Note

Your FI team decides and works on the creation of company codes in the system.



2.1.3 Plant

A *plant* is an organizational unit within the logistics component. You can classify a plant from the point of view of production, procurement, maintenance, warehouse, and planning. For example, the plant can be a manufacturing site, a head office, or a distribution center within a company. It organizes the tasks for the production logistics, and it can be a physical production site or the logical grouping of several sites in which materials are produced or goods and services are provided. Different production locations are mapped with the plant in the SAP ERP system. At the plant level, you can perform the following tasks:

- ▶ Managing inventory
- ▶ Evaluating and performing physical inventory of stocks
- ▶ Managing demand
- ▶ Planning production
- ▶ Executing and controlling production
- ▶ Performing material requirements planning (MRP)

In the organizational structure of the SAP ERP system, you can assign only one company code to a plant. However, you can assign multiple plants to the same company code.

To create a new plant or to make changes to the existing plant, follow the configuration (Transaction SPRO) menu path, ENTERPRISE STRUCTURE • DEFINITION • LOGISTICS – GENERAL • DEFINE, COPY, DELETE, CHECK PLANT (no transaction code available).

Note

Your SAP ERP Materials Management (MM) team decides and works on the creation of plants in the system.



Figure 2.4 shows the change transaction screen of plant 3000, with the provision to enter the complete address and other details. It's important to use the FACTORY

CALENDAR field to assign a factory calendar to a plant so that the system can plan out all the working and nonworking days of the plant.



Figure 2.4 Plant

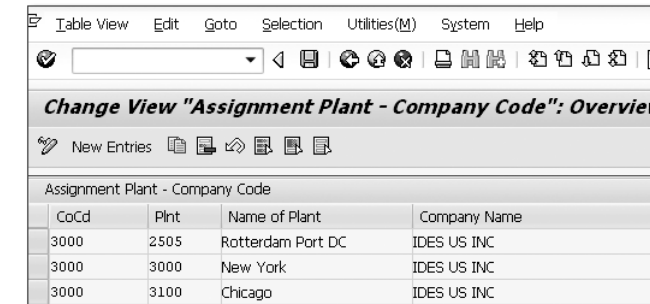


Note

We cover the creation of the factory calendar in Section 2.4.3.

After the creation of the plant, the next step is to assign the plant to the company code. A plant can only be assigned to one company code, and you can assign multiple plants to the same company code. It's mandatory to assign a plant to a company code.

To make a plant–company code assignment, follow the configuration menu path, ENTERPRISE STRUCTURE • ASSIGNMENT • LOGISTICS – GENERAL • ASSIGN PLANT TO COMPANY CODE, or use Transaction OX18 (see Figure 2.5). Choose the NEW ENTRIES icon to create a new plant–company code assignment.



CoCd	Plant	Name of Plant	Company Name
3000	2505	Rotterdam Port DC	IDES US INC
3000	3000	New York	IDES US INC
3000	3100	Chicago	IDES US INC

Figure 2.5 Assignment of Plant to Company Code

Note

Your MM team creates the plant–company code assignment in the system.



2.1.4 Storage Location

A *storage location* is the physical or virtual storage site for the materials. Examples of physical storage locations include raw materials store, components store, returned goods store, finished goods store, and so on, whereas the virtual storage location can be self-defined and may be a scrap yard or a production shop floor in which semifinished goods are temporarily stored.

You can even treat storage tanks or silos for storing bulk chemicals, oils, or grains as storage locations in the system. However, the limitation is that a storage location in the SAP ERP system doesn't have the provision to define the maximum storage capacity of an individual tank or silo. This provision is available in SAP ERP Warehouse Management (WM).

You can create as many storage locations as needed within a plant, but you can assign a storage location to one plant only.

To create a new storage location or to make changes to the existing storage location, follow the configuration (Transaction SPRO) menu path, ENTERPRISE STRUCTURE • DEFINITION • MATERIALS MANAGEMENT • MAINTAIN STORAGE LOCATION, or use Transaction OX09. Figure 2.6 shows the PLANT popup screen ❶, in which you enter the plant value as "3000". You add both the storage location code with a DESCRIPTION ❷ and the complete address.

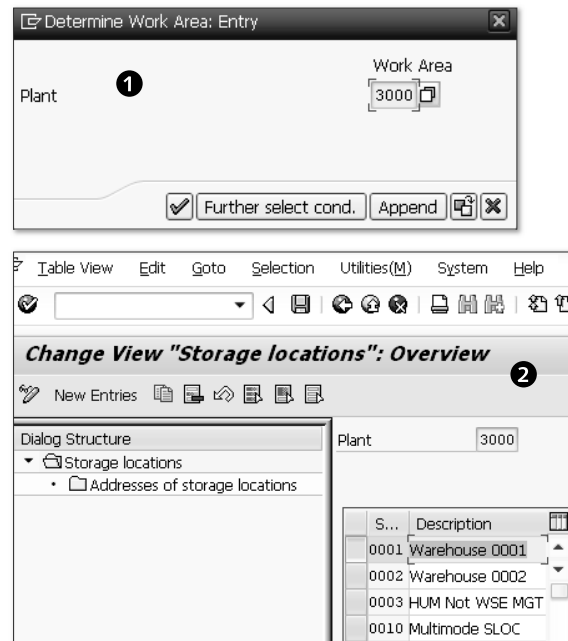


Figure 2.6 Storage Location

**Note**

Your MM team creates storage locations and assigns them to the plant(s).

2.1.5 Material Requirements Planning Controllers

An *MRP controller* can be an individual role or group of roles, performing the same task. For example, if three people in a company manage the packaging materials procurement, then it makes sense to define one MRP controller for this. The MRP controller is primarily responsible for attending to the requirements of materials. When defining the MRP controller, focus must remain on making sure it's defined based on responsibility, role, or area of working, instead of individuals. For example, you may have one MRP controller who is responsible for raw materials only, while another one may be for packaging material. You may have an MRP controller who is only responsible for managing consumables.

The MRP controller is assigned in the MRP 1 view of the material master. When you select the relevant MRP type in the material master by indicating

that planning will be done on the material, the system prompts you to enter the MRP controller. Again, the MRP controller should be based on position or responsibility rather than on the person. Later, when you run several reports, you'll be able to use the MRP controller as a selection criterion, among others.

To configure the MRP controller in SAP ERP, follow the configuration (Transaction SPRO) menu path, PRODUCTION • MATERIAL REQUIREMENTS PLANNING • MASTER DATA • DEFINE MRP CONTROLLERS.

Note

MRP controllers are extensively used by both production and procurement departments and the corresponding PP and MM components, respectively. MRP controllers for procurement may be raw materials, packaging materials, consumables, or spare parts. MRP controllers for production may be finished goods, semifinished goods, or assemblies.

The two teams (PP and MM) must coordinate in finalizing production and procurement MRP controllers because the bifurcation of PP and MM MRP controllers (including its transaction code) isn't obvious. It's best to mutually agree and make them available in the system.



2.1.6 Capacity Planners

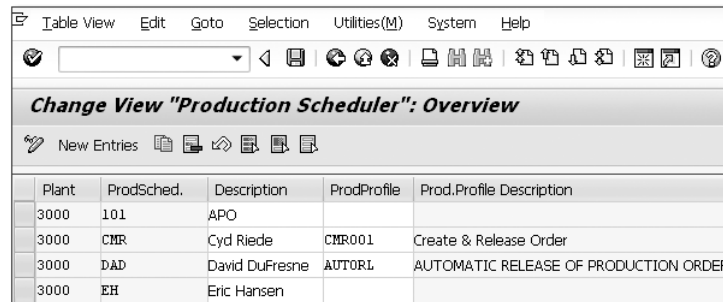
A *capacity planner* or *capacity planner group* is responsible for evaluating the current work center's or resource's capacity and, if needed, also performing the capacity leveling. When you create a new work center, you also have to assign the person responsible in a specific field. The capacity planner can also handle the role of person responsible for the work center. For example, it may make sense to combine all of the packing units of similar products as one capacity planner if the same person is responsible for it. If a company produces 10 different sizes of tomato ketchup—from a packet to a gallon size—and the same capacity planner is responsible for ensuring that various machines' capacities for each packing size are available, then you can simply agree to have one capacity planner in the SAP ERP system, together with its code.

The capacity planners are assigned in the capacity header data of the work center (resource). Then, in all the capacity evaluation and leveling reports, the capacity planner is available as the selection criterion for the planner to choose from and enables the system to display only relevant information.

To create a capacity planner, follow the configuration (Transaction SPRO) menu path, **PRODUCTION • CAPACITY PLANNING • MASTER DATA • CAPACITY DATA • SET UP CAPACITY PLANNER**.

2.1.7 Production Schedulers

A production scheduler is responsible for ensuring that production execution and operation takes place per the production plan. The production scheduler immediately attends or takes immediate remedial action, where necessary. To define a production scheduler, follow the configuration (Transaction SPRO) menu path, **PRODUCTION • SHOP FLOOR CONTROL • DEFINE PRODUCTION SCHEDULER**, or use Transaction OPJ9 (see Figure 2.7). You assign production schedulers in the **WORK SCHEDULING** view of the material master.



The screenshot shows the SAP SPRO configuration screen for 'Change View "Production Scheduler": Overview'. It features a table with the following data:

Plant	ProdSched.	Description	ProdProfile	Prod.Profile Description
3000	101	APO		
3000	CMR	Cyd Riede	CMR001	Create & Release Order
3000	DAD	David DuFresne	AUT0RL	AUTOMATIC RELEASE OF PRODUCTION ORDER
3000	EH	Eric Hansen		

Figure 2.7 Production Scheduler with Production Profile Assignment

Now that you have an understanding of how the SAP ERP system works, we'll add another ingredient into the mix: PP.

2.2 Production Planning in SAP ERP

Production planning is the core of any manufacturing process. SAP ERP helps you set up and streamline your specific process to maximize efficiency in the workplace when working with different types of manufacturing.

Actually, you'll find that the SAP ERP system is made up of several different components, in addition to PP (see Figure 2.8). We'll go into the different integration of PP with the different components you see here in Chapter 20.

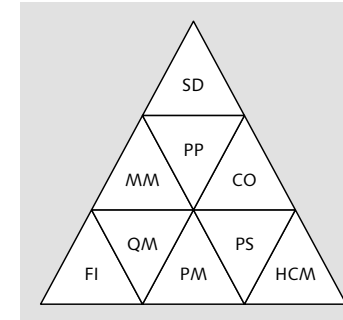


Figure 2.8 SAP ERP Components

In general, the entire process of production planning and control starts when you forecast the demand of a product and prepare a sales plan. The sales plan is synchronized with a production plan to take the project realities into account, such as capacity constraints. Various simulated models are considered, and the finalized production plan becomes the basis of MRP. Materials planning helps the production and the procurement planners know when to procure and produce a material for its eventual availability and dispatch to the customer. The production execution accounts for and records each production detail, including generation of scrap, co-products, or by-products, if any. Quality checks in the production processes ensure minimal customer returns or other rejections. The produced product is sold to a customer, and the production plan continues to be a monitoring barometer against the sales plan.

Of course, this information is great for providing a bird's-eye view of the production planning process. We'll help you understand how the individual objects you have to work with in the SAP system help streamline and manage your business processes in the following sections.

PP includes the following types and tools:

- ▶ **Master data**

This includes the material master, work centers, resources, production lines, routings, master recipe, rate routing, bill of materials (BOM), and production version.

- ▶ **Sales and operations planning (S&OP)**

You can use standard S&OP or flexible planning to forecast sales and production plans to meet customers' requirements for products.

► **Production Planning**

This includes material forecasting, SAP Demand Management, Long-Term Planning (LTP), and Master Production Scheduling (MPS).

► **Material requirements planning (MRP)**

This attends to standard and unique customers' requirements via various planning and production methods.

► **Discrete manufacturing or shop floor control (SFC)**

Production orders processing, goods issuances and receipts, and confirmations are used for complex manufacturing processes in which there may be a need for intermediate or interim storage.

► **Process manufacturing or Production Planning for Process Industries (PP-PI)**

Process orders processing, Process Management, material quantity calculation, goods issuances and receipts, and confirmations are used for production processes of liquid-based or flow-based materials.

► **Repetitive manufacturing (REM)**

This adopts the lean manufacturing principle in which generally the production process is not only simple but also consistent over a considerable period of time.

► **Capacity requirements planning (CRP)**

This consists of capacity evaluation and capacity leveling. Capacity evaluation reflects the load and overload at work centers/resources, whereas capacity leveling helps the planner optimize the production processes.

► **Product Costing (CO-PC)**

This completely integrates with PP and is responsible for ensuring all production-related costs are accounted for, including overheads, variances, and work in process (WIP).

► **Kanban**

This production type replenishes stocks based on a pull system by using Kanban cards. Kanban works well for both in-house produced materials and outside procured materials.

► **Distribution resource planning (DRP)**

This enables planning the demand of products at distribution centers.

► **Reporting**

A large number of information systems and standard and flexible analysis reporting options are available in PP.

In the following sections, we'll cover the features and characteristics of various production types as well as important business processes in production planning and control.

2.2.1 Characteristics of Production Types

A *production type* characterizes the frequency, complexity, or stability with which a product is produced in the production process. When implementing an SAP ERP system, one of the very first decisions a company makes is which production type to implement to reflect the complexity (or simplicity) of the production process. For example, if the production process is relatively simple with a linear production line involving one operation and one work center, then it makes sense to implement the REM production type to enable the company to benefit from lean manufacturing. Similarly, the process manufacturing production type is more suited to scenarios in which the product is generally in liquid form and flows or where the manufacturing process is generally continuous. The discrete manufacturing production type is used where the production process is order based, involves special procurement types, or when products are stored in interim storage locations between the production processes. Kanban is a demand-driven production type in which the demand triggers the replenishment and initiates the supply process. This production type enables minimal involvement of the Inventory Management function.

We discuss each of the main production types in the following sections. While this book will primarily cover discrete, process, and repetitive production types, this sections also briefly covers engineer-to-order (ETO) and Kanban to provide a comprehensive look at production types.

Discrete Manufacturing

The *discrete manufacturing* production type, which is also known as shop floor production, describes the production of a product on the basis of production orders. Discrete manufacturing is implemented where the products change frequently, the demand pattern is irregular, and production is workshop oriented in character. A range of master data is required for discrete manufacturing; the most important are the material, BOM, work center, and routing.

[Ex] Example

In steel rerolling mills, the entire production process passes through five different production steps. However, customers can place orders based on a different level of the processed good. Hence, the company has to produce and also store a semifinished good at each production step to meet its customer's demand.

The production process in discrete manufacturing starts when a production order is created and processed. A production order can either be created manually or by converting a planned order that the system generated after running MRP. A production order is a request to the production department to produce the product at a specific time and in a specific quantity. It specifies the work centers and material components that are required for production. The creation of a production order automatically creates reservations for the required material components. Purchase requisitions are created for externally procured material components and services, and capacity requirements are created for the work centers at which each operation of the order will be executed. The discrete process is shown in Figure 2.9.

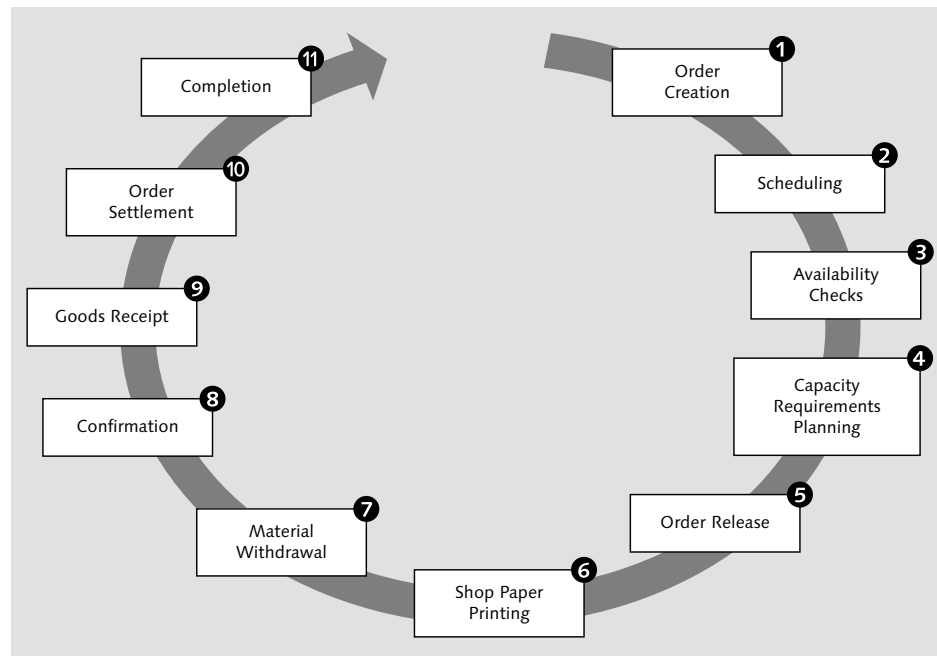


Figure 2.9 Discrete Manufacturing Process Flow

Production orders are released on the release date as long as the required materials and capacity are available. The production order-related documents (known as shop floor papers) are printed to prepare for production execution. The capacity situation is evaluated, and any required capacity leveling is carried out in any phase of production order processing, although this is usually ensured before the actual production starts.

The components required to produce the products are issued with reference to the production order, the product is produced on the basis of the production order, and the finished quantity is confirmed with reference to the production order. The product is put into a storage location, and the goods receipt is posted. Finally, the settlement of the production order is ensured.

Note

Chapter 3 covers the configuration basics of discrete manufacturing, and Chapter 6 details the business processes of discrete manufacturing.

[«]**Process Manufacturing**

Process manufacturing is the batch-oriented and recipe-oriented production of products or co-products in the process industry. Manufacturing can be in the form of continuous production, discontinuous production, or regulated production. In *continuous production*, the product is continuously produced, raw material is continuously supplied to the production line, and the plant and machinery are in continuous operation. An example of this is fertilizer manufacturing, where the production process is continuous, starting with production of ammonia from natural gas (methane) and continuing until the final urea/fertilizer is produced. The process may find an interim storage in the form of bulk urea being stored in the warehouse before the bagging process starts.

In *discontinuous production*, the products aren't produced in a continuous process. Instead, the material components are provided and weighed out as required for each step of the production process. Its greater application is found in industries such as food processing.

Regulated production is used if the product quality requirements are very stringent and specific industry standards must be met. This type of production is generally followed in pharmaceutical or cosmetics manufacturing. In regulated production,

orders can be created only with approved recipes. If changes need to be made to master recipes, these are subject to master data change administration procedures.

The central master data elements in process manufacturing are the material, the BOM, the resource, and the master recipe.

The business process in process manufacturing starts when a *process order* is created and processed in accordance with a master recipe. A process order is a request to the production department to produce a product at a specific time and in a specific quantity. It specifies the resource and material components that are required for production.

A process order can be created either manually or when a planned order that was created in the PP process is converted. The creation of a process order automatically creates reservations for the required material components. The system automatically creates purchase requisitions for externally procured material components and services, and capacity requirements are created for the resources at which the order will be executed. Process orders are released on the release date, provided the required materials and capacity are available. At the time of release, you can run an automatic batch-determination process for components that are subject to a Batch Management requirement. The relevant documents in the process order can be printed to prepare for the execution of the process order. The process manufacturing flow is shown in Figure 2.10.

The capacity situation is evaluated, and any required capacity leveling can be carried out in any phase of the process order processing, although this is usually ensured before the actual production commences.



Note

Refer to Chapter 14 in which we show you how to use capacity requirement planning (CRP) for evaluation and leveling.

The actual production can now begin, with or without the use of Process Management. If you implement Process Management to execute a process order, this serves as the interface between the SAP ERP system and process control. The flexible structure of this interface makes it possible to connect automated, semiautomated, and manually controlled plant and equipment to the production process.

Process Management makes extensive use of the classification system, which is cross-component.

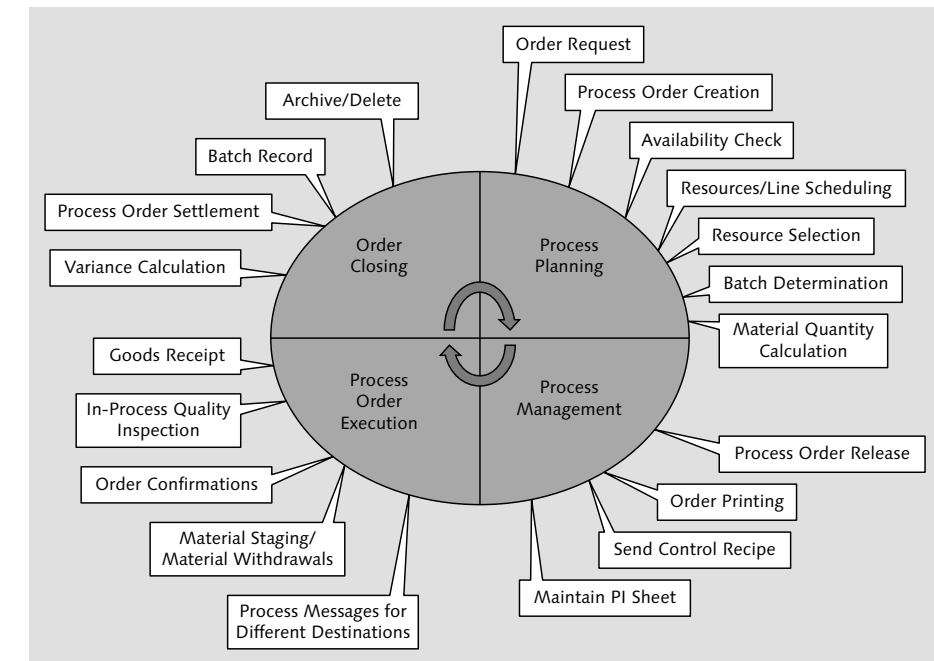


Figure 2.10 Process Manufacturing Process Flow

Note

Chapter 15 shows you how to implement the classification system and then integrate it in Process Management. You can also integrate classification in other logistics components to bring better organization to your master data management.



After the process order or the relevant phases of the process order is released for production, control recipes are generated from the process instructions in the process order. The *control recipes* contain all the information required for the process control function to execute a process order. Next, the control recipes for the process control system are either automatically or manually sent to the relevant process operator in the form of process instruction sheets. In the process instruction sheet, the process operator can refer to operation's instructions, refer to the online instruction manual using the Document Management System (DMS), input process parameters, or write shift highlights.

When the process operator has entered all process parameters and is ready to mark the process instruction sheet as complete, the system can prompt the process operator to digitally sign the process instruction sheet to set it to completion status.

»] **Note**

In Chapter 17, we show you how to implement digital signature and then integrate it in Process Management.

The process data that results from the execution of the process order are sent back to the SAP ERP system, are transferred to external function modules for further processing, or both. This data is transferred from the process control function to the various recipients by means of the process-coordination interface with the help of process messages. A material consumption message, for example, causes a goods issue to be posted for a component. Similarly a material-produced message triggers a goods receipt posting in the system.

If process order execution takes place without process coordination, the material components required to produce the finished product are withdrawn with reference to the process order, and the goods issue is posted in the Inventory Management subcomponent of MM. The required finished product is then produced in accordance with the process order. The quantities created and the products produced are confirmed to the process order, the finished product is put into storage, and the goods receipt is posted. In the final step, the product costing team ensures the order settlement.

»] **Note**

Chapter 4 and Chapter 7 cover the configuration basics and business processes of process manufacturing, respectively.

Repetitive Manufacturing

Repetitive manufacturing (REM) is the interval-based and quantity-based creation and processing of production plans. With REM, a certain quantity of a stable product is produced over a certain period of time. The product moves through a work center, which may be a group of machines, in a continual flow, and intermediate products aren't put into intermediate storage (e.g., motherboard assembly in computer manufacturing).

The data entry efforts involved in production control with REM is significantly reduced when compared with single-lot and order-based production control. REM can be used for the make-to-stock (MTS) production method. In this case, production has no direct connection to a sales order. The requirements are created in the SAP Demand Management process, and the sales orders are supplied from stocks. Sales order-based production (i.e., the make-to-order [MTO] production method) is also possible in REM. In this case, production is directly related to a sales order or can even be directly trigger from a sales order. The most important master data in REM are material, BOM, production line, rate routing, and production version. The REM process flow is shown in Figure 2.11.

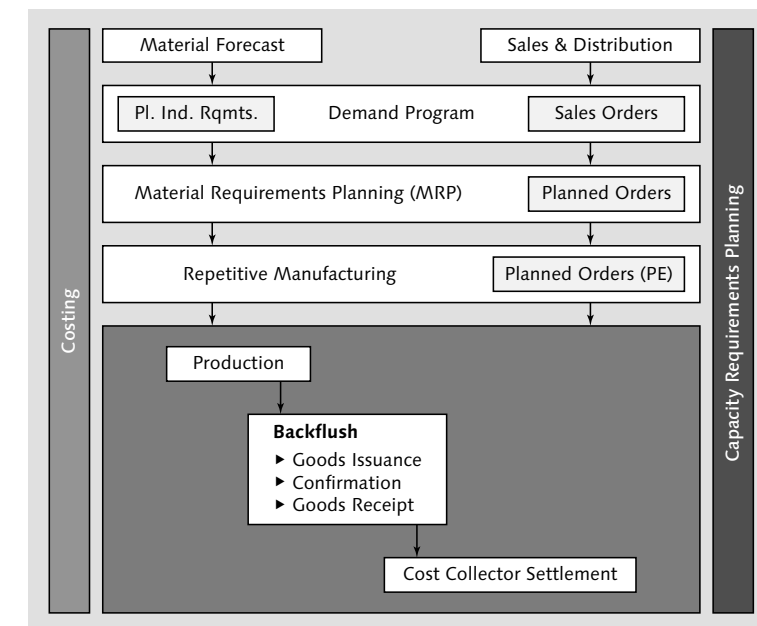


Figure 2.11 Repetitive Manufacturing Process Flow

There are significant similarities between the master data of REM when compared with discrete manufacturing or process manufacturing.

If a material is produced using the REM production type, it has to be flagged accordingly in the material master by setting the REM checkbox in the MRP 4 view of SAP ERP. Further, it's mandatory to assign a REM profile to the material. This profile determines the type of planning and confirmation by specifying, among other things, whether reporting points will be used, whether production

activities will be posted to the cost collector for material confirmations, whether a decoupled confirmation will be used, whether a backflush will be carried out for the entry of actual data, and which transaction types will be used.

The BOM for the material specifies the quantities of components required for production. In REM, not every goods issue is recorded at the same time as the physical withdrawal of the material from stock. Usually, component usage/goods issuance (*backflush*) is automatically posted only when the finished product is received in the warehouse. To backflush a component, a storage location is specified in every BOM item, and the backflush is carried out from this storage location.

Work centers in REM are known as *production lines* because the product moves through the machines in a continuous flow, and the machines are usually spatially arranged in a line. These can be simple production lines, which often consist of just one work center, or complex production lines, which consist of several work centers. The individual processing stations are set up as individual production lines and are grouped into a line hierarchy. A production line determines the available capacity of the processing station and is assigned to a single cost center.

In REM, standard routing is known as *rate routing*. A rate routing contains the operations or the processes required to produce the material. Because the same product is produced over a long period of time in REM, very simple routing is used, often consisting of just one operation/process. This kind of process specifies the production rate, which, in turn, specifies the quantity per time unit that is produced on the line (e.g., 50 units per hour).

Because there are different BOMs and routings for a material depending on the production process, a *production version* is used to specify which BOM and which routing will be used to produce the material. The production version also specifies the lot size for which the production version is valid. It's important to set the REM ALLOWED checkbox in the production version. There has to be at least one production version of a material in REM. The costs incurred in REM are posted to a *product cost collector (PCC)*. In the process of entering actual data, the material costs and production costs are added to the PCC. The PCC is created for a material within a plant in a specific production version.

In REM, the planned orders for a material that result from the production and procurement planning process are managed in a *planning table*. In these tables,

the planner can schedule the production quantities on the assembly lines. In REM, the term *run schedule quantity* is used instead of planned orders (as used in discrete or process manufacturing) to denote the quantity that you plan to produce. The components are supplied anonymously to the production line by using the pull list. The components required on a production line for a specific period are calculated in the pull list. The missing quantities that the system detects are replaced by means of direct stock transfers, for example, from the main storage location to the production storage location. This is known as *replenishment*.

The production of the product usually takes place in a continuous flow along the production line. Entry of actual data is carried out at regular intervals for each finished production quantity. Component use (backflush) and production activities are automatically posted when the finished product is received in the warehouse. For longer production lead times, the actual data is recorded with a *reporting point* within the production line to enable the system to post consumption data more promptly.

Note

Chapter 5 covers the configuration basics of REM, and Chapter 8 details the business processes.

[«]

Engineer-to-Order

The *engineer-to-order* (ETO) production type attends to the complexities and challenges when a sales order-based MTO production method is unable to fulfill the requirements. In the MTO production method, the system is unable to make a distinction between the predecessor-successor relationships in the production process; for example, a material's production can't initiate (successor) until the production of the previous product (predecessor) is ensured. In ETO, the system uses work breakdown structure (WBS) and networks for scheduling and coordinating the production processes and also managing Cost Accounting. All produced goods are specific to the project, and the system maintains project-based inventory.

Note

Chapter 20 illustrates the integration of PP with SAP ERP Project Systems (PS).

[«]

Kanban

Kanban involves a requirements-oriented production control procedure and uses material flow control that avoids time-intensive requirements planning. With Kanban, a material is produced or procured only when it's actually required. A specific quantity of the components required to produce a material are stored on-site and in containers. When a container is empty, this component is replenished according to a predefined replenishment strategy (in-house production, external procurement, or stock transfer). In the interval between the request for replenishment and the delivery of the refilled container, the other available containers simply do the work of the empty one.

The replenishment process is largely automatic in the Kanban procedure, thereby greatly reducing the amount of manual posting work required. The material isn't pushed through the production process as specified by an overall plan; rather, it's requested by one production level (consumer) from the previous production level (source) as and when needed. It adopts the "pull" strategy in the production process.

In Kanban processing, *production supply areas* (PSAs) divide the plant. The components required for production are stored in these PSAs, and various work centers take what they need from them. A Kanban control cycle is defined to specify how a material should be obtained within a PSA. The control cycle defines a replenishment strategy for the material that specifies, for example, whether the required material is to be produced in-house or procured externally. The control cycle also specifies the number of containers in circulation between the consumer and source, as well as the quantity per container.

Replenishment strategies specify how a material component should be replenished and which of the following replenishment elements should be created for this purpose:

- ▶ In-house production
- ▶ Manual Kanban
- ▶ Replenishment with run schedule quantity
- ▶ Replenishment with production order
- ▶ Replenishment by purchase order
- ▶ External procurement

- ▶ Replenishment with schedule agreement
- ▶ Replenishment with reservation
- ▶ Replenishment with direct transfer posting
- ▶ Replenishment with summarized just-in-time (JIT) call
- ▶ Stock transfer
- ▶ Replenishment by transport requirements of a WM administered storage location

The replenishment process with Kanban entails that a material is produced at a machine. The components required to produce it are available onsite in containers and are ready for withdrawal. If one of these containers is empty, the source that is responsible for its replenishment has to be informed. If Kanban processing without the SAP ERP system support is being used, the consumer sends a card to the work center (source). The card contains the information about which material is required, in what quantity, and where it should be delivered to.

Note

The replenishment process gets its name from the Japanese word for these cards (*Kanban*).

[«]

The source can now produce or procure the material and then refill the container. If Kanban processing with SAP ERP support is in place, the containers are managed in the system and have a specific status. After the last component is withdrawn from a container, the status of that container is simply changed from "full" to "empty." This status change is the Kanban signal, and it can be set by passing a barcode reader over the card attached to the container. It's also possible to have the system display the containers in a production area in the form of a Kanban table and to make the status change there. The Kanban signal now triggers the replenishment process and creates, for example, a run schedule quantity in accordance with the replenishment strategy. The source then processes the run schedule quantity, and the finished material is sent to the container. The status of the container is set to "full" again (through barcode or Kanban table), and the goods receipt for the material is posted with reference to the procurement element.

The SAP ERP system also supports other kinds of Kanban procedures besides the more-prevalent procedure just mentioned. The Kanban process also works well

with stock transfer replenishment (plant-to-plant and store-to-store stock transfer).

2.2.2 Processes in Production Planning and Control

We discuss the main processes in PP in the following sections.

Sales and Operations Planning

The S&OP process is used to determine the quantities for production. Sales planning, which is also known as demand planning, covers future requirements without considering stocks and available capacities. The historical sales figures serve as a basis for sales planning. Operations planning uses the results of the sales planning process to plan the production quantities and takes initial stocks and capacities into account.

[»]

Note

Chapter 9 covers S&OP.

SAP Demand Management aligns sales planning with the customer requirements in accordance with the planning strategy and thus calculates the independent requirements for production. The planning methods that SAP Demand Management looks for are MTS, MTO, planning with final assembly, and several others.

[»]

Note

Chapter 10 covers SAP Demand Management.

Material Requirements Planning

MRP is one of the most important functions of PP. The system performs net quantity calculation for component requirements while taking scrap and lot sizes into account. MRP calculates requirement coverage elements for all MRP levels such as plant, material, product group, and MRP areas, and it takes into account the lead times, lot sizes, and scrap quantities. MRP also enables capacity planning.

[»]

Note

Chapter 11 covers MRP.

Long-Term Planning (LTP) is a simulation tool for MRP that examines how a change in planned independent requirements (PIRs) will affect capacity utilization, stocks, and external procurement. LTP is also suitable for short-term simulations.

Note

Chapter 12 covers LTP.

[«]

Capacity Requirements Planning

For detailed production planning while taking available capacities into account, capacity requirements planning (CRP) schedules the worklist in detail, which usually consists of the processes for created or released production orders. CRP delivers a production sequence that is feasible from the capacity viewpoint. CRP consists of capacity evaluation and capacity leveling.

Note

Chapter 14 covers CRP.

[«]

Production Control

The central controlling and recording element—the production process—is the production order in discrete manufacturing, the process order in process manufacturing, and the run schedule quantity in REM. While the previous processes dealt with production planning, production execution is concerned with how the actual production as specified in the production order is recorded and controlled, from material withdrawal to order confirmation to storage and invoicing.

2.3 Product Costing

Product Costing (CO-PC) is a subcomponent of SAP ERP Controlling (CO) and comprehensively integrates with PP. In fact, PP is unable to function completely until the Product Costing subcomponent is in place. Product Costing helps to ensure that the total cost of goods manufactured (COGM) and cost of goods sold (COGS) are completely accounted for. To calculate the COGM, you need to have

first-hand information of the cost of all the raw materials and components used. Further, you also need to know the activity rates for each work center (resource). The material and activities costs are also known as *direct costs* and are individually assigned to the order without any allocation. *Overhead cost* is determined by overhead charges. Examples of overhead costs are the electricity consumed in the production process and the salaries of employees involved in the production of goods.

There is also a method of assigning a *costing sheet* to an order type, which for example, may contain details such as 2% of raw material cost will equal the electricity cost of producing a material. Before the actual business processes, such as order creation, in PP begins, the product costing team runs a *material cost estimate* in the SAP ERP system. When running the material's standard cost estimate, the system refers to the complete master data information of PP such as BOM, routing, work center, and production version. It draws information from CO, such as activity types and activity rates. The material cost estimate is first saved and then released. Then, when you create an order, the system performs planned cost calculations within the order. When you perform production execution activities such as goods issuance, confirmation, goods receipt, and recording of co-products or by-products, the system continuously updates the actual cost and presents a comparison of planned costs with actual costs.



Note

Chapter 16 shows you how to manage co-products and by-products in the production processes.

The WIP, the overhead, the variances, and finally the settlement are some of the functions managed by the product costing team. When an individual order is settled, the system updates the material price based on the price control. If the price control in the material master (finished or semifinished good) is standard price, the system reflects all differences and variances to the price difference account. If the price control in the material master is a moving average, the system updates the material price. Order-based settlement in discrete and process manufacturing is a mandatory requirement.

The process differs slightly in REM, in which either the material's standard cost estimate is used or a PCC is created with infinite validity. A PCC is preliminary costing, and all the product costs are summed up in the PCC for a material before

the actual settlement takes place. In REM, the settlement process isn't order-based but period-based.

2.4 SAP Calendar

For all of the planning and scheduling to effectively take place, it's imperative that a calendar exists in the system. This calendar is then assigned to the plant. You have to first define all of the national holidays, followed by combining all of the individual holidays in the holiday calendar. This holiday calendar then gets assigned to the factory calendar.

The SAP calendar creation function includes three individual steps:

- ▶ Defining holidays
- ▶ Creating a holiday calendar
- ▶ Defining a factory calendar and assigning a holiday calendar to it

To create a new calendar, follow the configuration (Transaction SPRO) menu path, SAP NETWEAVER • GENERAL SETTINGS • MAINTAIN CALENDAR, or use Transaction SCAL (see Figure 2.12). Here you have the options you need to maintain the requisite details, such as PUBLIC HOLIDAYS, HOLIDAY CALENDAR, and FACTORY CALENDAR, in the same sequence.



Figure 2.12 SAP Calendar

In the following sections, we'll go into more detail about the different calendar steps.

2.4.1 Public Holidays

Select the PUBLIC HOLIDAYS radio button shown previously in Figure 2.12, and then choose the CHANGE icon. Select the NEW HOLIDAY icon, so you can then select whether it's a fixed date or a floating public holiday. A floating public holiday depends on factors such as moon sighting to decide the holiday. In Figure 2.13, selecting FLOATING PUBLIC HOLIDAY ❶ leads to the FLOATING PUBLIC HOLIDAYS dialog box ❷, in which you can choose the holiday to be any specific date, day, or even with religious denominations, such as Buddhist, Christian, Islamic, or Jewish calendars.

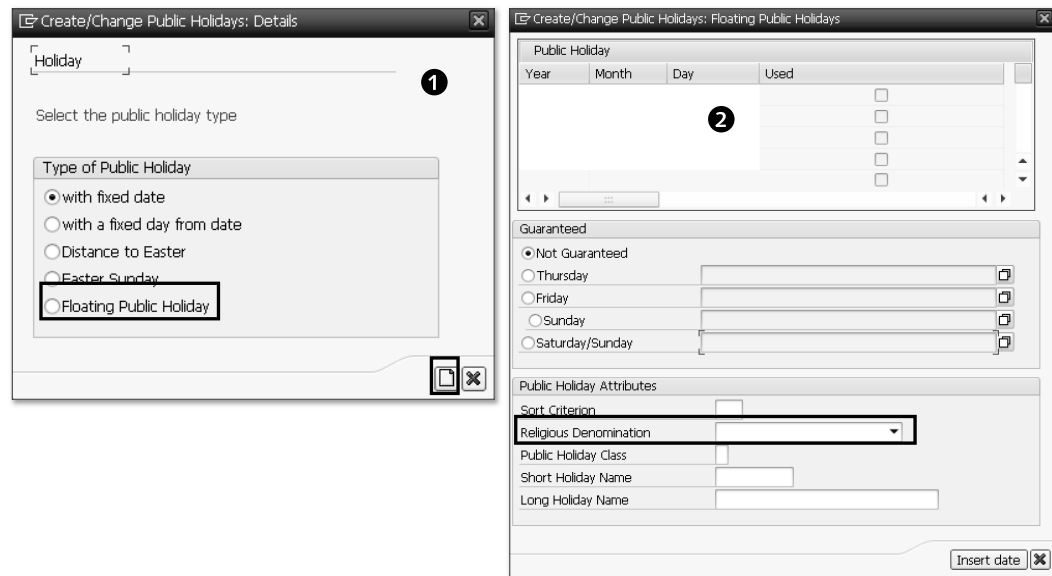



Figure 2.13 Public Holidays

2.4.2 Holiday Calendar

After defining and saving a public holiday, you'll again come back to the screen shown in Figure 2.12, where you select the HOLIDAY CALENDAR radio button, which consists of a list of all of the holidays defined so far. Choose the NEW ENTRY icon , which leads to the screen shown in Figure 2.14. After you provide the

identification code and a short text for the holiday calendar in this screen, you define the validity of the holiday calendar. Next, select the ASSIGN HOLIDAY button, which leads to the pop-up in which you can select all of the relevant public holidays by choosing the relevant checkboxes, pressing **Enter** to confirm, and finally saving the holiday calendar. This takes you back to the original SAP CALENDAR screen shown earlier in Figure 2.12.

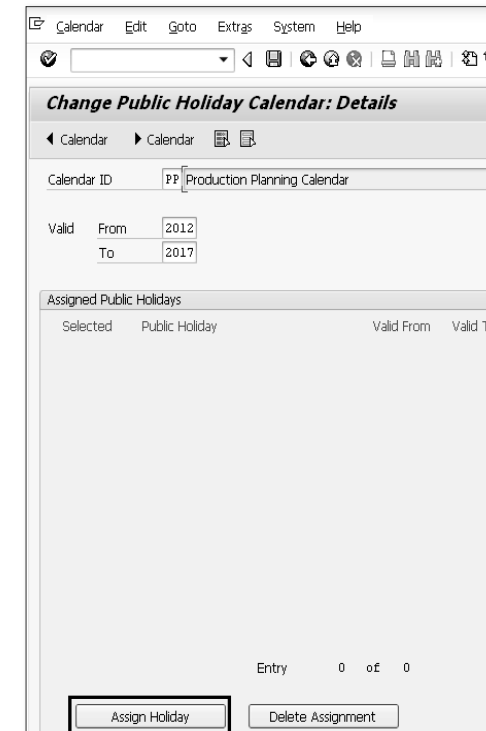


Figure 2.14 Public Holiday Calendar

2.4.3 Factory Calendar

Finally, in the screen shown earlier in Figure 2.12, select the FACTORY CALENDAR radio button, which leads to the screen shown in Figure 2.15, where you can enter the validity date of the factory calendar, assign a HOLIDAY CALENDAR ID, and define WORKDAYS. You can also define SPECIAL RULES to denote any holiday (off day) as a workday.

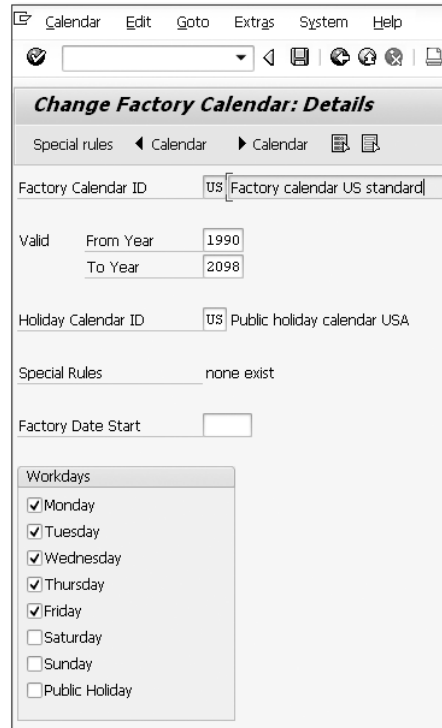


Figure 2.15 Factory Calendar



Note

With the necessary configuration of the factory calendar in place, you can proceed to assign the same in the plant (refer to Figure 2.4 in Section 2.1.3).

Table 2.1 provides a summarized view of configurations specific to PP, which will eventually form the basis of selection criteria in reporting (or the evaluation tools). Based on the various roles configured in this chapter, for example, capacity planner, MRP controller, or production scheduler, this table provides a broader description of which role makes use of which evaluation tools. For example, the MRP controller generally uses Transaction MD06 (MRP List/Collective Display Evaluation Tool); hence, the option to enter the MRP controller on the initial selection screen is available. Similarly, capacity evaluation tools (Transactions

CM01, CM02, etc.) are of more interest to capacity planners than, for example, to MRP controllers. Further, all these evaluation tools make use of the factory calendar defined earlier in this chapter.

Keep this table in mind as you read through the rest of the book.

Function	Transaction	MRP Controller	Capacity Planner	Production Scheduler
SAP Demand Management	MD73	✓		
MRP List/Collective Display	MD06	✓		
Stock/Requirements List/Collective Display	MD07	✓		
Long-Term Planning (Requirements)	MS65	✓		
Mass Processing of Production/Process Orders	COHV COMAC	✓		✓
Production Order Information System	COOIS	✓		✓
Process Order Information System	COOISPI	✓		✓
Missing Parts Information System	CO24	✓		✓
Capacity Evaluation	CM01 CM02 CM04 CM05 CM07		✓	
Capacity Leveling	CM21 CM22		✓	
Production Resources and Tools	CF10 CF13			✓

Table 2.1 MRP Controllers, Capacity Planners, and Production Schedulers Available as Selection Criteria

2.5 Summary

This chapter explained the importance of mapping most, if not all, of the important actual business processes of the company in SAP ERP during its implementation. We also highlighted the importance of the enterprise structure of not just PP, but of the entire organization, along with their interdependencies. The reference table acts as an invaluable guide in helping understand the importance of several PP-specific configuration elements, such as MRP controllers, production schedulers, and capacity planners.

The next chapter begins Part II and covers the configuration basics of PP for discrete manufacturing.

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Dear Reader,

In manufacturing, there's a maxim: "You can have it cheap, fast, or good. Pick two." In the publishing industry, where micro-level editing is seemingly endless, we usually say, "It's either published or perfect. Pick one."

For an editor, then, there is a unique pleasure in working on a second edition. It offers a chance to right past editorial wrongs (the missing comma on page 438 or the typo on page 822 that sneaked into the first edition). We can take the opportunity to re-examine a best-seller that has already reached bookshelves around the world—and find new ways to both reinvigorate its content and aim for that elusive perfection.

In my mission to create the perfect book, I could have asked for no better partner than expert and author Jawad Akhtar. His tireless effort, his attention to detail, and his commitment to a new edition of his first-ever book were second to none. While perfection may never truly be possible, I do believe we have come quite close!

As always, your comments and suggestions are the most useful tools to help us make our books the best they can be. Let us know what you thought about this second edition of *Production Planning and Control with SAP ERP*! Please feel free to contact me and share any praise or criticism you may have.

Thank you for purchasing a book from SAP PRESS!

Meagan White
Editor, SAP PRESS

Rheinwerk Publishing
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meaganw@rheinwerk-publishing.com
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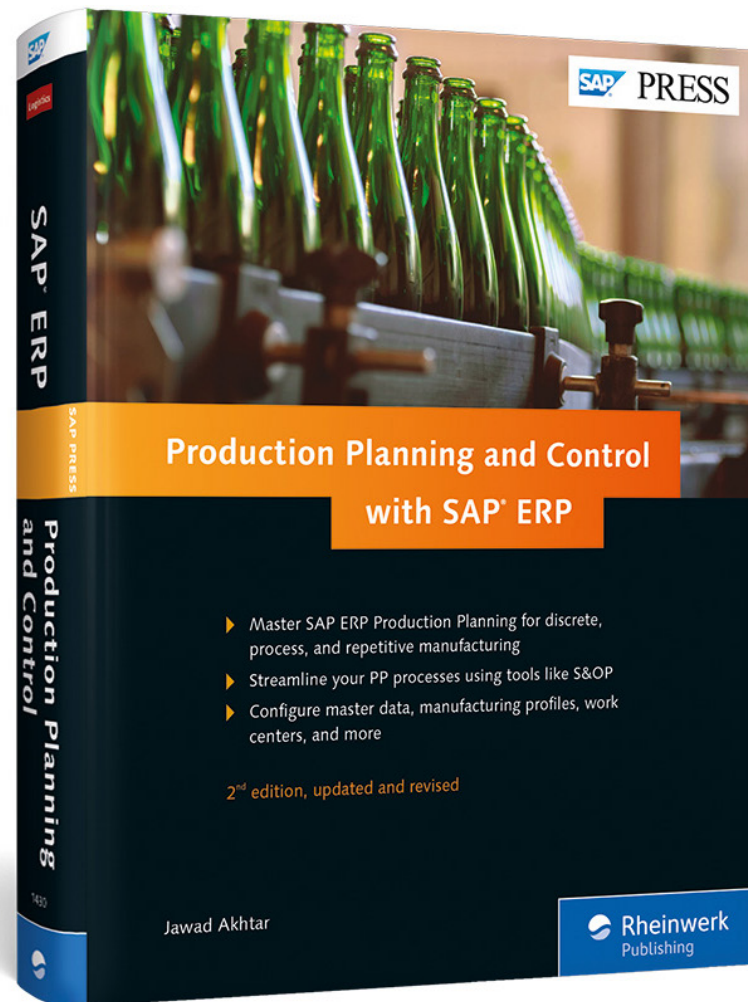
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Jawad Akhtar is the SAP leader for business sales and delivery at IBM Pakistan. He earned a chemical engineering degree from the Missouri University of Science and Technology (USA) in 1996. He has more than 18 years of professional experience and has completed several large-scale SAP implementations and rollout lifecycles. He has led large teams in his roles as an SAP integration manager and SAP project manager, and has also been actively involved in business development and solution architect roles.

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