

# Production Planning and Execution (PP)

Curriculum: Introduction to S/4HANA using Global Bike



# Teaching material - Information

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## Teaching material - Version

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- GBI 4.1 on S/4HANA 2020 / June 2022
- Software used
  - S/4HANA 2020
  - Fiori 3.0
- Model
  - Global Bike
- Prerequisites
  - No prerequisites needed

# Module Information

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## Authors

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- Bret Wagner
- Stefan Weidner
- Babett Ruß



## Target Audience

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- Beginner

# Module Information

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## Learning Objectives

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- Understand a manufacturing process cycle
- Get familiar with the basics of a production plan

# Functionality

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- SAP divides production into multiple processes
  - Production Planning
  - Manufacturing Execution
    - Discrete Manufacturing
    - Repetitive Manufacturing
    - KANBAN
  - Production – Process Industries
    - Integrated planning tool for batch-orientated process manufacturing
    - Design primarily for chemical, pharmaceutical, food and beverage industries along with batch-oriented electronics

# Unit Overview

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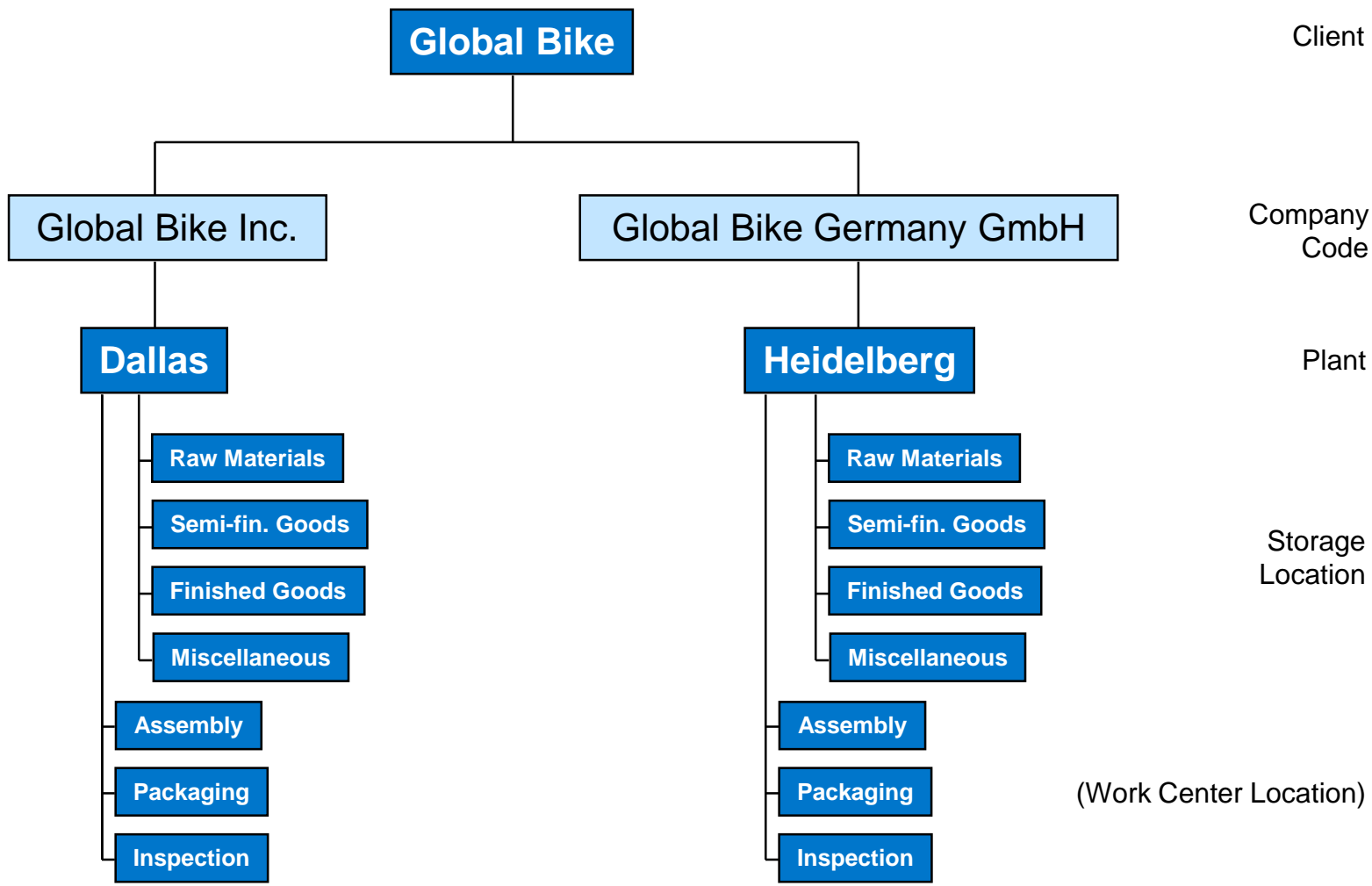
- PP Organizational Structure
- PP Master Data
- PP Processes
  - Material Planning
  - Production Planning
  - Manufacturing Execution Process

# PP Organizational Structure

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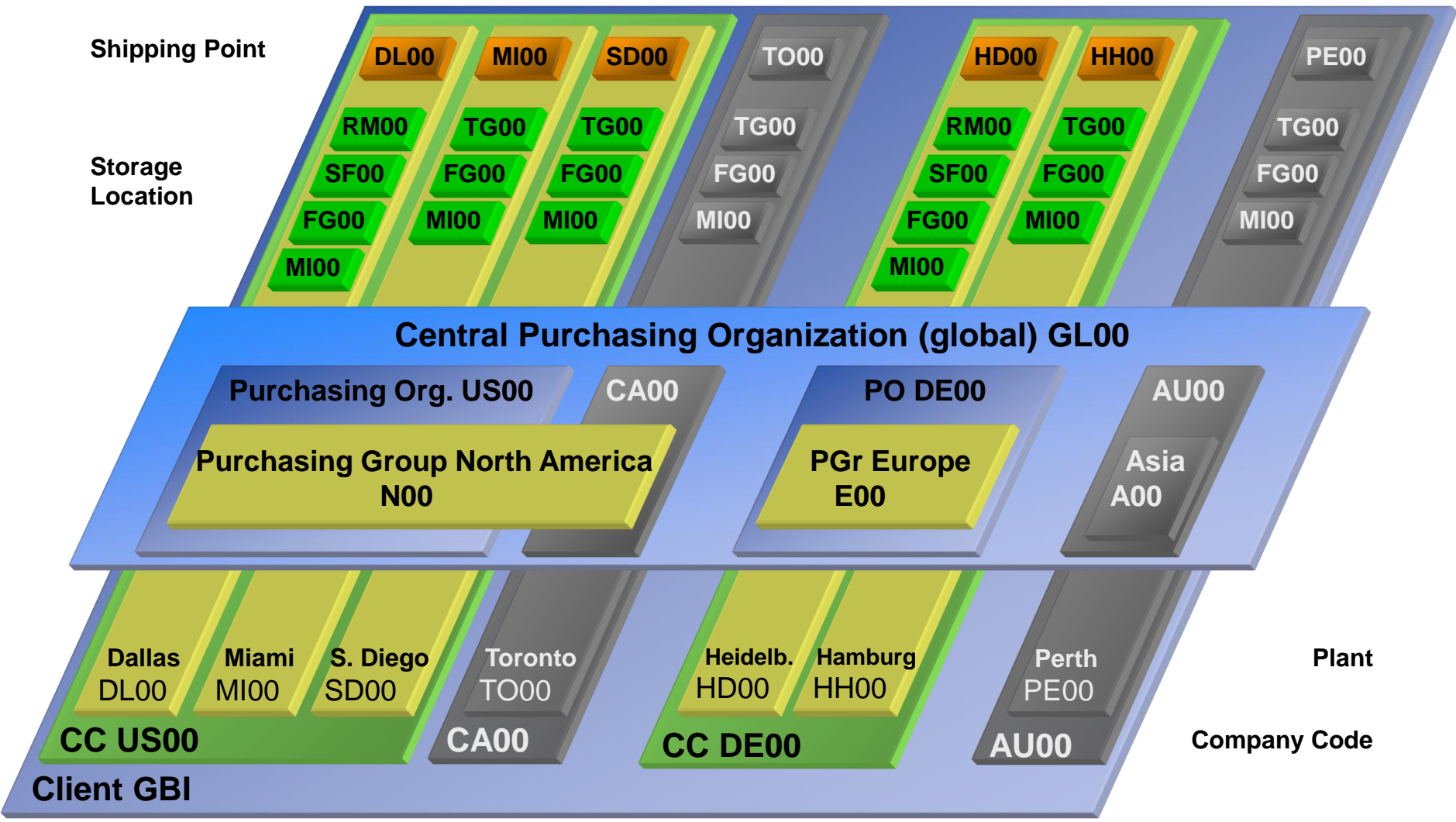
- Client
  - An independent environment in the system
- Company Code
  - Smallest org unit for which you can maintain a legal set of books
- Plant
  - Operating area or branch within a company
    - Manufacturing, distribution, purchasing or maintenance facility
- Storage Location
  - An organizational unit allowing differentiation between the various stocks of a material in a plant
- Work Center Locations (in SAP system → master data)
  - An organizational unit that defines where and when an operation is performed
  - Has an available capacity
  - Activities performed are valuated by charge rates, which are determined by cost centers and activity types.
  - Can be machines, people, production lines or groups of tradespeople

# Global Bike Structure for Production Planning





# GBI Enterprise Structure in SAP ERP (Logistics)



# PP Master Data

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- Material
- Bill of Materials (BOM)
- Routing
  - BOM and routing are like a cooking recipe
  - BOM = ingredients
  - Routing = steps in the recipe
- Work Center
- Product Group

# Material Master Record

Display Material DXTR1000 (Finished Product)

Other Material

Additional Data

Org. Levels

More

Exit

Sales text

MRP 1

MRP 2

MRP 3

MRP 4

Advanced Planning

Forecasting

W

Material: DXTR1000

Descr.: Deluxe Touring Bike (black)

Plant: DL00 Plant Dallas

General Data

Base Unit of Measure: EA each

Purchasing Group:

Plant-sp.matl status:

MRP Group:

ABC Indicator:

Valid from:

MRP Procedure

Advanced Planning

MRP Type:

Reorder Point:

Planning cycle:

Lot size data

Lot Sizing Procedure:

Minimum Lot Size:

Assembly scrap (%):

Rounding Profile:

MRP areas

Display Material DXTR1000 (MRP 1, Finished Product)

Material DXTR1000

Deluxe Touring Bike (black)

Industry sector M Mechanical engineering

Material type FERT Finished Product

Low-level code 000

Created by BOETTCHER on 24.05.16

Last changed by BRUSS on 27.09.17

Status information:

No deletion flags or locks exist

# Bill of Materials (BOM)

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- List of components that make up a product or assembly
- Wheel Assembly
  - Tire
  - Tube
  - Wheel
  - Hex Nut
  - Lock Washer
  - Socket Head Bolt
- Frame
- Derailleur Gear Assembly
- Seat Kit
- Handle Bar
- Pedal Assembly
- Chain
- Brake Kit
- Warranty Document
- Packaging

# Bill of Materials (BOM)

## ■ Single-Level

Material:

Men's Off Road Bike

Plant:  Plant Dallas

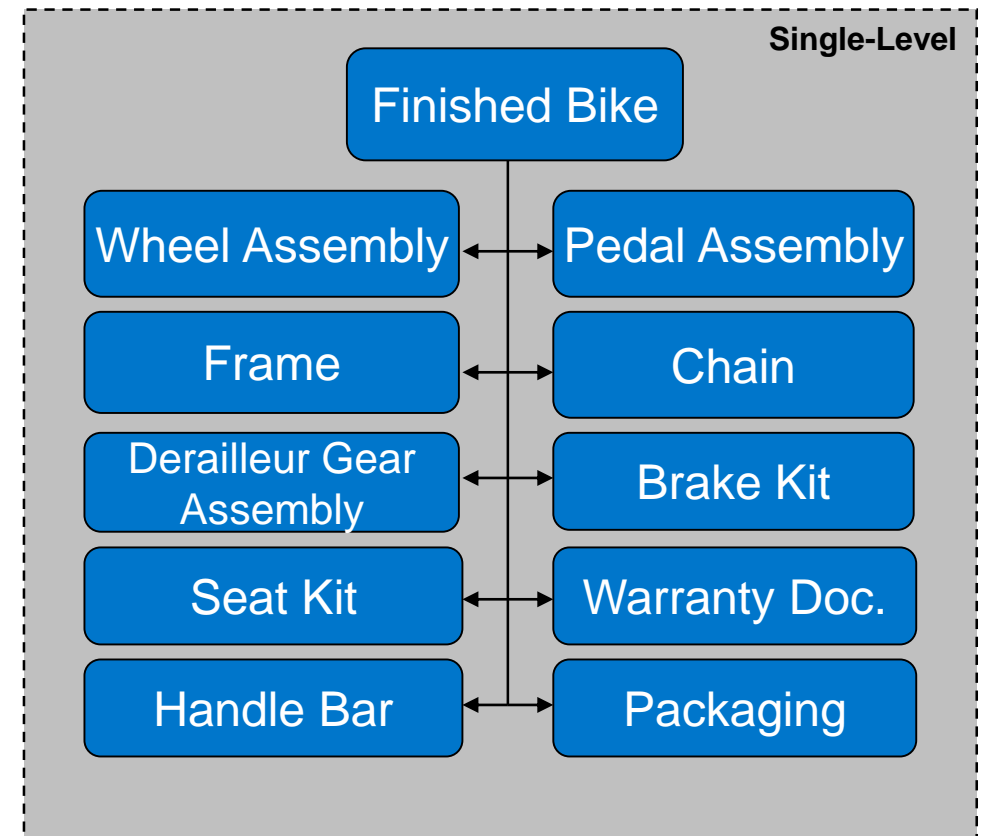
Alternative BOM:

Material

Document

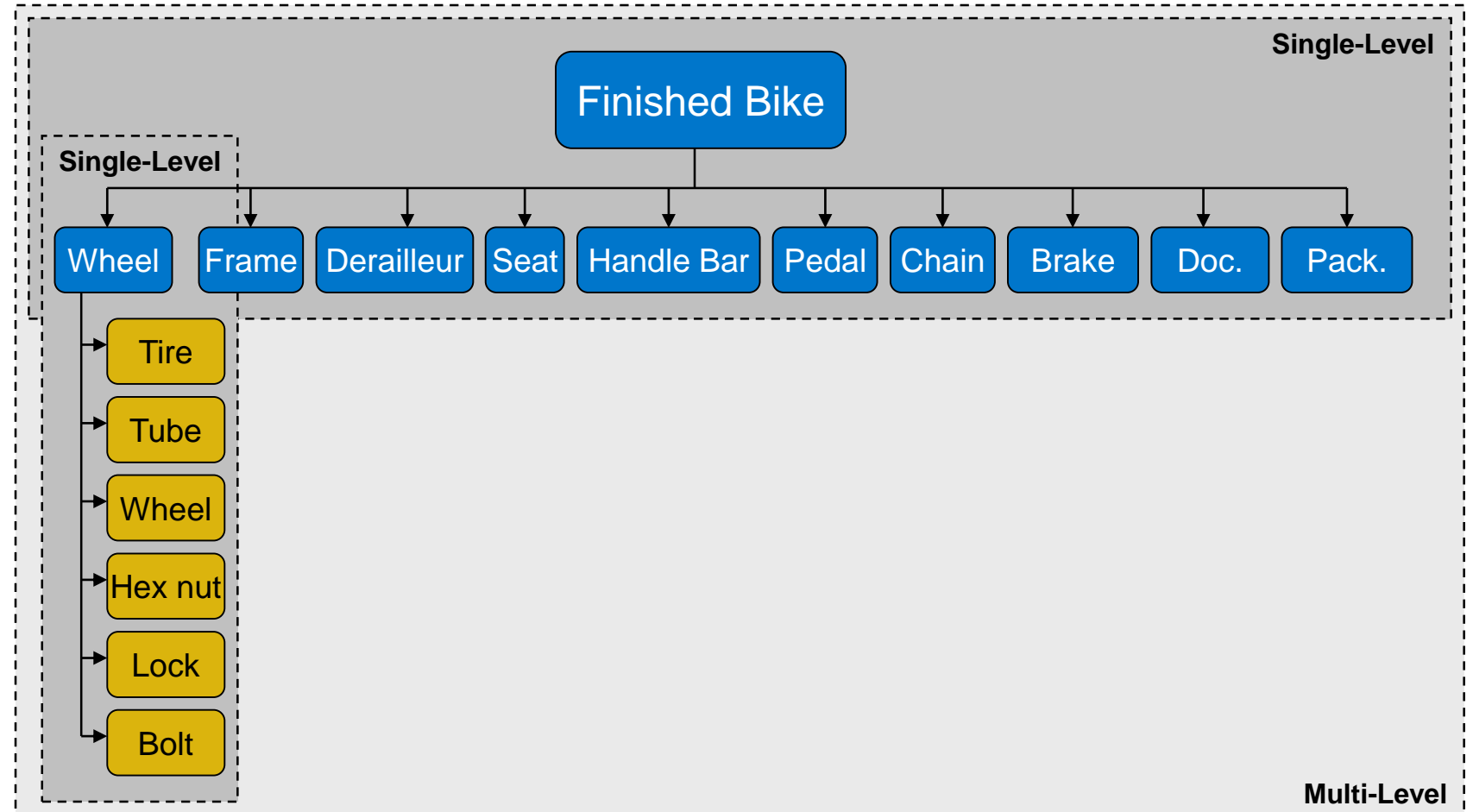
General

<input type="checkbox"/>	Item	ICt	Component	Component description	Quantity	U...
<input type="checkbox"/>	0010	L	<a href="#">ORWA1000</a>	Off Road Aluminum Wheel Assembly	2	EA
<input type="checkbox"/>	0020	L	<a href="#">OFFR1000</a>	Men's Off Road Frame	1	EA
<input type="checkbox"/>	0030	L	<a href="#">DGAM1000</a>	Derailleur Gear Assembly	1	EA
<input type="checkbox"/>	0040	L	<a href="#">ORSK1000</a>	Off Road Seat Kit	1	EA
<input type="checkbox"/>	0050	L	<a href="#">ORHB1000</a>	Off Road Handle Bar	1	EA
<input type="checkbox"/>	0060	L	<a href="#">PEDL1000</a>	Pedal Assembly	1	EA
<input type="checkbox"/>	0070	L	<a href="#">CHAN1000</a>	Chain	1	EA
<input type="checkbox"/>	0080	L	<a href="#">BRKT1000</a>	Brake Kit	1	EA
<input type="checkbox"/>	0090	L	<a href="#">WDOC1000</a>	Warranty Document	1	EA
<input type="checkbox"/>	0100	L	<a href="#">PCKG1000</a>	Packaging	1	EA



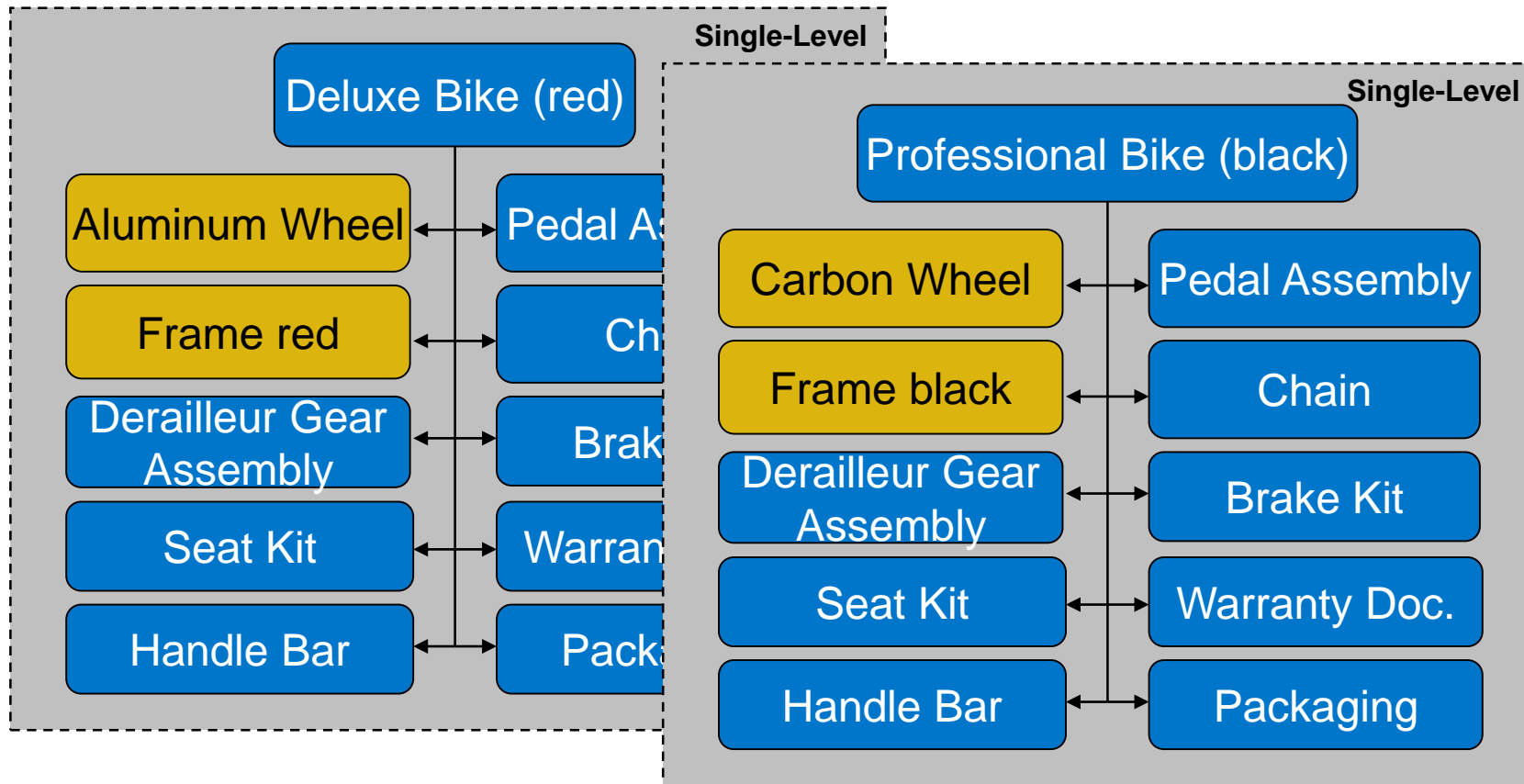
# Bill of Materials (BOM)

- Single-Level vs. Multi-Level



# Bill of Materials (BOM)

- Variant Bill of Materials (BOM)
  - Several products with a large proportion of identical parts.



# BOM – Item Categories

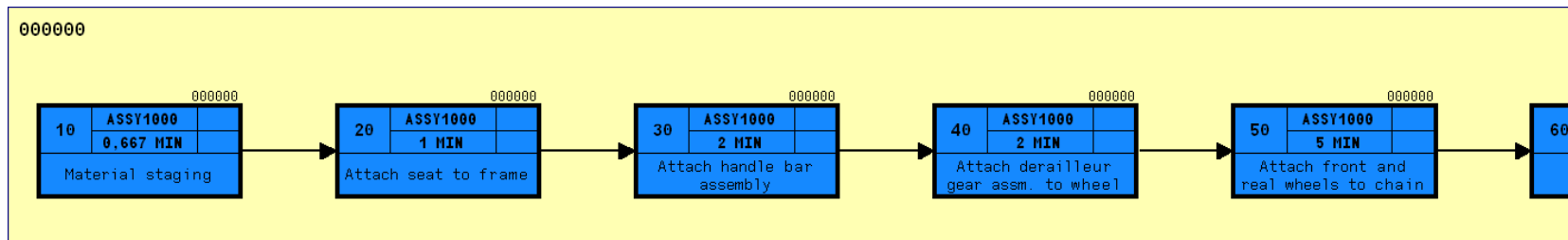
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- An object that defines items in a BOM according to criteria, such as the object type of the component, for example, material master record or document info record.
- The item category controls the following:
  - Screen sequence
  - Field selection
  - Default values
  - Material entry
  - Inventory management
  - Subitems
- Item Categories
  - Stock item
  - Non-stock item
  - Variable material – Sheet of steel
  - Document item
  - Text item



# Routing

- Routings enable the planning of the production of materials (products)
- 
- Routings are used as a template for production orders and run schedules
- Routings are also used as a basis for product costing
- Series of sequential steps (operations) that must be carried out to produce a given product
- Routings contain:
  - What, Where, When, How



# Routing

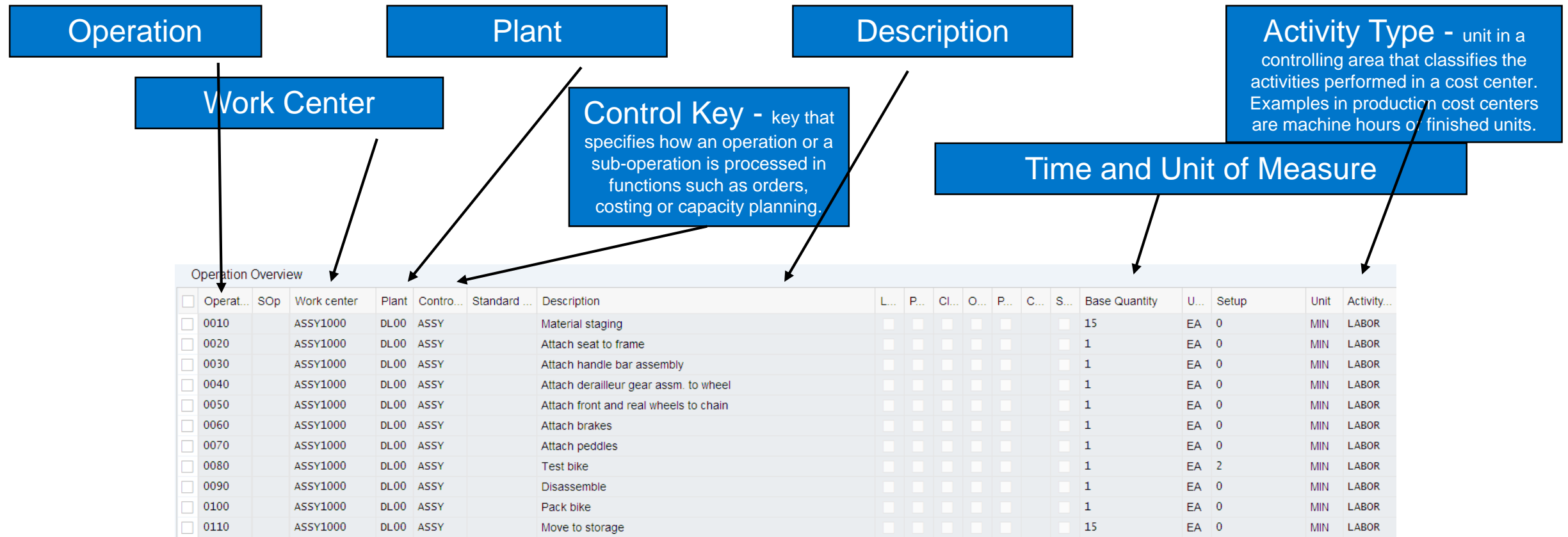
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- Routing – Operation 20
  - Attach seat to frame
- Work Center – ASSY1000
  - Assembly Work Center
- Time
  - 1 minute

20	ASSY1000	
	1 MIN	
Attach seat to frame		

# Routing

## ■ Routing for Finished Bike



# Work Center

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- A location within a plant where Value-added work (operations or activities) is performed
  - Work Centers can represent
    - People or Groups of people
    - Machines or Groups of machines
    - Assembly Lines
- Work Center used to define capacities
  - Labor
  - Machine
  - Output
  - Emissions
- Capacities used in
  - Capacity requirements planning (CRP)
  - Detailed scheduling
  - Costing

# Work Center

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- Work Centers capture and use the following Resource related data
  - Basic Data
    - Person Responsible, Location of Work Center
  - Scheduling Information
    - Queues and Move Times (interoperation), Formula Keys
  - Costing Data
    - Cost Center, Activity Types
  - Personnel Data
    - People, Positions, Qualifications
  - Capacity Planning
    - Available Capacity, Formulas, Operating Time
  - Default Data
    - Control Key, Standard Text Key

# Product Group

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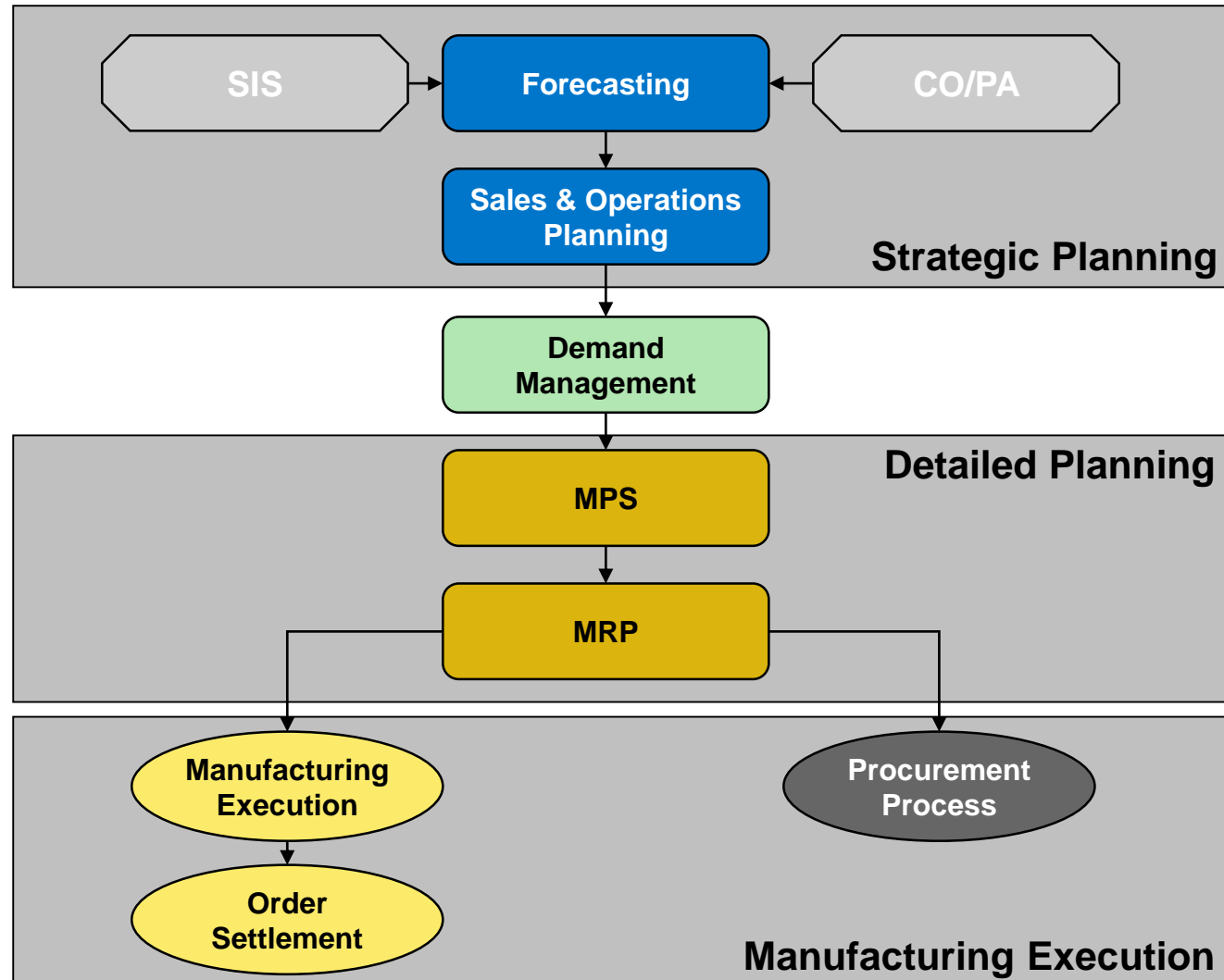
- Aggregate planning that groups together materials or other product groups (Product Families)
- Multi- or Single-Level Product Groups
  - The lowest level must always consist of materials

# PP Processes

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- Production Planning & Execution
  - Forecasting
  - Sales and Operations Planning (SOP)
  - Demand Management
  - Master Production Scheduling (MPS)
  - Material Requirement Planning (MRP)
  
- Production Order

# Production Planning & Execution

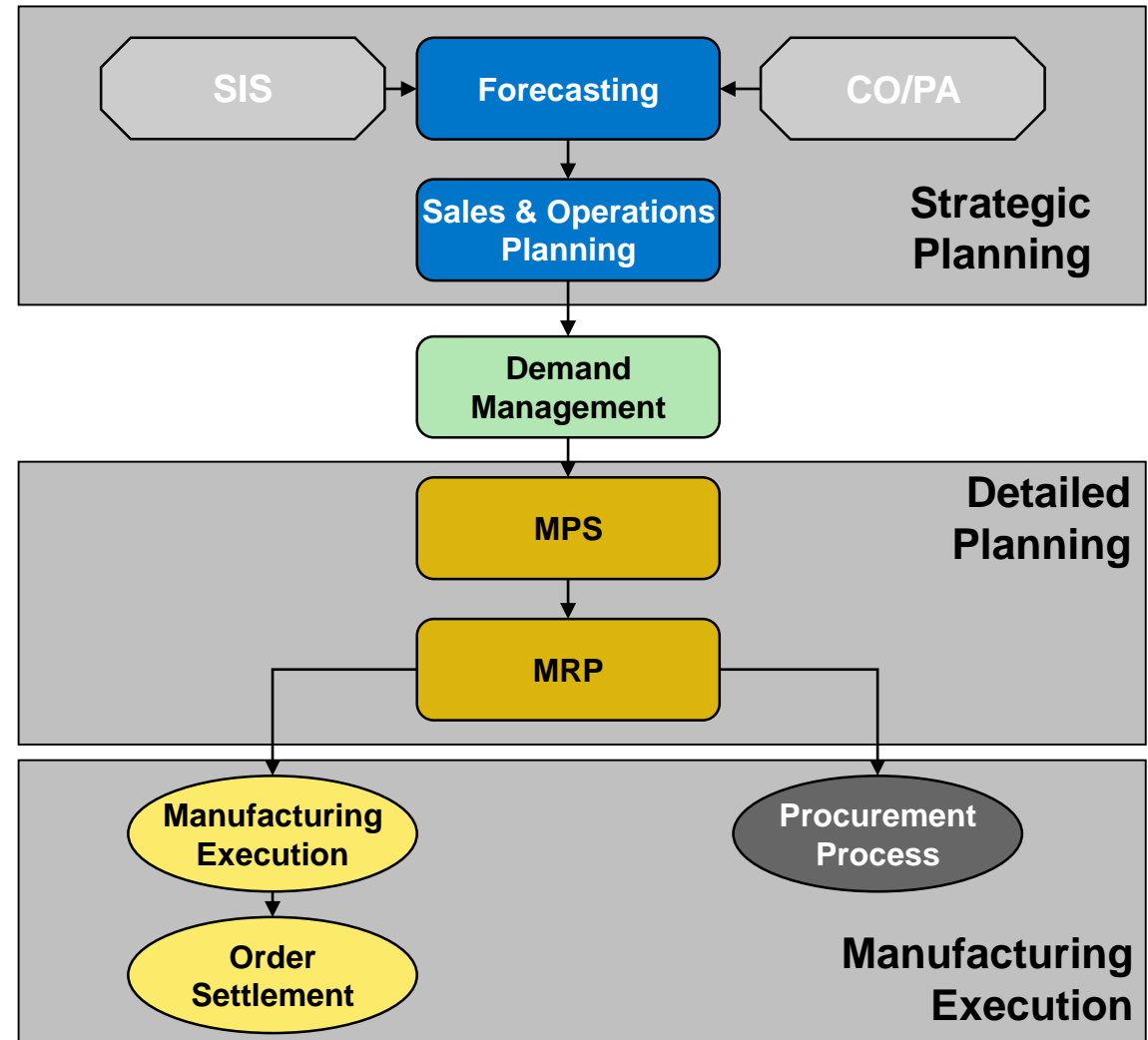




# Production Planning & Execution

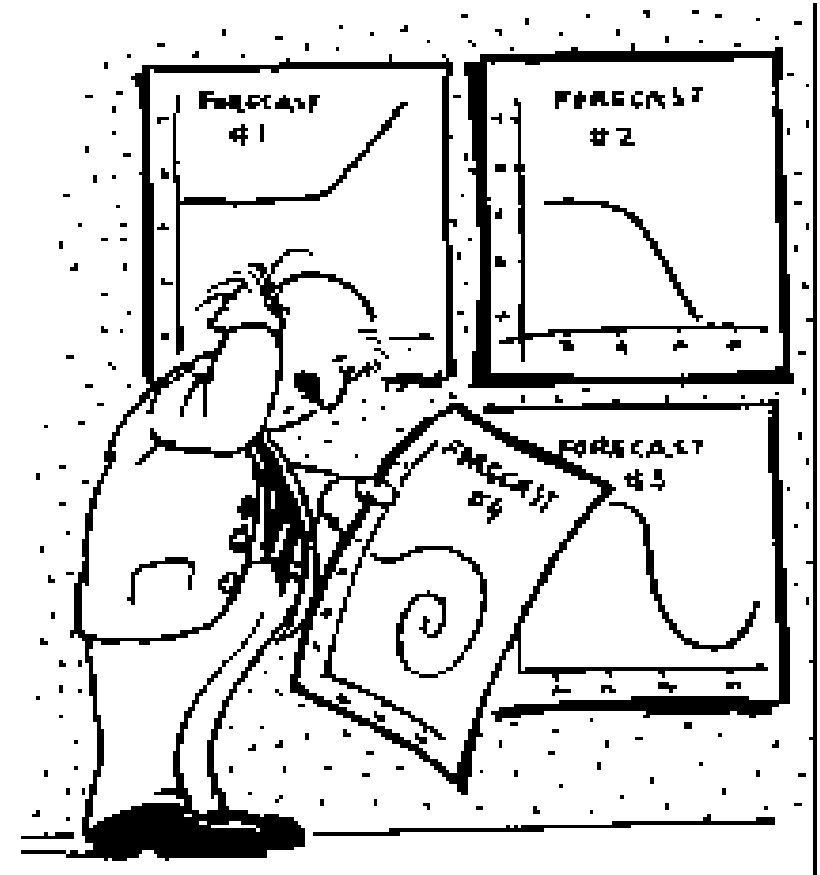
## ■ Players in the Game

- Strategic Planning
  - CEO, COO, CIO, CFO, Controller, Marketing Director
- Detailed Planning
  - Line Managers, Production Scheduler, MRP Controller, Capacity Planners
- Execution
  - Line Workers, Shop Floor Supervisors



# Forecasting

- Forecasting is the foundation of a reliable SOP
- Accurate forecasts are essential in the manufacturing sector
- Overstocked & understocked warehouses result in the same issue: A loss in profits.
- Forecasts are ALWAYS WRONG



# Forecasting

- Forecasting Models
  - Trend
  - Seasonal
  - Trend and Seasonal
  - Constant
- Selecting a Model
  - Automatically
  - Manually

Forecast: Parameters for Automatic Model Selection

Exponential smoothing, first-order with test for

☐ Trend

Alpha factor	0.20
Beta factor	0.20

☐ Season

Alpha factor	0.20
Gamma factor	0.20
Periods per season	12

☒ Trend and season

☐ Seasonal model and test for trend

☐ Trend model and test for season

Alpha factor	0.20
Beta factor	0.20
Gamma factor	0.20
Periods per season	12

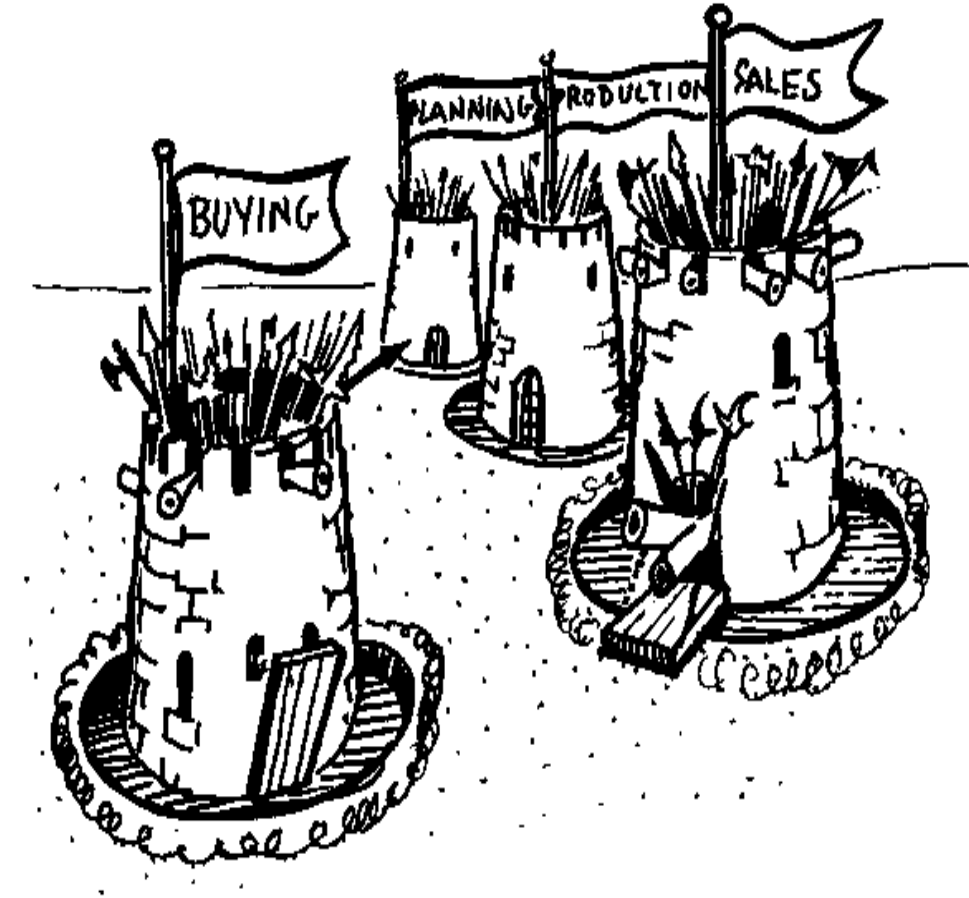
☐ Forecast model sel. using procedure 2

Periods per season	12
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Forecasting Historical... X

# Sales and Operations Planning (SOP)

- Information Origination
  - Sales
  - Marketing
  - Manufacturing
  - Accounting
  - Human Resources
  - Purchasing
- Intra-firm Collaboration
  - Institutional Common Sense



# Sales and Operations Planning (SOP)

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- Flexible forecasting and planning tool
- Usually consists of three layers:
  - Sales Plan
  - Production Plan
  - Rough Cut Capacity Plan
- Planned at an aggregate level in time buckets

# Demand Management

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- The planning of requirement quantities and requirement dates for finished products and important assemblies
- Definition of the strategy for planning and producing or procuring a finished product
- Link between Strategic Planning (SOP) & Detailed Planning (MPS/MRP)
- Demand management can be done manually or based on previous planning results such as sales planning, SOP, and forecast.
- The results of Demand Management is called the Demand Program, it is generated from our independent requirements - PIR - Planned Independent Requirements and CIR - Customer Independent Requirements

# Demand Management

**Forecast**



**Planned  
Independent  
Requirements**

**Customer  
Independent  
Requirements**

**Sales**



**Demand  
Program**

**MPS / MRP**

# Planning Strategies

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- Planning strategies represent the business procedures for
  - The planning of production quantities
  - Dates
- Wide range of strategies
- Multiple types of planning strategies based upon environment
  - Make-To-Stock (MTS)
  - Make-To-order (MTO)
    - Driven by sales orders
  - Configurable materials
    - Mass customization of one
  - Assembly orders



# Planning Strategy for Make-to-Stock

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- Planning takes place using Independent Requirements
- Sales are covered by make-to-stock inventory
- Strategies
  - 10 – Net Requirements Planning
  - 11 – Gross Requirements Planning
  - 30 – Production by Lot Size
  - 40 – Planning with Final Assembly

# Planning Strategy for Make-to-Order

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- Planning takes place using Customer Orders
- Sales are covered by make-to-order production
- Strategies
  - 20 – Make to Order Production
  - 50 – Planning without Final Assembly
  - 60 – Planning with Planning Material

# Master Production Scheduling (MPS)

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- MPS allows a company to distinguish planning methods between materials that have a strong influence on profit or use critical resources and those that do not

# Material Requirement Planning (MRP)

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- In MRP, the system calculates the net requirements while considering available warehouse stock and scheduled receipts from purchasing and production
- During MRP, all levels of the bill of material are planned
- The output of MRP is a detailed production and/or purchasing plan
- Detailed planning level
  - Execute primary functions
  - Monitor inventory stocks
  - Determine material needs
    - Quantity
    - Timing
  - Generate purchase or production orders

# Demand-Independent vs. Dependent

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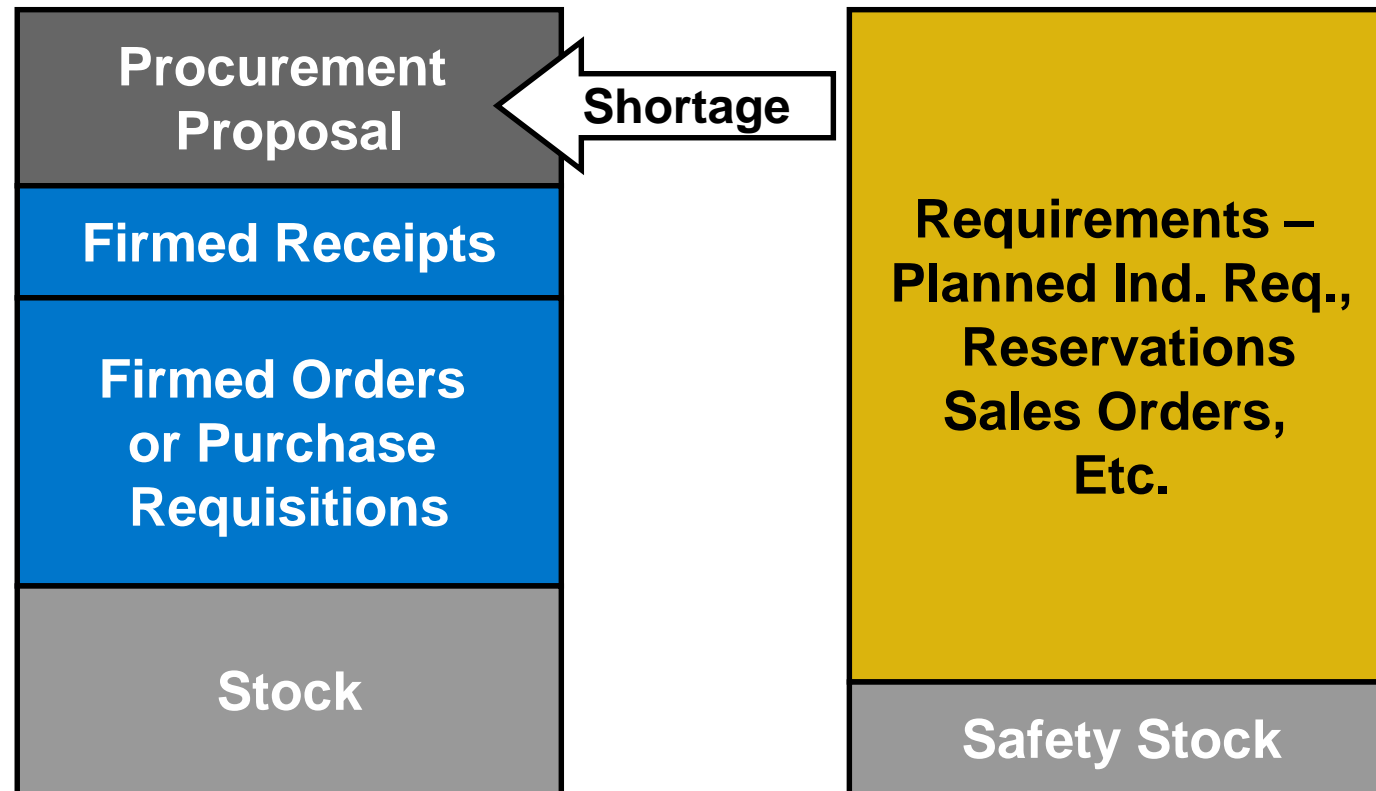
- Independent Demand – Original source of the demand.
  - **Independent demand** is demand for a finished product, such as a computer, bicycle, or pizza.
- Dependent Demand – Source of demand resides at another level.
  - **Dependent demand**, on the other hand, is demand for component parts or subassemblies. For example, this would be the microchips in the computer, wheels on the bicycle, or cheese on the pizza

# Material Requirement Planning (MRP)

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- MRP is used to ensure the availability of materials based on the need generated by MPS or the Demand Program
  - 5 Logical Steps
    - Net Requirements Calculation
    - Lot Size Calculation
    - Procurement Type
    - Scheduling
    - BOM Explosion

# Net Requirements



# Lot sizing

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- Static
  - Based on fixed values in the Material Master
- Periodic
  - Groups net requirements together from multiple periods
- Optimized
  - Calculates the optimum lot size for a several periods of net requirements

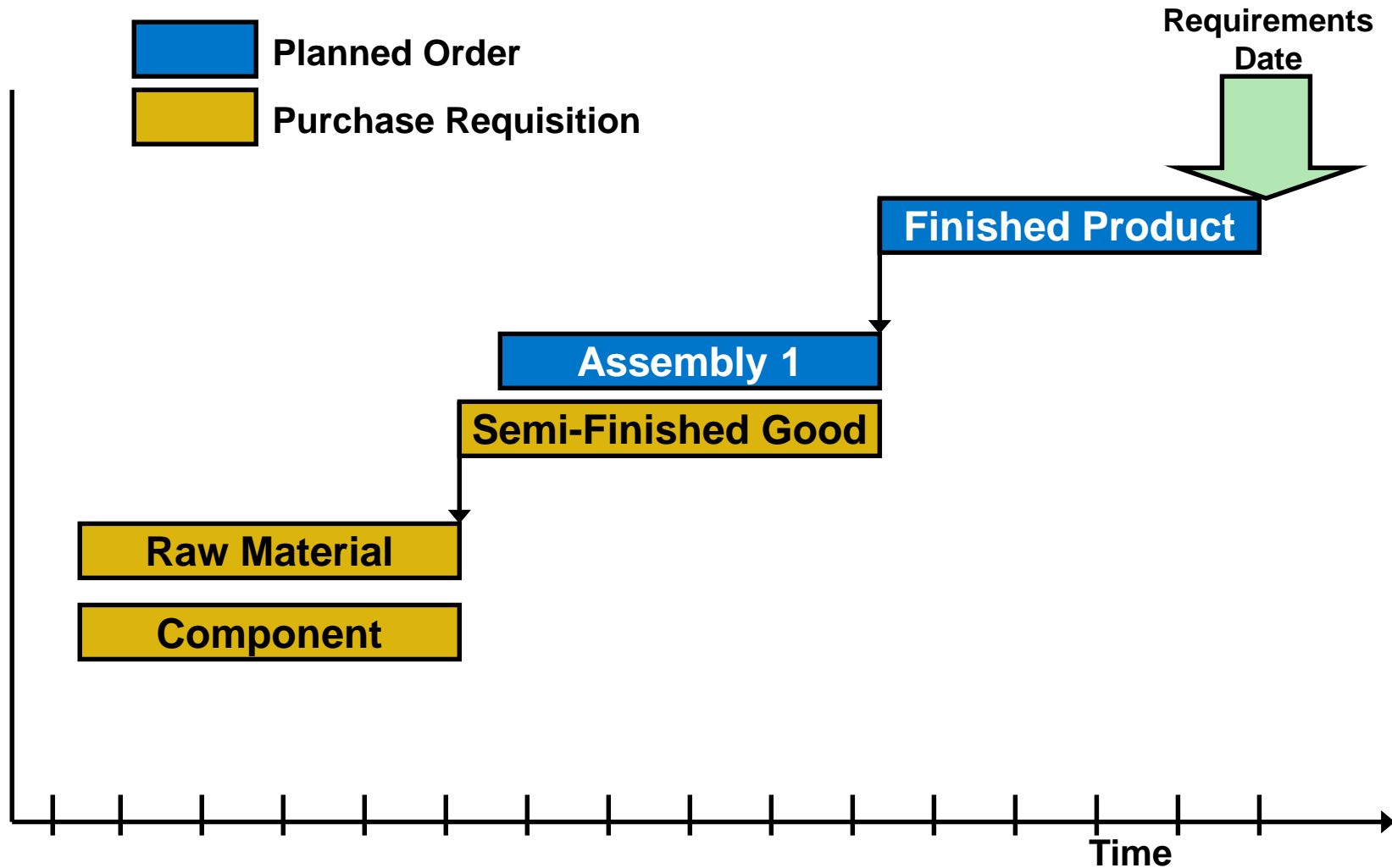


# Procurement Type

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- External Procurement
  - Purchase Requisition
  - Purchase Order
  - Schedule Line
  
- Internal Procurement
  - Planned Order
  - Production Order
  - Process Order

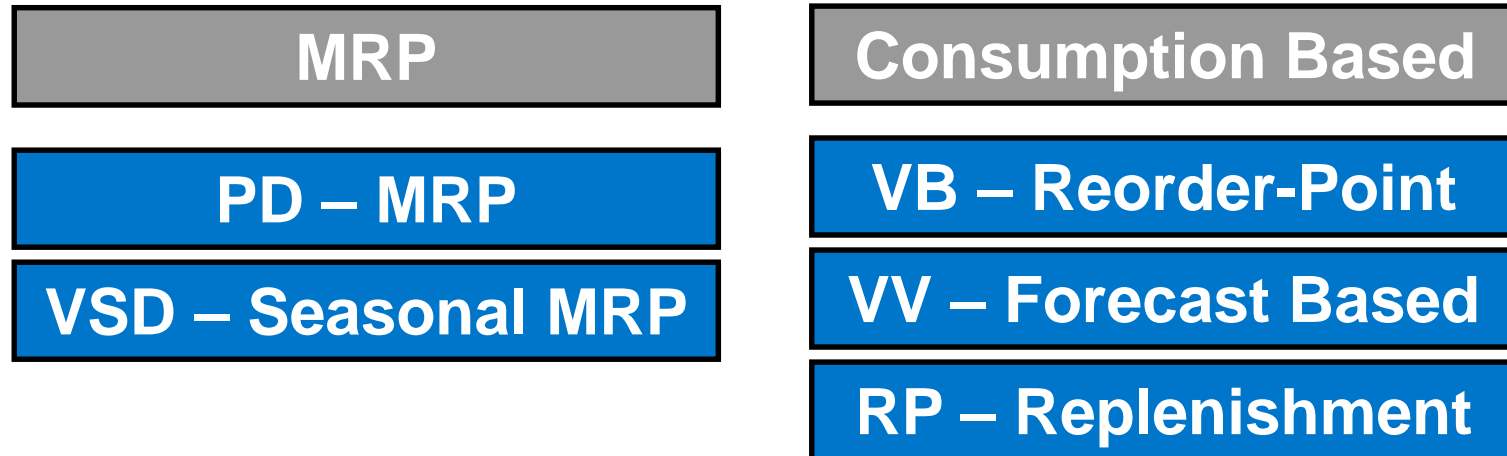
# Multi-Level Scheduling



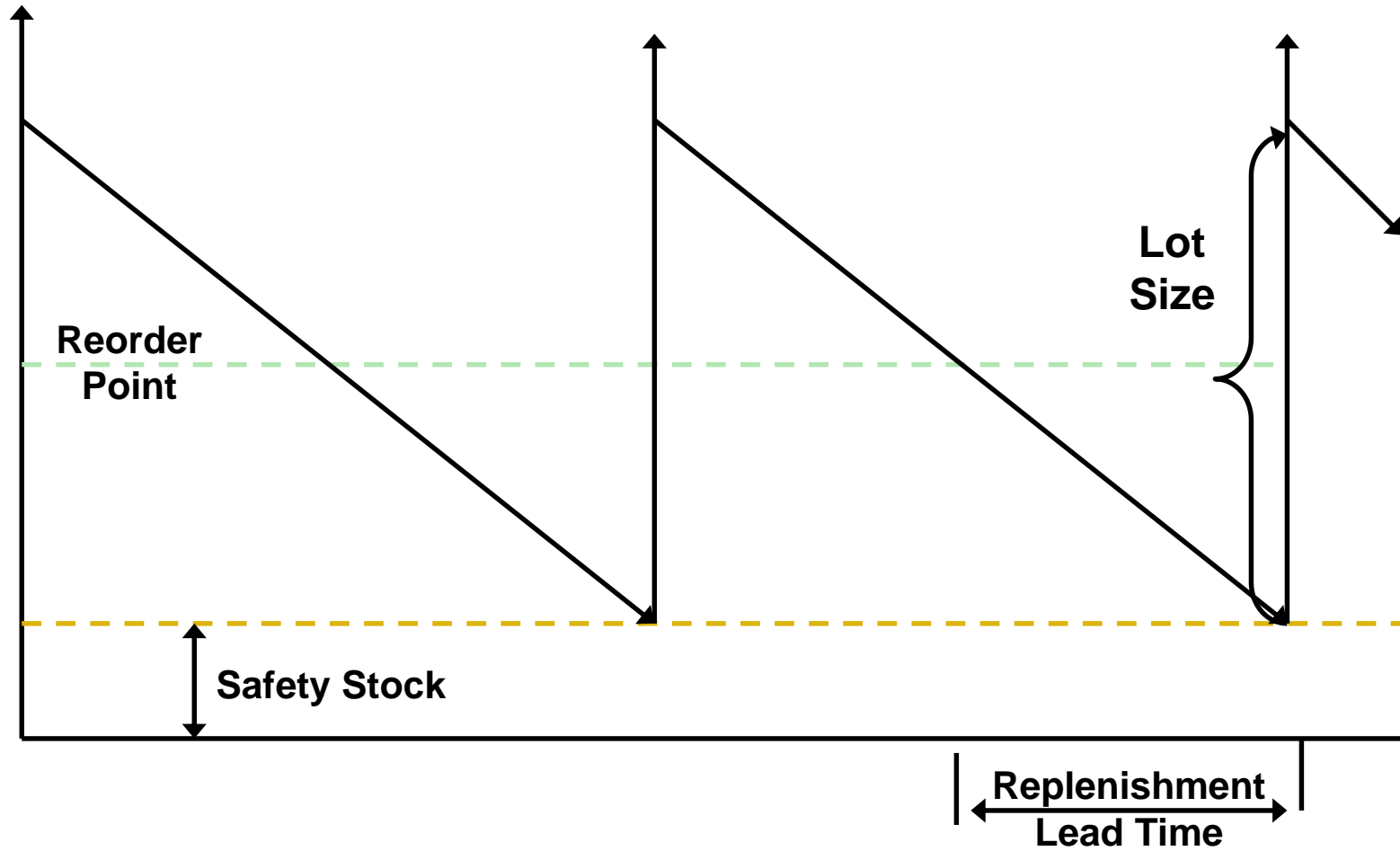
# MRP vs. Consumption-Based

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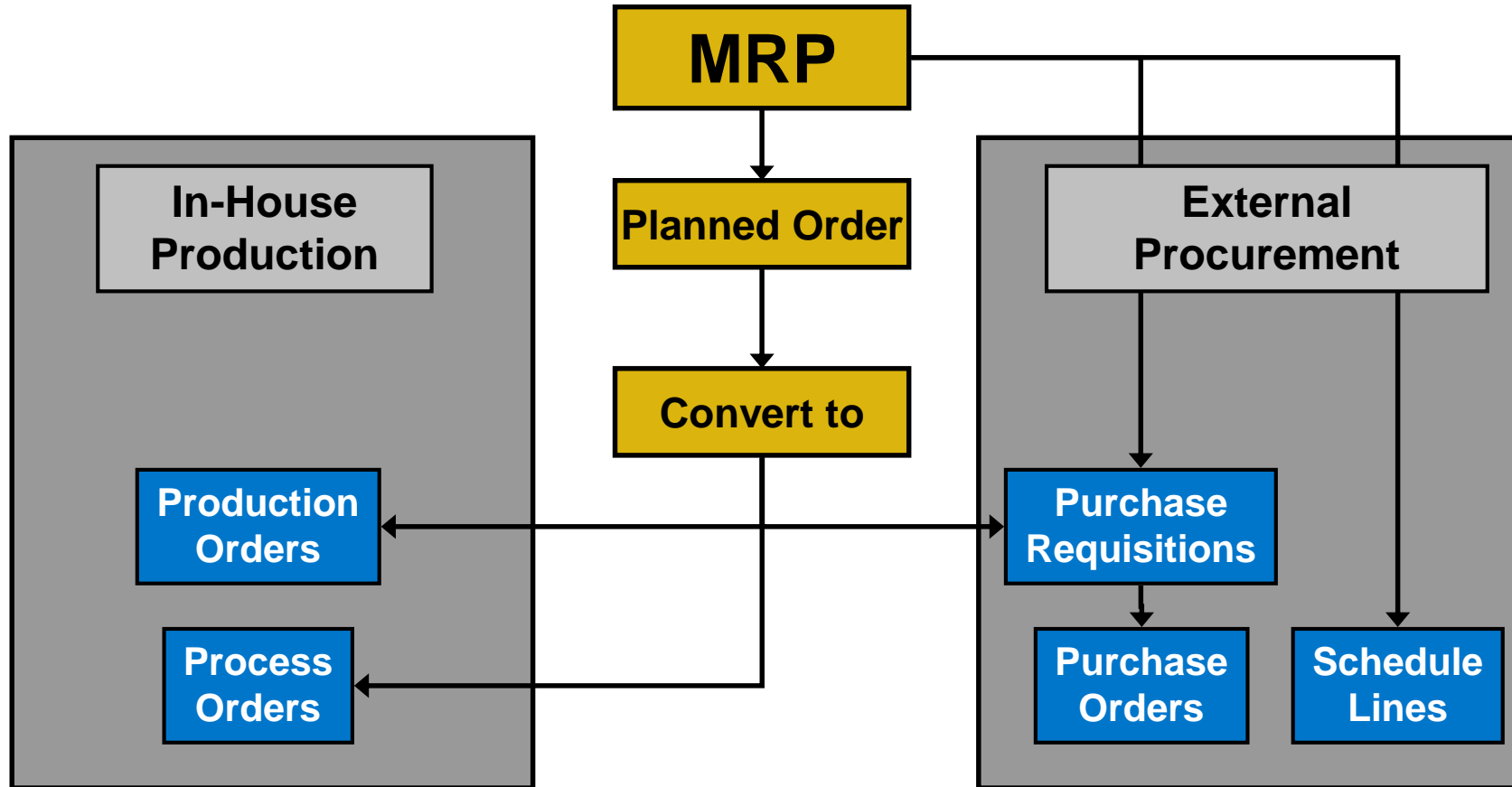
- Whether or not a material is planned using MRP or Consumption Based is determined by the MRP Type on the MRP1 screen of the Material Master



# Consumption-Based



# Output of MRP

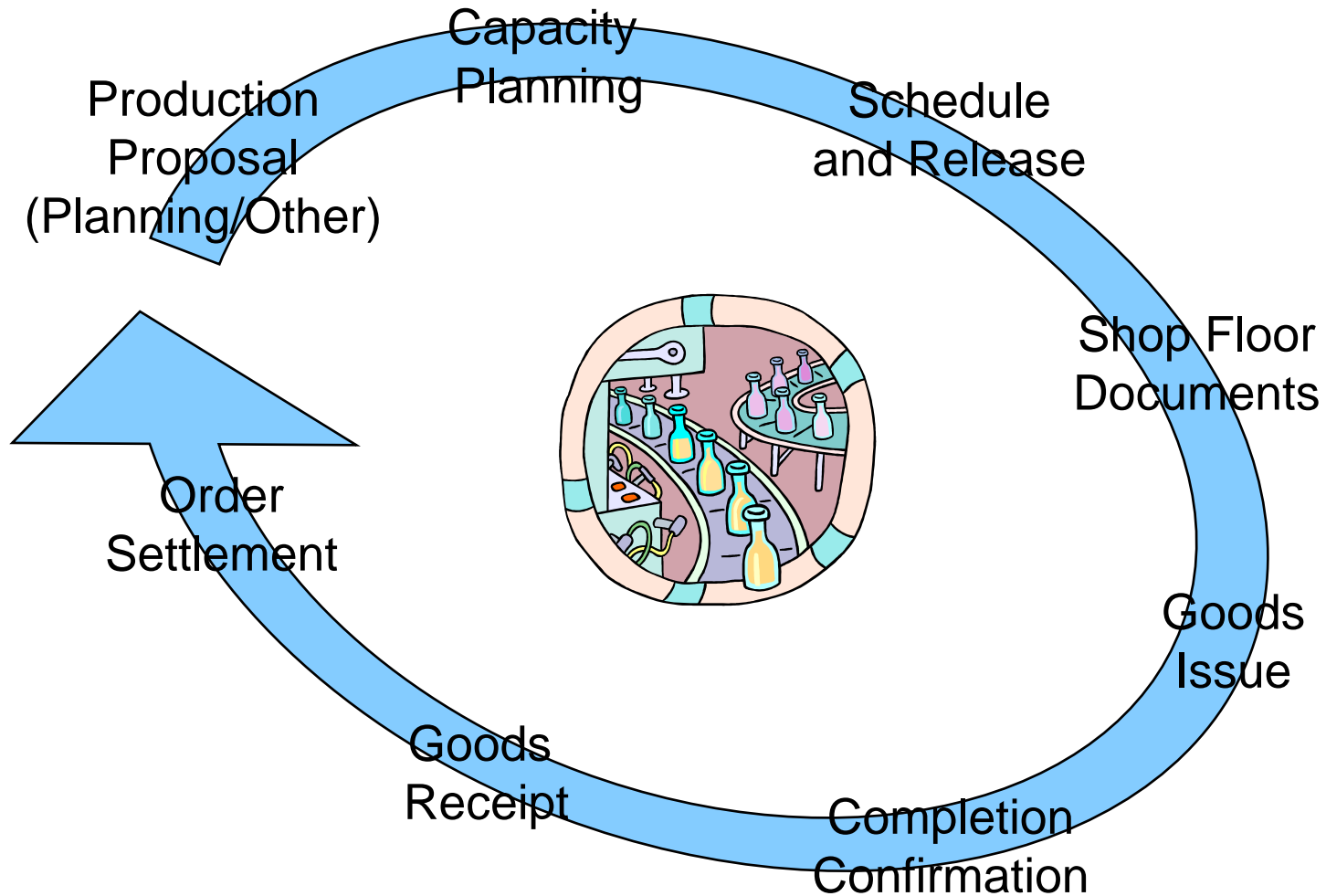


# Orders, orders, orders

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- Planned Order (planning)
  - A request created in the planning run for a material in the future (converts to either a production or purchase order)
- Production Order (execution)
  - A request or instruction internally to produce a specific product at a specific time
- Purchase Order (execution)
  - A request or instruction to a vendor for a material or service at a specific time

# Manufacturing Execution Process



# Production Order

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- Production orders are used to control production operations and associated costs
  - Production orders define the following
    - Material produced
    - Quantity
    - Location
    - Timeline
    - Work involved
    - Resources used
    - Cost settlement



# Production Order

The screenshot shows the SAP 'Production order Create: Header' interface. Annotations highlight key areas:

- How**: Points to the 'Components' tab in the top navigation bar.
- What**: Points to the 'Material' field, which contains 'DXTR1000' and 'Deluxe Touring Bike (black)'.
- How many**: Points to the 'Total Qty' field, which contains '10'.
- Timeline**: Points to the 'Confirmed' date and time field in the 'Dates/Times' section.

**Production order Create: Header**

Order: %000000000001

Material: DXTR1000 Deluxe Touring Bike (black)

Status: CRTD MSPT RELR SETC

Type: PP01

Plant: DL00

General Assignment Goods Receipt Control Dates/Qties Master Data Long Text Administration Items Fast Entry

**Dates/Times**

Basic Dates		Scheduled		Confirmed	
End:	16.04.2018 00:00	14.04.2018	13:39		
Start:	13.04.2018 00:00	14.04.2018	08:00		00:00
Release:		13.04.2018			

**Scheduling**

\* Type: 2 Backwards

Reduction: No reduction carried out

Note: Automatically carried out today scheduling

Priority:

**Floats**

Sched. Margin Key: 001

Float Bef. Prdn: 1 Workdays

Float After Prdn: 1 Workdays

Release Period: 1 Workdays

# Schedule

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- Calculates the production dates and capacity requirements for all operations within an order
  - Determines a Routing
    - Operation specific timelines
    - Material Consumption Points
  - Material Master
    - Scheduling Margin Key (Floats)
  - Work Center
    - Formulas
    - Standard Inter-operation Times

# Release

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- Two release processes
  - Header Level
    - Entire order and all operations are released for processing, order is given a REL status
  - Operation Level
    - Individual operations within an order are released
    - Order is given a PREL status
    - Not until the last operation is released does the order obtains a REL status
- Automatic vs. manual

# Availability Check

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- Automatic check to determine whether the component, production resource tools, or capacities in an order are available
  - Can be automatic or manually executed
  - Determines availability on the required date
- Generates an availability log
  - Displays results of the check
  - Missing parts list
  - Reservations that could not be verified

# Schedule & Release

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- The time between scheduling and releasing an order is used for company checks and any preparation needed for the processing of the order
- Once an order has been released it is ready for execution, we can at this time
  - Print shop floor documents
  - Execute goods movements
  - Accept confirmations against the order

# Shop Floor Documents

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- Shop Floor Documents are printed upon release of the Production Order, examples would be:
  - Operation-based Lists
    - Time Tickets, Confirmation Slips
  - Component-based Lists
    - Material Withdrawal Slips, Pull List (consumption list)
  - PRT Lists
    - Overview of PRT's used with their respective operations
  - Multi-Purpose Lists
    - Operation Control Ticket, Object Overview

# Material Withdrawal

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- When a production order is created it references a BOM to determine the necessary components to produce the material
- It then places a reservation on each of the components
- Upon release of the order (or operation) you can withdraw the reserved materials from inventory
  - Reservation is updated
  - Inventory is updated
  - Costs are assigned to the order as actual costs

# Confirmations

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- Confirmations are used to monitor and track the progression of an order through its production cycle
  - Confirmation can be done at the operation or order level
- Exact confirmation shortly after completion of an operation is essential for realistic production planning and control
- Data that needs confirmation include
  - Quantities – yield, scrap, rework
  - Activity data – setup time, machine time
  - Dates – setup, processing, teardown started or finished
  - Personnel data – employee who carried out the operation, number of employees involved in the operation
  - Work center
  - Goods movements – planned and unplanned
  - Variance reasons
  - PRT usage



# Goods Receipt

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- Acceptance of the confirmed quantity of output from the production order into stock
  - Effects of the Goods Receipt
    - Updates stock quantity
    - Updates stock value
    - Changes price stored for future valuation
    - Updates production order
  - Three documents are created
    - Material document
    - Accounting document
    - Controlling document

# Order Settlement

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- Consists of settling the actual costs incurred in the order to one or more receiver cost objects
  - Receivers could include: a material, a cost center, an internal order, a sales order, a project, a network, a fixed asset
- Parameters for Order Settlement
  - Settlement Profile
    - Specifies the receivers, distributions rules and method
  - Settlement Structure
    - Determines how the debit cost elements are assigned to the settlement cost elements
- Settlement Rule
  - Automatically assigned on creation of order, the parameters are used to define this rule
    - Has one or more distribution rule assigned to it
    - Distribution rules define: cost receiver, settlement share, settlement type

# Order Settlement

- Settling a Production Order to Stock
  - Debit posting is made to the Production Order with the value of the material \*
  - Difference between the debt posting and credit posting is posted to a price difference account

Material	Prod. Order	Price Diff.
80	100	20

\* Material Price is determined by the quantity produced times the Standard Price in the Material Master.

# Order Settlement

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- Costs analyzed
  - Primary
    - Materials
    - External Processing
  - Secondary
    - Production, Material, and Administrative Overhead
    - Labor
- Cost Analysis Reporting
  - Calculate and analyze planned costs, target costs, and actual costs of the production order.
  - Calculate and analyze variances



Thank you!

