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Transforming Manufacturing by Combining Replenishment, Complex BOMs and Seasonality

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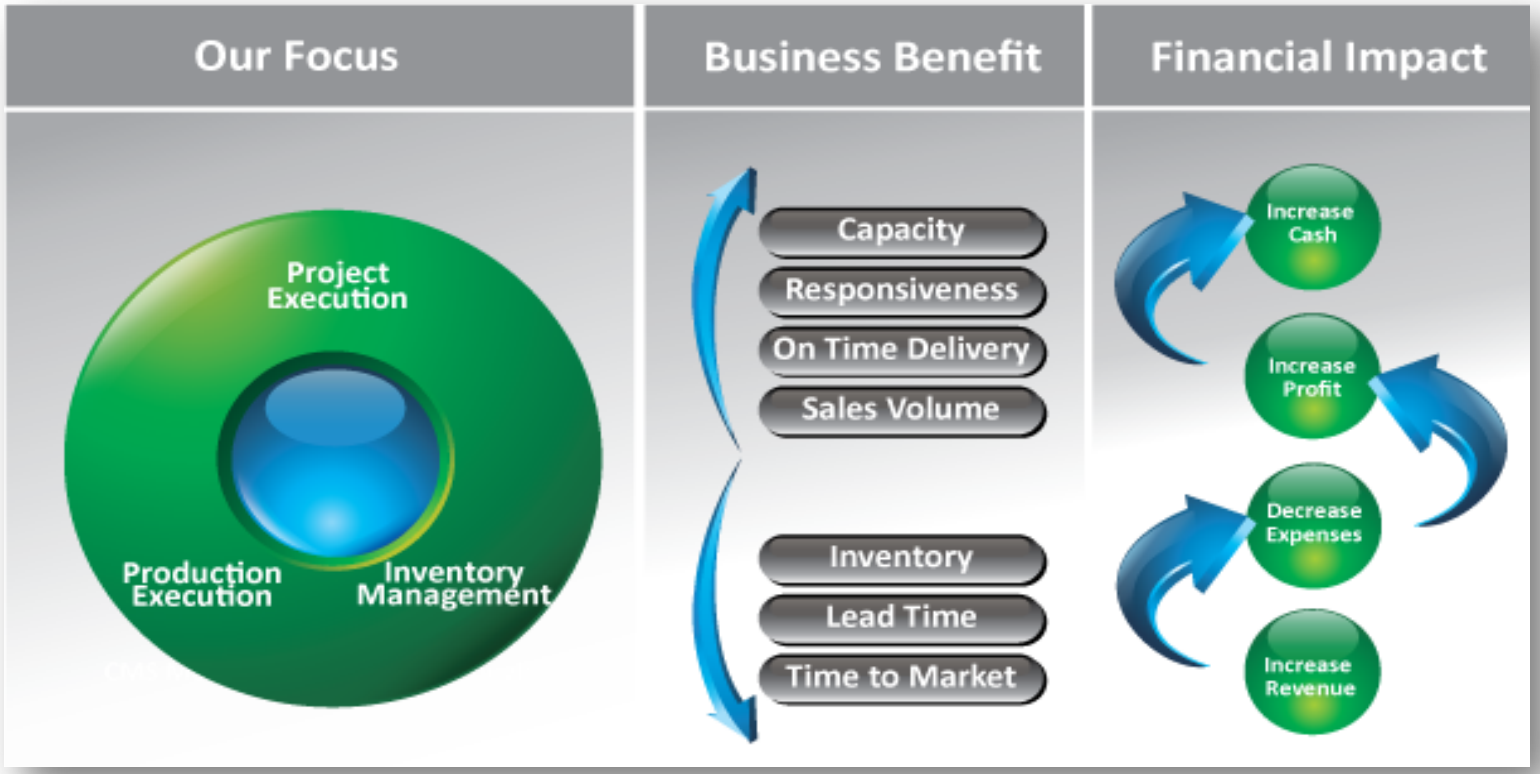
Key Topics

- Introduction and Client Situation
- Lead Time Quadrants for Finished Goods
- Buffer Sizing Approach
- Buffer Adjustments for Finished Goods, based on…
  - Actual Performance
  - Comparison to Forecast
  - Seasonality – Effectivity Dates
- Buffer Adjustments for Raw Materials and Components, based on…
  - Actual Performance
  - Comparison to the Finished Goods Forecast through the BOM
  - Seasonality of Finished Goods through the BOM
- Implications for Planned Load (Drum Capacity)
- Summary

Who is CMS Montera?

- CMS Montera Provides Management Solutions and Software to Accelerate Projects and Optimize Operations



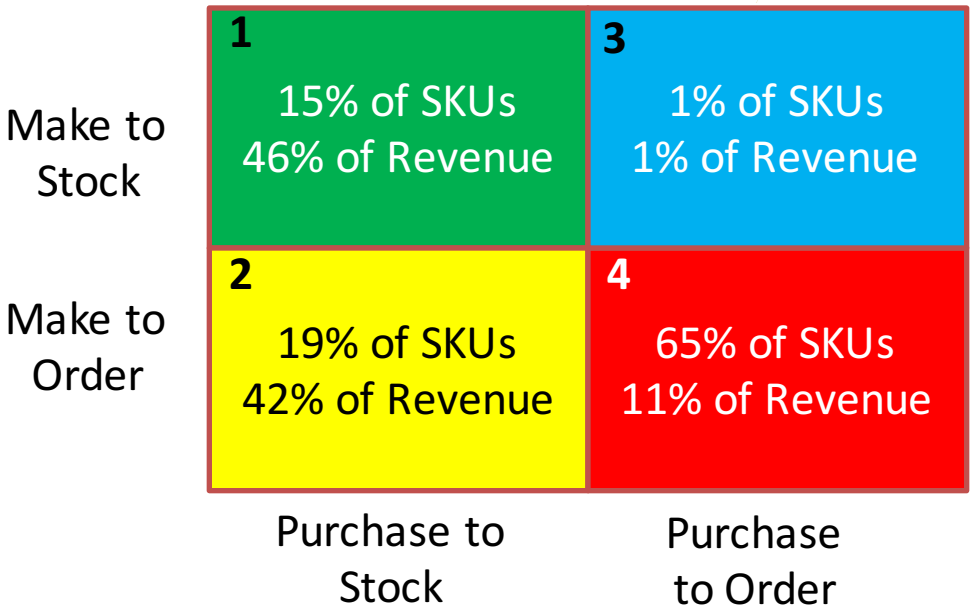
Our Hope for this Presentation

- At the end of this presentation, you …
  - Appreciate that Stock Buffers exist to increase competitive advantage and profitability – by reducing customer lead time and increasing on-time delivery
  - Agree that adjusting buffers solely based on 'buffer zone' penetration is not sufficient
  - Believe that a product can have more than 1 pre-planned buffer size
  - Understand the process to connect Finished Goods actual consumption and forecast to both RM and Components

The Client Situation

- Large manufacturer of industrial products
- Global scale – 12 facilities across 4 continents
  - Vertically integrated – foundry to finished goods
  - Very large amount of inter-plant supply
- Seasonal demand
- Commodity product
  - Lead time, availability and new products are all key to Decisive Competitive Edge
- Customer Lead Times much too long with poor OTD
- Highly reliant on the Sales Forecast for purchasing and manufacturing
- Scale of Inventory Challenge (one location)
  - 9,300 Purchased Parts
  - 4,500 Manufactured Components / Sub-Assemblies
  - 4,000 Manufactured Finished Goods
  - 15,000 Phantom Part #s
  - On average more than 220 Purchased and Manufactured Components per FG

Lead Time Matrix
FG Replenishment Policy – 1 location



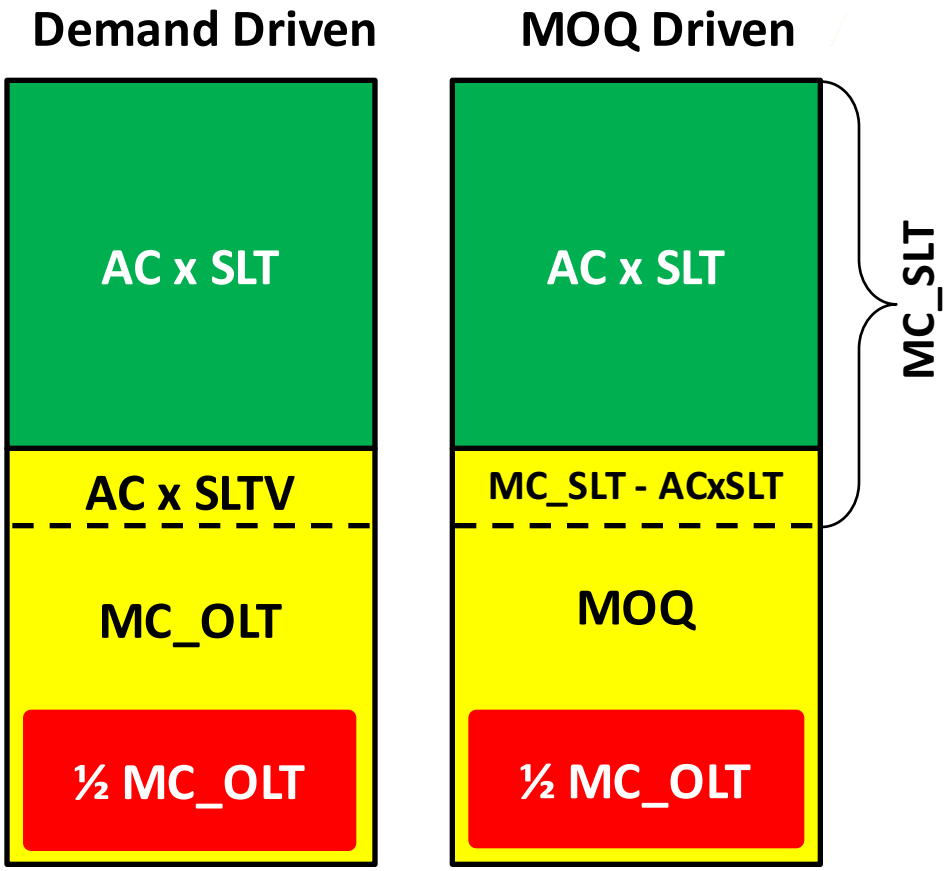
1 LT = 1 – 2 days

2 LT = 2 weeks

3 LT = 1 – 2 days

4 LT = LT of longest Purchased Part plus Mfg LT

Buffer Sizing Approach



- **Definitions**
  - **Supply**
    - OLT — Order Lead Time
    - SLT — Supply Lead Time
    - SLTV — Supply Lead Time Variability
    - MOQ — Minimum Order Quantity
  - **Consumption**
    - AC — Average Daily Consumption
    - MC_OLT — Maximum Consumption across OLT
    - MC_SLT — Maximum Consumption across SLT

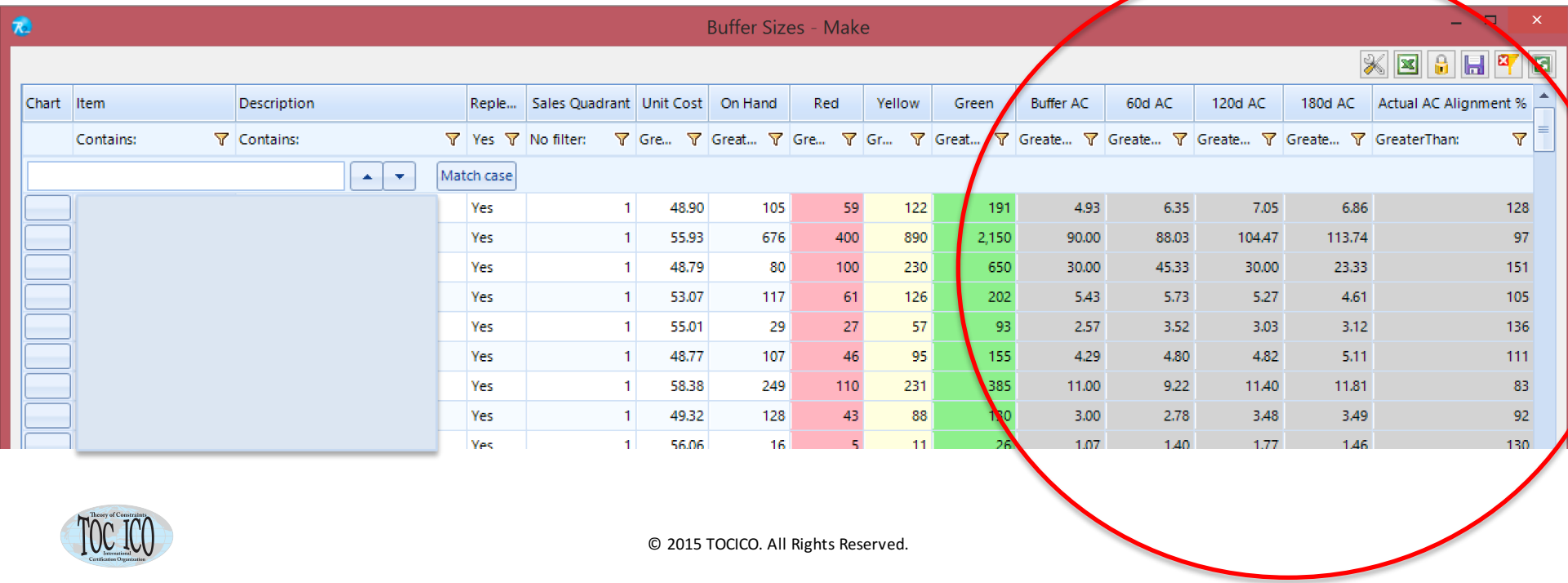
- **Buffer Types**

Demand Driven	Demand determines the order interval
MOQ Driven	The MOQ determines the order interval

Buffer Adjustments for FG

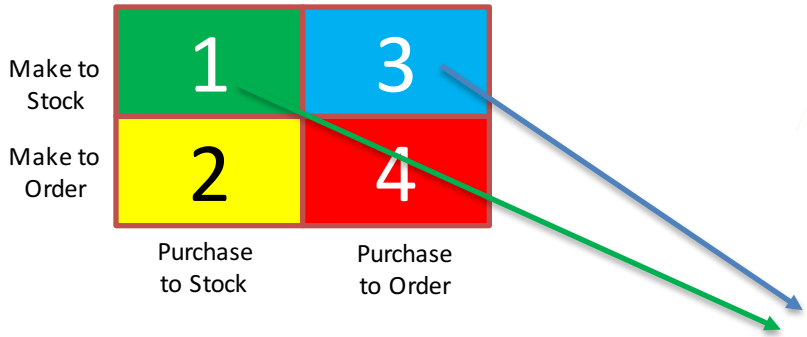
Based on Current Performance

- Zone penetration
  - Too Red or Too Green
- Planned vs Actual consumption
  - FG - Buffer AC vs Actual AC



Buffer Adjustments for FG

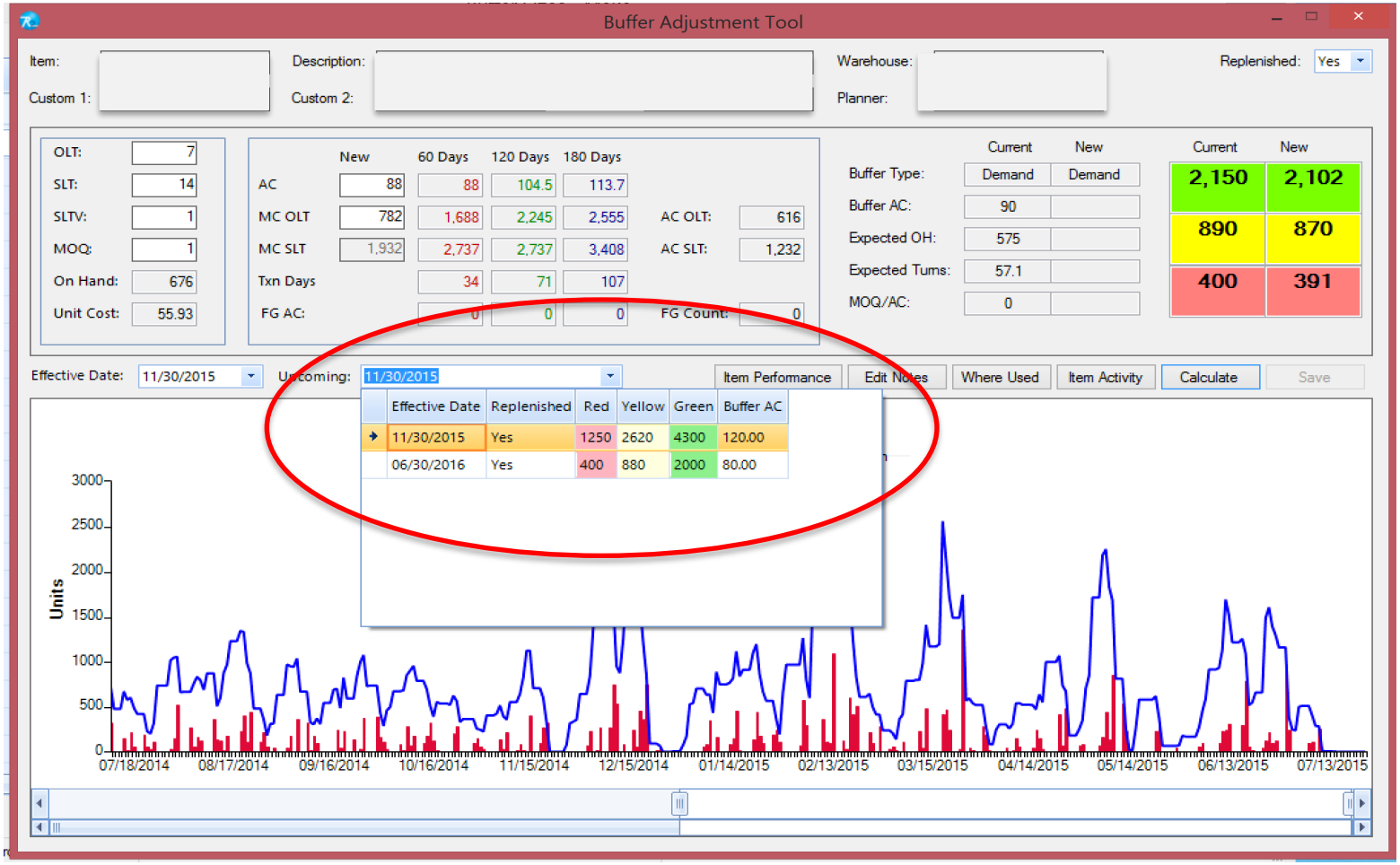
Based on Actual and Forecast



	Actual AC < Forecast AC	Actual AC > Forecast AC
Actual AC < Buffer AC	**Investigate**	**Decrease Buffer**
Actual AC > Buffer AC	**Increase Buffer**	**Investigate**

Buffer Adjustments for FG

Based on Seasonality – Effectivity dates



Buffer Adjustments for RM & Components

Based on Current Performance

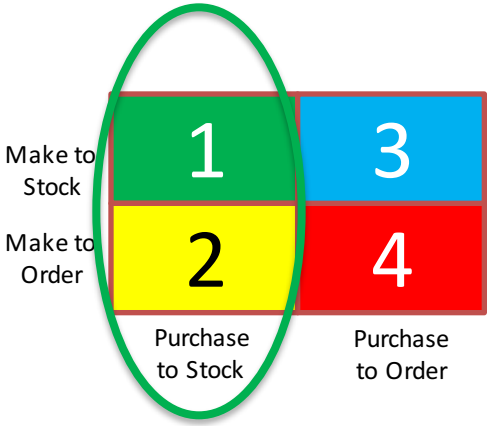
- Zone penetration
  - Too Red or Too Green
- Planned vs Actual consumption
  - Buffer AC vs Actual AC vs FG Actual AC

FG Count	# of RM Items
1	77
<5	395
<10	250
<20	306
<50	280
<100	178
<250	227
<500	75
<1000	63
>1000	11

77 RM items go into just 1 FG
11 RM items go into more than 1000 FGs

Buffer Adjustments for RM & Components

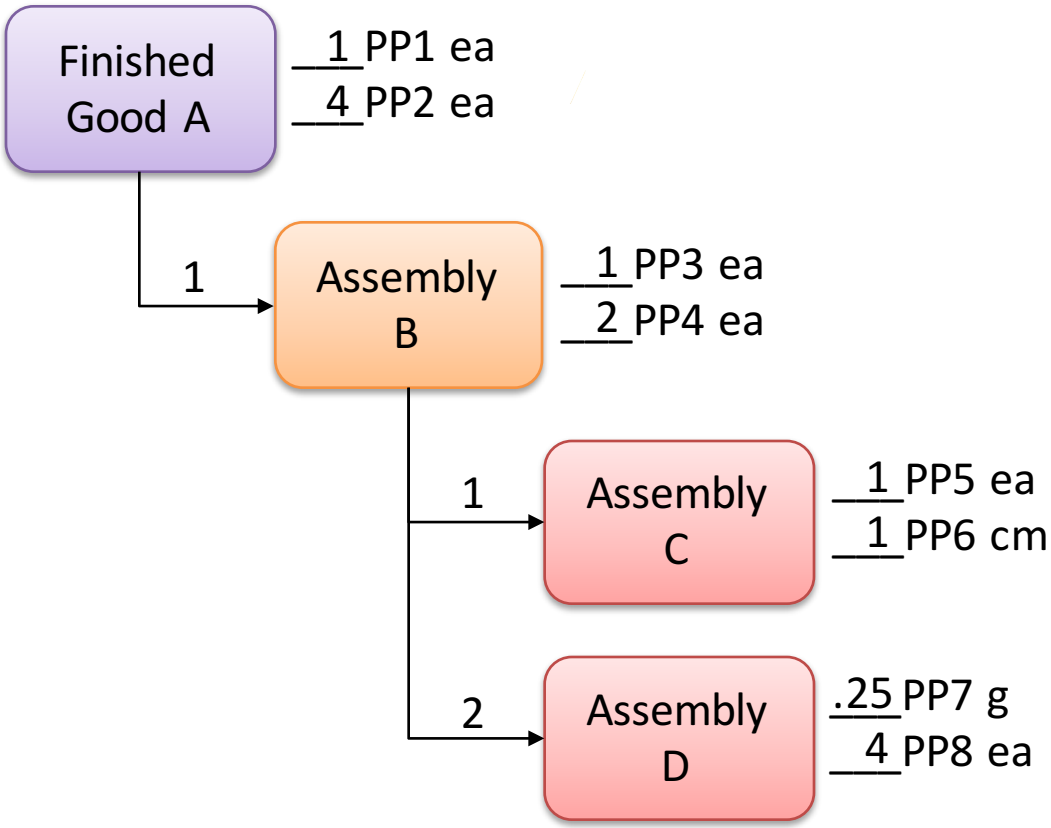
Based on Comparison to Finished Goods Forecast through BOM



- Replenished RM and Components can supply FG in both Q1 and Q2
- For a given RM or Component
  - Compare to Forecast AC of all the Finished Goods it goes into
  - Whether the FG is replenished or not
- Requires ‘flattening the BOM”

Buffer Adjustments for RM & Components

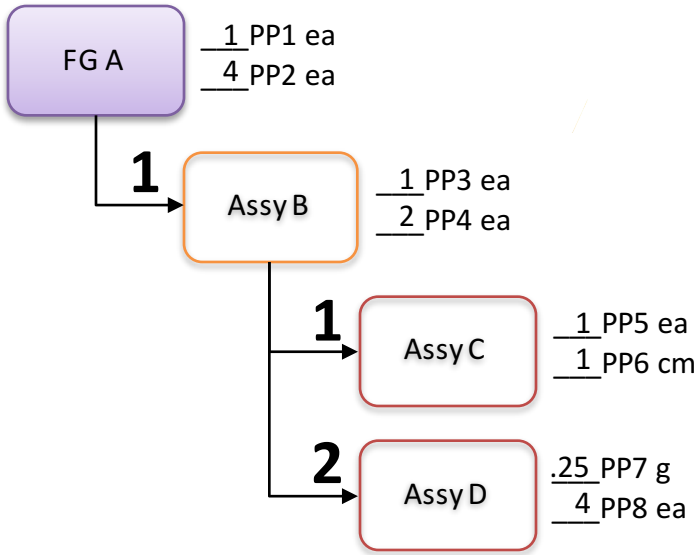
Flattening the BOM - BOM Levels



If we expect to sell 100 units of Finished Good A per month…how many grams of PP7 will be consumed?

Buffer Adjustments for RM & Components

Flattening the BOM - BOM Requirements

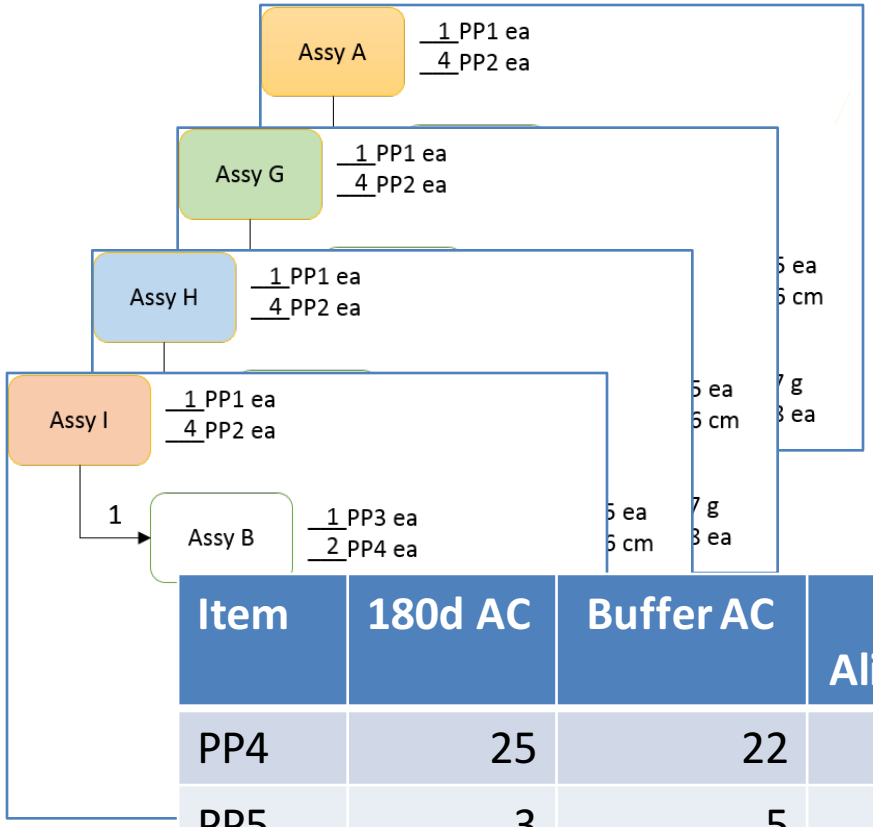


Component	Input Qty per FG A	Equivalent AC
PP1	1	100
PP2	4	400
PP3	1	100
PP4	2	200
PP5	1	100
PP6	1	100
PP7	.5 (.25 x 2 x 1)	50
PP8	8	800

Without changing the actual bill of materials, a table is built linking each component to its Finished Good (top level BOM Assembly), accounting for different rates of input of components : assemblies

Buffer Adjustments for RM & Components

Flattening the BOM – Generating a FG AC for Each Part

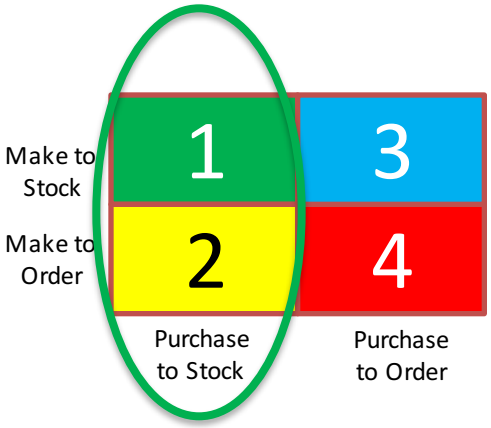


Assembly	Component	Input Qty per Assy	FG AC
Assy A	PP7	.5	12
Assy G	PP7	.4	3
Assy H	PP7	.75	25
Assy I	PP7	.5	2
….	….	….	….

Item	180d AC	Buffer AC	AC Alignment	Txn Days	FG Count	FG AC
PP4	25	22	114%	24	25	20
PP5	3	5	60%	10	4	4.5
PP6	12	10	120%	15	7	12.5
PP7	36	40	90%	45	35	63

Buffer Adjustments for RM & Components

Based on Comparison to Finished Goods Forecast through BOM



- Allows us to create a Forecast AC for each RM & Component based on the FG Forecast
- Compare Buffer AC to Actual AC to Forecast AC

	Actual AC < Forecast AC	Actual AC > Forecast AC
Actual AC < Buffer AC	Investigate	Decrease Buffer
Actual AC > Buffer AC	Increase Buffer	Investigate

Buffer Adjustments for RM & Components
Based on Seasonality of the FG through the BOM

- In addition, the 'Flattened BOM' Allows us to create Effectivity Dates for RM and Component Buffers based on Effectivity Dates of FG Buffers
  - Timing offset by differing Supply Lead Times

Implications for Planned Load

- Many environments are a mix of Make-to-Stock and Make-to-Order (Quad 1 & Quad 2)
- Planned Load for MTS is based on projected Buffer AC of Manufactured Components and Finished Goods
- Future Buffer Changes (Effectivity Dates) based on either Seasonality or Forecast need to be reflected in the Planned Load
  - Offset by at least 1 Supply Lead Time
  - Some Effectivity Dates may need to be pulled further forward to ensure enough time to 'build ahead'

Summary

- Lead Time Quadrants determine replenishment policies for RM and Components and ensure the replenishment solution is customer focused
- Buffer adjustments need to be based on more than just the traditional 'zone penetration' approach
  - Buffered vs Actual vs Forecast consumption
- Buffer Effectivity Dates greatly help manage seasonal items
- RM and Component Buffers can be more effectively managed by comparing their consumption to the actual and forecasted consumption of all the FGs they go into - through a flattened BOM
- The Planned Load is easier to manage when the capacity need by Buffered items reflects expected future changes

About the Presenters

- **Duncan Patrick** is the Executive Vice President of CMS Montera
- Prior to CMS, Duncan was on the Leadership Team of a National Industrial Distributor, Ernst & Young management consultant, and a Landman with Husky Energy
- Duncan is a Certified Management Consultant and certified by the TOCICO in all aspects of TOC. He holds an MBA degree from Western Business School and a Bachelor of Commerce from The University of Calgary, Canada

- **Peter Milroy** is Vice President – Consulting with CMS Montera
- Prior to CMS, Pete was a controller with a large Apparel Manufacturer, a lecturer at Wilfrid Laurier University and a controller with a social services agency
- Pete is a Certified Public Accountant and certified by the TOCICO in Supply Chain, Finance & Measurement and Project Management. He holds a Bachelor of Business Administration from Wilfrid Laurier University in Waterloo, Canada