MANUFACTURING & MATERIAL FLOW ANAGEMENT

Quality & Industrial Performance version 3

"Going From Reactive to Proactive"

PSA GROUPE

DIRECTION SUPPLIER DEVELOPMENT

Global Purchasing and Supply Chain

Reference Doc-Info: 01601_13_00157

Introduction

PURPOSE

- Have a Production Control system that ensures production according to Master Production Schedule and on-time product delivering.
- Product at the right place at the right time
- Robust line feeding process to effectively respond to manufacturing demands
- Appropriate levels of finished goods to supply customers
- Optimized level of stock

SCOPE

- Production Planning and Control Area
- Manufacturing Operations
- Material Handling Area

RESPONSIBILITY (Ownership) :

- Logistics department
- Manufacturing Manager

Benefits

- Avoids plant disruptions (External and Internal)
- Reduction in stock levels ➔ Cost savings
- Increase flexibility in schedule changes ➔ Cost savings
- Better reaction time in regards to last minute schedule changes
- Increase reliability of logistic flow – production flows are optimized
- Ensures right part is delivered at right time

Manufacturing Scheduling , what are we searching for?

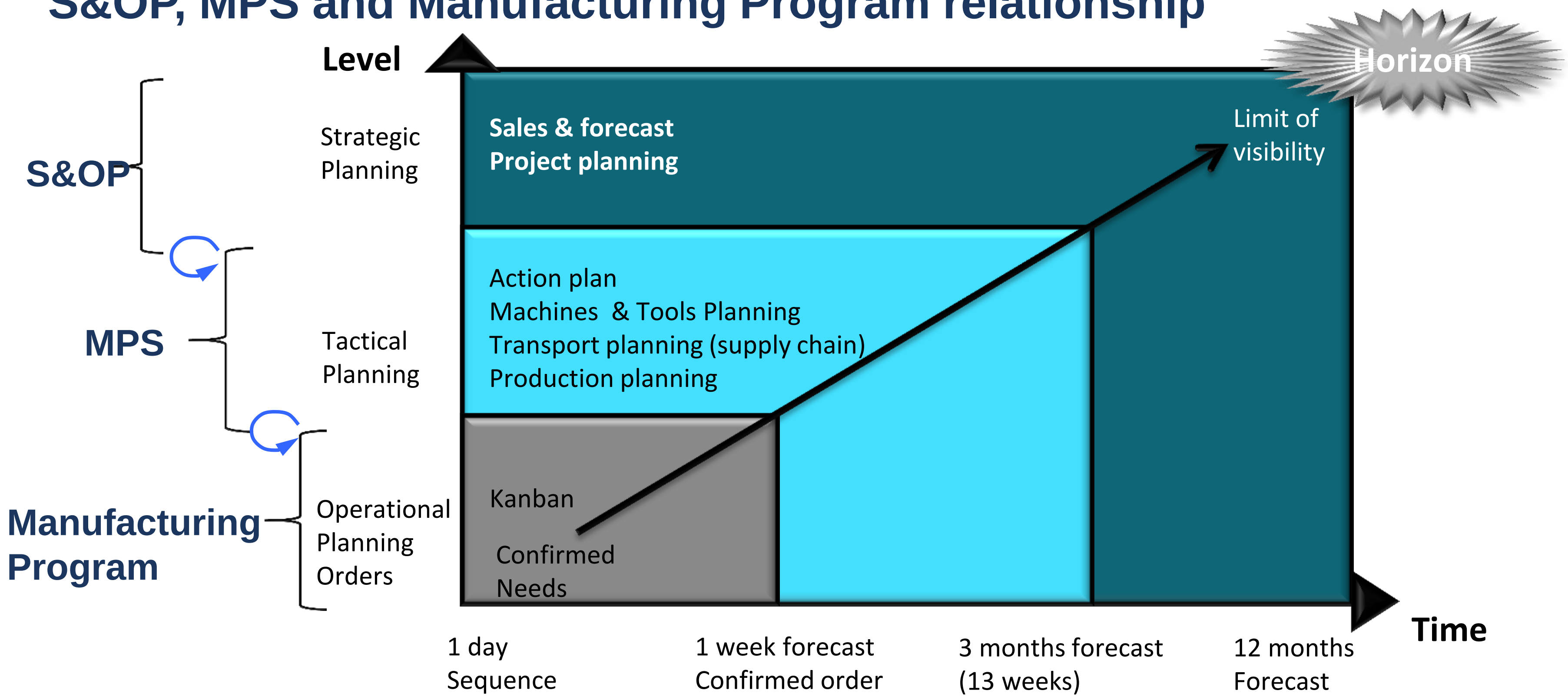
Item	Requirement	#Criteria	Criteria requirement
MMFM1	**Manufacturing operations are planned and tracked**	**MMFM11**	**Long term strategic scheduling is managed via a Sales and Operating Planning (S&OP), it contains all customer needs). It is used to define manufacturing capacity, stock level and investment plan.**
		MMFM12	**A Master Production Schedule (MPS), coherent with the S&OP outputs, is managed on the site.It provides a complete forecasting of the customer demand at the Part Number level on short term. It is used to define the required resources (the availability of the equipment, the human ressources, components & raw materials etc...)**
		MMFM13	**A manfacturing detailled program is defined on a daily basis coherent with MPS outputs, under manufacturing leadership.**
		MMFM14	**Deviations between forecast and real production are followed and controlled on daily basis at production line level. An escalation process is defined (e.g. Escalation to FR meeting)**
		MMFM15	S&OP and MPS are shared with production team and with tier X Suppliers.
		MMFM16	A process to improve the setup time is in place. Organization should establish a target, measure the setup time and define the action plan once the setup time goal is not reach.

Criteria of Requirement

11 – page 5-17
12 – page 5-12 et *page 18-21*
13 – page 22-23
14 – page 24
15 – page 25
16 – page 26 - 33
Auditor Hints – page 34

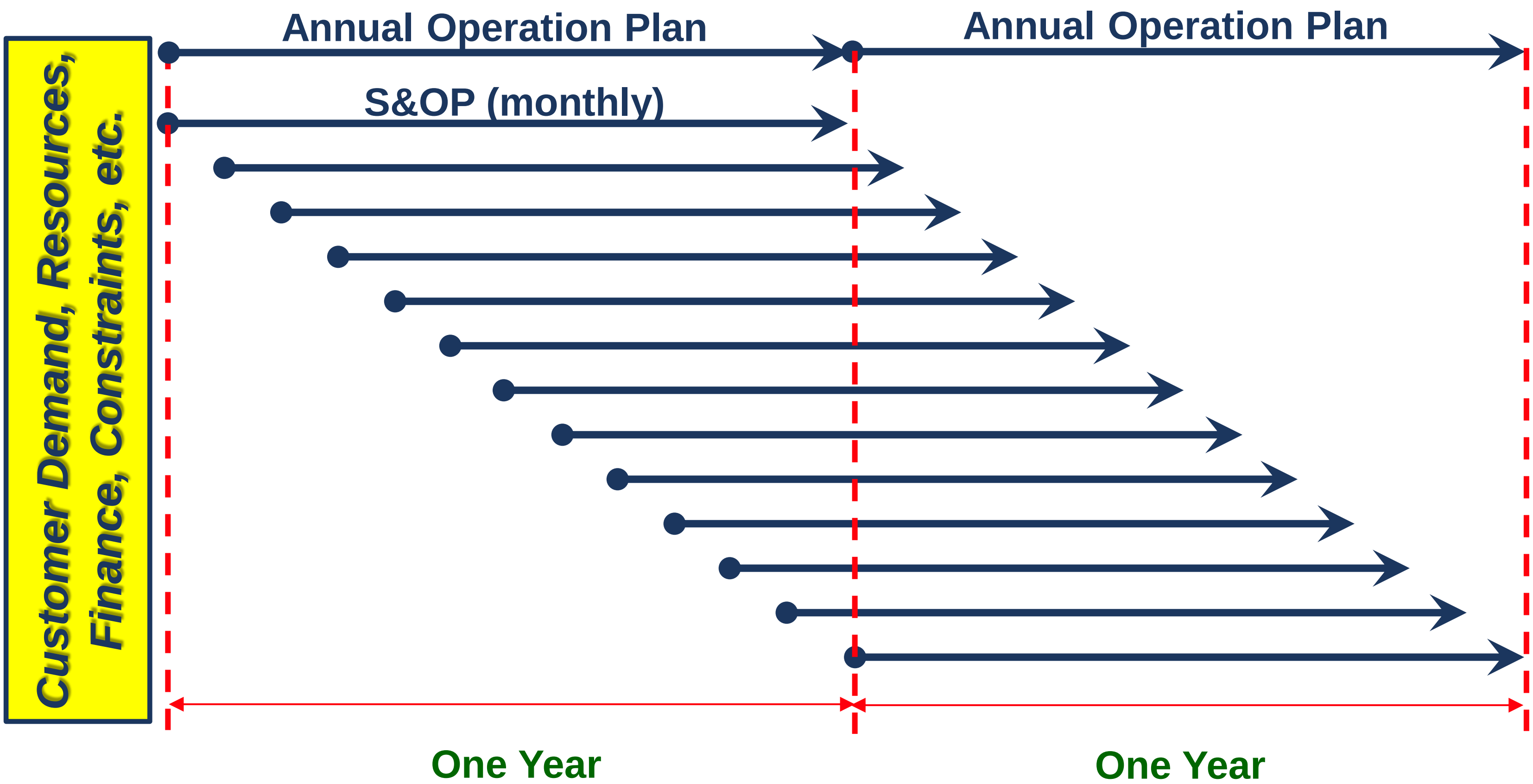
Next Requirement

S&OP, MPS and Manufacturing Program relationship



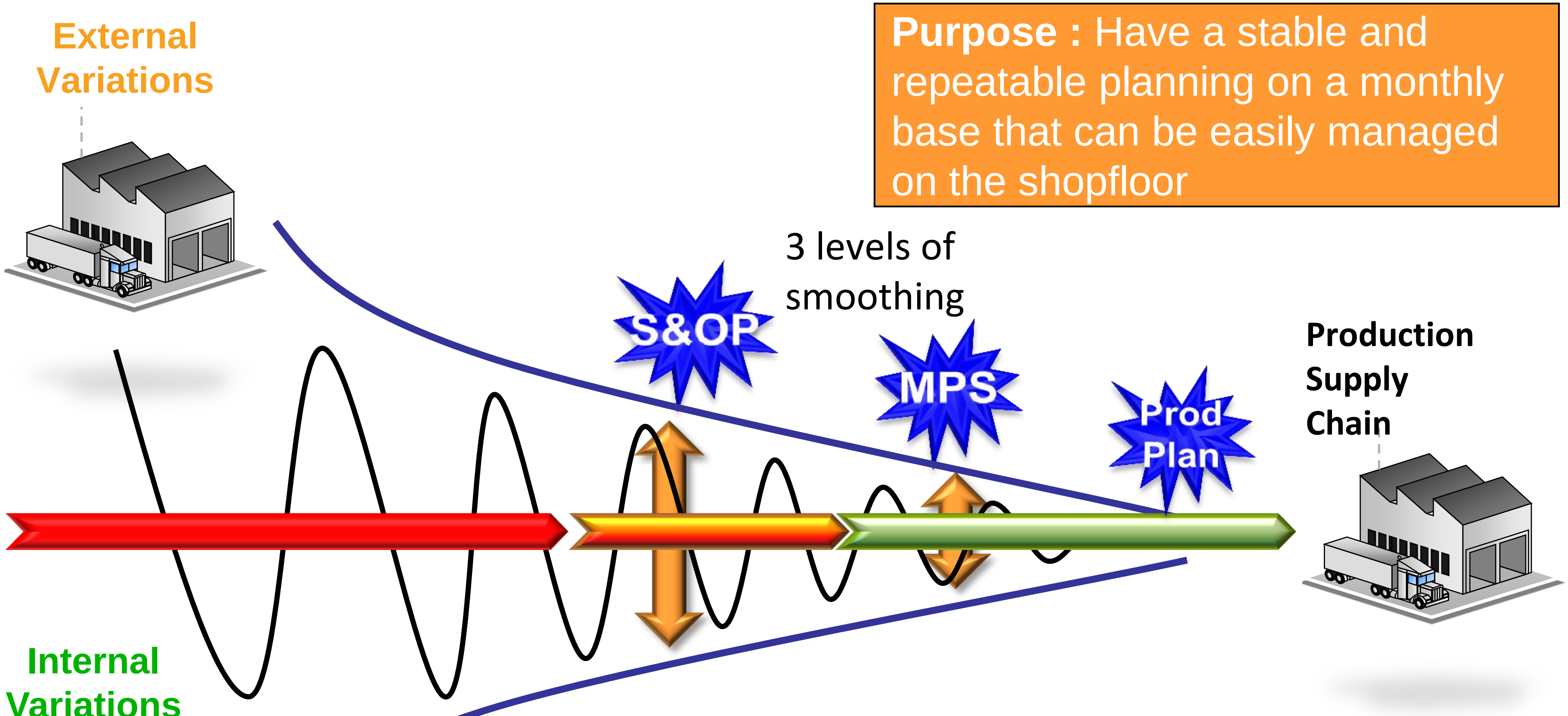
	Product	Horizon	Review	Level
S&OP	Product Family	Year (Long Term) / Month	Monthly / Quarterly	strategic
MPS	Part Reference	2 Months (Mid Term) / Week	Weekly	Tactical
Manuf. Program	Part Reference	Day (Short Term)	Daily	Operational

Relationship between Annual Operation Plan and Sales & Operating Plan (S&OP)



Production level and waste elimination

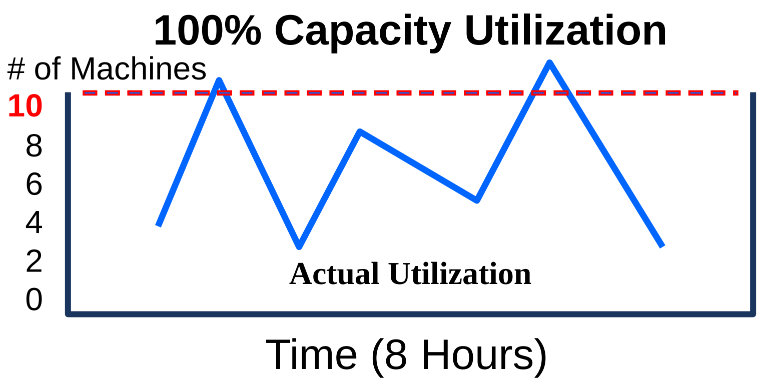
Purpose : Have a stable and repeatable planning on a monthly base that can be easily managed on the shopfloor



The organization doesn't generate any waste
The activity is fully standardize
The management of the activity allows variations leveling

Production Level

Example: Improved Equipment Utilization = Cost Savings



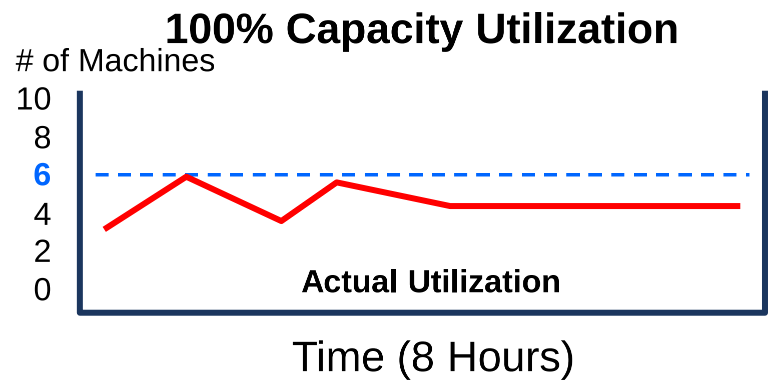


Figure A:
Number of machines: **10**
Average Machine Utilization: **54%**
(10 x 0.54 = 5.4)

← Same Output →

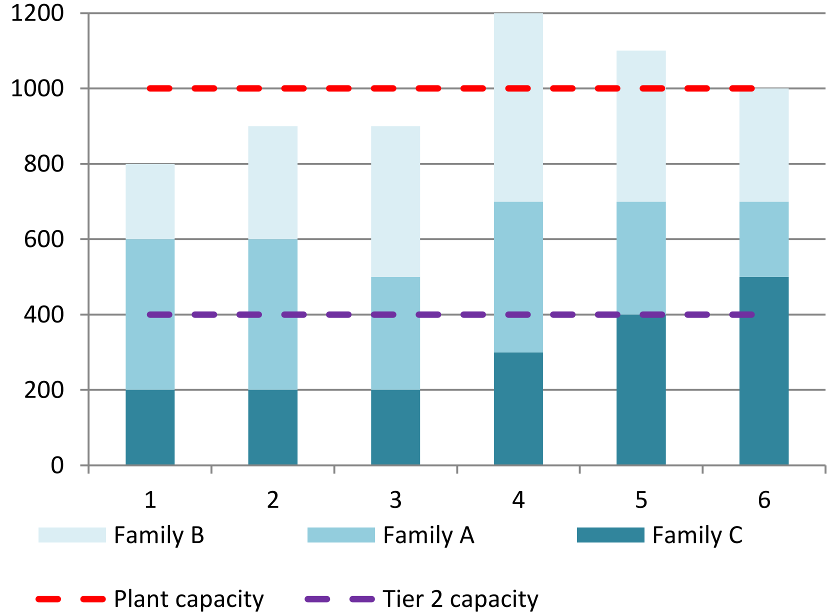
Figure B:
Number of machines: **6**
Average Machine Utilization: **90%**
(6 x 0.90 = 5.4)

- **Manufacturing scheduling**
- **Level scheduling**
- **Cost savings and higher equipment utilization**

Without leveling

Customer Demand

	Month 1	2	3	4	5	6
Family A	400	400	300	400	300	200
Family B	200	300	400	500	400	300
Family C	200	200	200	300	400	500
Total	**800**	**900**	**900**	**1200**	**1100**	**1000**



Constrains

- Plant full capacity: 1000
- Family C: Tier 2 with full capacity: 400

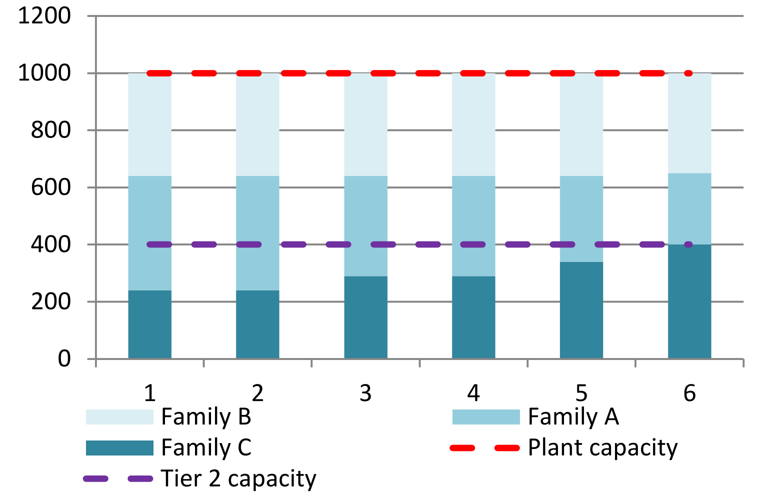
What will happen ?

- Month 4 & Month 5: Customer plant disruption (*overrun of plant capacity*)
- Month 6: Customer plant disruption (*overrun of Tier 2 capacity*)
- Month 7: you are ***<u>red</u>*** in the BIDLIST

With leveling

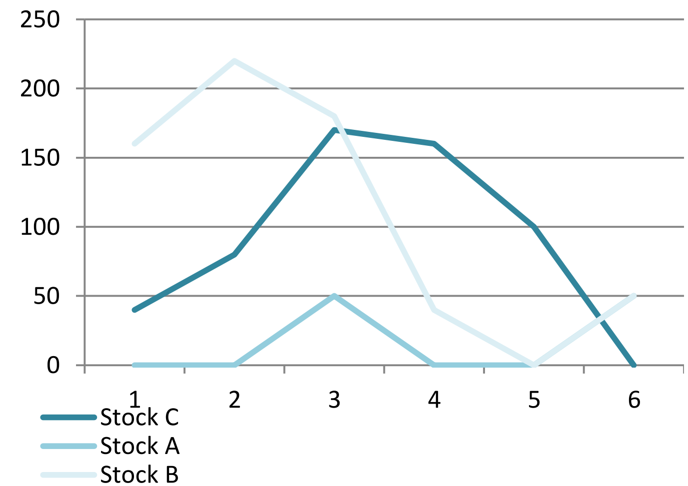
Month	1	2	3	4	5	6	
Family A	400	400	350	350	300	250	
Stock A	0	0	50	0	0	50	
Family B	360	360	360	360	360	350	
Stock B	160	220	180	40	0	50	
Family C	240	240	290	290	340	400	
Stock C	40	80	170	160	100	0	
Total	1000	1000	1000	1000	1000	1000	

Production levels

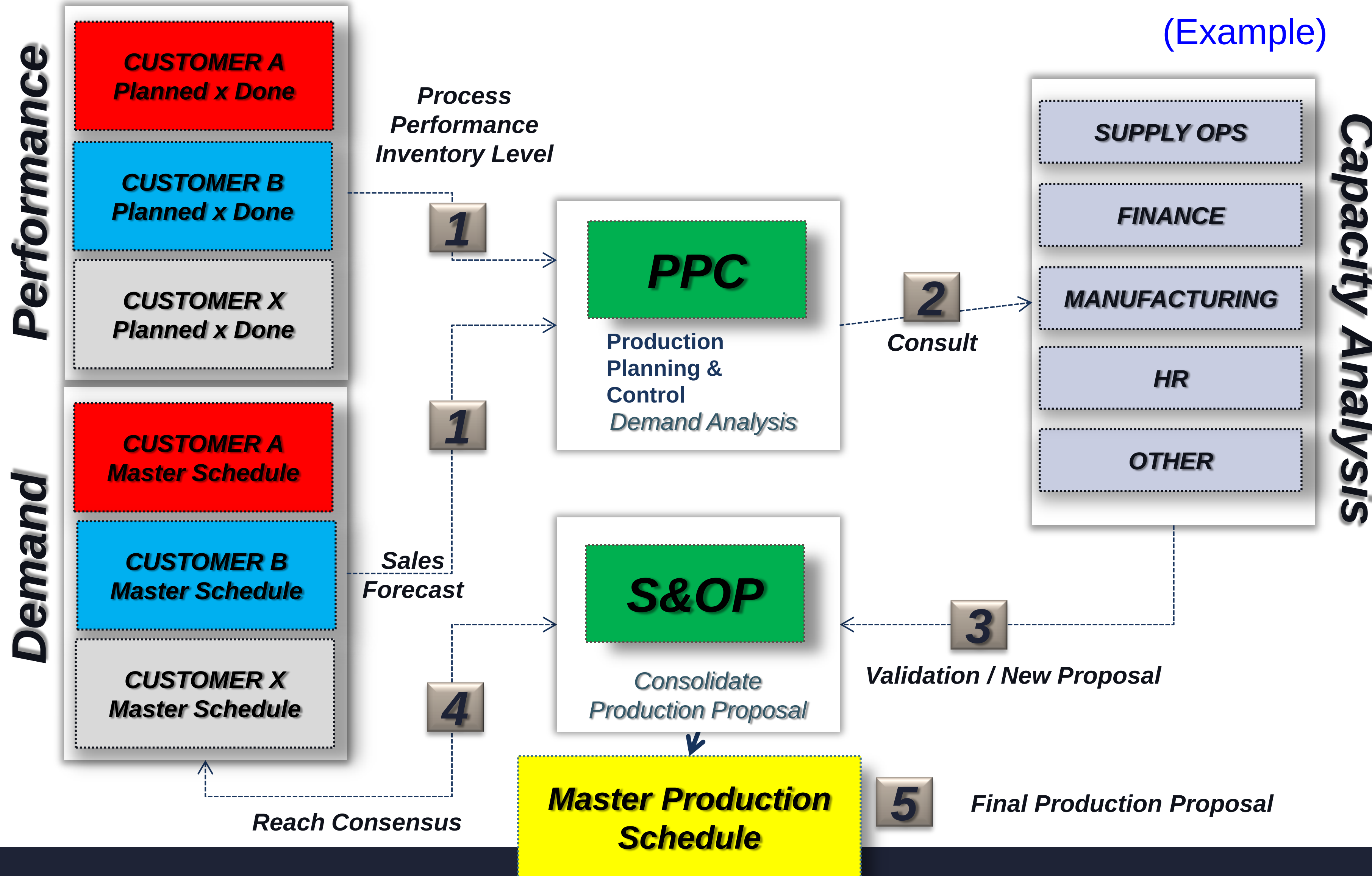


- ***Constrains***
  - Plant full capacity: 1000
  - Family C: Tier 2 with full capacity: 400

Stock levels

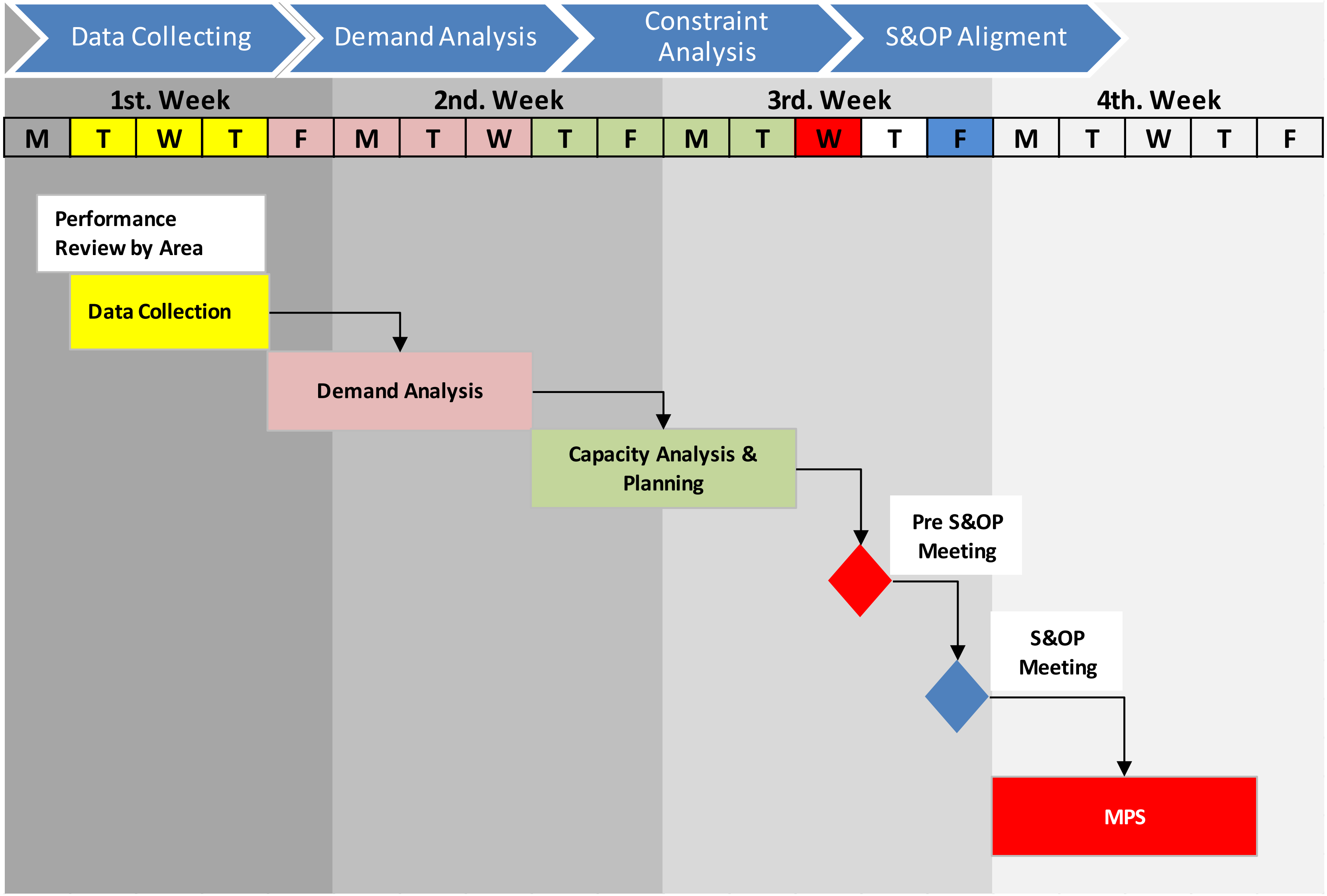


- ***Output***
  - Stock levels ➔ financial availabilities & cash flow
  - Action plan #1: increase plant capacity (near full capacity used)
  - Action plan #2: increase tier2 capacity


(Example)
Performance
CUSTOMER A
Planned x Done
CUSTOMER B
Planned x Done
CUSTOMER X
Planned x Done
Demand
CUSTOMER A
Master Schedule
CUSTOMER B
Master Schedule
CUSTOMER X
Master Schedule
Process
Performance
Inventory Level
1
1
Sales
Forecast
4
Reach Consensus
PPC
Production
Planning &
Control
Demand Analysis
2
Consult
Capacity Analysis
SUPPLY OPS
FINANCE
MANUFACTURING
HR
OTHER
S&OP
Consolidate
Production Proposal
3
Validation / New Proposal
Master Production
Schedule
5
Final Production Proposal

MANUFACTURING & MATERIAL FLOW MGMT

(Example)



Sales & Operating Plan (S&OP)

- **Frequency: Monthly (Fortnightly review when needed)**
- **Attendance: Sales, Manufacturing, Engineering, Finance, HR, Supply Operations, etc.**
- **Inputs: Annual Operation Plan, Customer Order (Fixed and Forecast Period), Manufacturing Capacity (Resources Available – machine, man, etc.), Material Available and Lead Time, Constraints, Stock Level, Finance Issues, Investment Plans status, etc.**
- **Process:**

  1. Past Performance Data Review
  2. Conduct the Demand Analysis
  3. Conduct the Production Capacity Analysis
  4. Reach Consensus and adjust proposal through S&OP meeting
  5. Conclude the Production Plan and release it to implementation

S&OP: Past Performance Data Review

- In this stage the team collect and evaluate data related to recent performance (planned versus done);
- Examples of data:
  - Sell: planned versus achieved
  - Production: planned versus done
  - Inventory Levels: planned versus effective
  - Finance impacts
- Based on this review some actions are taken:
  - Change the Sell plan
  - Change the Production Plan
  - Change the Inventory Levels
  - Keep the plan
- Sources of this info: Sales, Production, Supply Chain Operations, etc.

S&OP: Demand Analysis

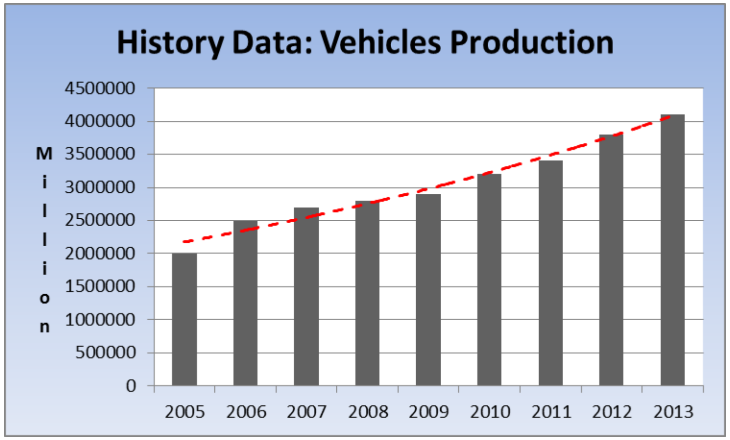
- The Demand team shall conduct a Demand Analysis using some information like:
  - Customer information,
  - History Market data,
  - and others sources.
- This Demand Analysis will support the Production Team in their analysis

Customer Forecast – 12 Months (Example)

20XX CALENDAR YEAR GM INITIAL M-SCHEDULE
(By Vehicle Assembly Location)
Published 1/17/20XX

		VEHICLE	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
GM															
GRAVATAI															
	CHEVROLET	A	12,341	11,753	11,753	12,929	12,929	11,753	12,929	12,929	11,753	13,516	10,578	9,403	144,566
	CHEVROLET	B	8,732	8,316	8,316	9,148	9,148	8,316	9,148	9,148	8,316	9,564	7,485	6,653	102,290
	CHEVROLET	C	1,264	1,204	1,204	1,324	1,324	1,204	1,324	1,324	1,204	1,384	1,083	963	14,806
	CHEVROLET	D	3,065	2,919	2,919	3,211	3,211	2,919	3,211	3,211	2,919	3,357	2,627	2,335	35,904
Total			25,402	24,192	24,192	26,612	26,612	24,192	26,612	26,612	24,192	27,821	21,773	19,354	297,566
ROSARIO															
	CHEVROLET	E	3,719	3,542	3,542	3,896	3,896	3,542	3,896	3,896	3,542	4,073	3,188	2,834	43,566
	CHEVROLET	F	6,939	6,609	6,609	7,270	7,270	6,609	7,270	7,270	6,609	7,600	5,948	5,287	81,290
Total			10,658	10,151	10,151	11,166	11,166	10,151	11,166	11,166	10,151	11,673	9,136	8,121	124,856
SAO CAETANO															
	CHEVROLET	G	1,537	1,463	1,463	1,610	1,610	1,463	1,610	1,610	1,463	1,683	1,317	1,171	18,000
	CHEVROLET	H	2,646	2,520	2,520	2,772	2,772	2,520	2,772	2,772	2,520	2,898	2,268	2,016	30,996
	CHEVROLET	I	6,349	6,047	6,047	6,652	6,652	6,047	6,652	6,652	6,047	6,954	5,442	4,838	74,379
	CHEVROLET	J	4,766	4,539	4,539	4,993	4,993	4,539	4,993	4,993	4,539	5,220	4,085	3,632	55,831
	CHEVROLET	L	4,582	4,364	4,364	4,800	4,800	4,364	4,800	4,800	4,364	5,019	3,928	3,491	53,676
	CHEVROLET	M	2,295	2,186	2,186	2,404	2,404	2,186	0	0	0	0	0	0	13,661
Total			22,175	21,119	21,119	23,231	23,231	21,119	20,827	20,827	18,933	21,774	17,040	15,148	246,543
TOTAL GMSA															

History Market Data (Example)



S&OP: Production Capacity Analysis

- The team (Manufacturing, Supply Operations, HR, Finance etc.) shall establish a preliminary production plan for each product which attend desired demand using data like:
  - Demand Analysis,
  - Past Performance Data Review,
  - Resources Constraint Analysis (man, material, machine)
  - Supplier Constraints
  - Investment Plan
  - Inventory Level

(Example)

Equipment Availability - Assessment

Area: Stamping	Equipment number	Quantity of Equipment Available	Equipment - Hours Available (per day)	Month/ Year: 04/ 2013				Notes
				Available Hours	Days	Hours needed to attend the Customer Demand	Ocupation	
Press 60/ 85 Ton	1/ 2	2	15	660.00	22	530.00	80%	
Press Type C 200/ 250 Ton	3/ 4/ 5/ 6/ 7/ 8/ 9/ 10	9	15	2,970.00	22	2,350.00	79%	
Press Type H 250/ 300 Ton	11/ 12	2	15	660.00	22	530.00	80%	
Press Type H 350 Ton	13	1	15	330.00	22	260.00	79%	
Press Type H 400/ 500 Ton	14/ 15/ 16	3	15	990.00	22	880.00	89%	
Press 100/ 160 Ton	17/ 18/ 19/ 20	4	15	1,320.00	22	1,060.00	80%	
Press 250 Ton	21	1	15	330.00	22	260.00	79%	
Press 400 Ton	22	1	15	330.00	22	260.00	79%	
TOTAL		**23**		**7,590.00**		**6,130.00**	**81%**	

Constraint: Above 90% must be established a countermeasure

- The leveling methodology should be used in this plan.

S&OP: Reach Consensus through S&OP Meeting

Pre S&OP Meeting

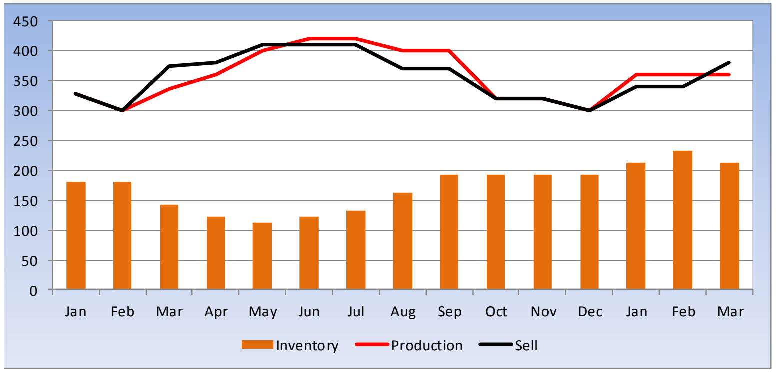
- The purpose of this meeting are:
  - Conclude the S&OP Plan and,
  - Get the consensus from the stakeholders before the S&OP meeting

S&OP Meeting

- In this meeting is shared with Leadership the S&OP plan
- The Leadership shall evaluate if the plan are aligned with Strategic Plan and it is feasible.

(Example)

	HISTORY			PLANNING											
MONTHS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Production Days	20	17	20	21	19	21	23	21	22	22	20	17	20	17	22
Sell Plan															
Actual	320	280	360	360	400	400	400	360	360	320	320	280	320	320	
Proposal	328	300	374	380	410	410	410	370	370	320	320	300	340	340	380
Diff	8	20	14	5%	2%	2%	2%	3%	3%	0%	0%	7%	6%	6%	
Cum Diff	8	28	42												
Production Plan															
Actual	340	310	340	360	400	400	400	400	320	320	320	300	340	340	
Proposal	328	300	336	360	400	420	420	400	400	320	320	300	360	360	360
Diff	-12	-10	-4												
Cum Diff	-12	-22	-26												
Inventory															
Plan	200	230	210	210	210	210	210	250	210	210	210	230	250	270	
Proposal	180	180	142	122	112	122	132	162	192	192	192	192	212	232	212
Diff	-20	-50	-68												



Master Production Schedule

The MPS is a list of all the products to be supplied within a specific period of time

This period of time must be sufficiently long to allow for the ordering and delivery of required sub-assemblies and parts, as well as allowing sufficient time for manufacturing the product in question

- Horizon: 2 Months
- Frequency: Weekly review
- Attendance: Logistic (PPC area), Manufacturing and Supply Operations

PPC: production planning & control

Inputs: S&OP Plan, Manufacturing Capacity (Resources Available – machine, man, etc.), Material Available, Preventive Maintenance Plan, Weekly Customer Order Review, Supplier Constraints, etc.

Process:

1. Deploy the Monthly Production Plan in Weekly/Daily Production Plan (part level)
2. In a weekly basis review the plan: based on inputs above
3. Establish countermeasures (when necessary): revised MPS, extra-hours, etc

Master Production Schedule: Daily Production Planning

By Month Production Plan

Model	Jan.	Feb.	Mar.
A	8,000	6,500	6,000
B	3,000	4,000	4,500
C	1,000	1,500	1,500
Total	12,000	12,000	12,000

Inputs Into Plant Production Plan

- **Plant Manufacturing Capacity** (example 600 units per day)
- **Production Restrictions**:
  - *Part Constraints (Model C: Tier II can only produce 100 parts per day)*

(Example)

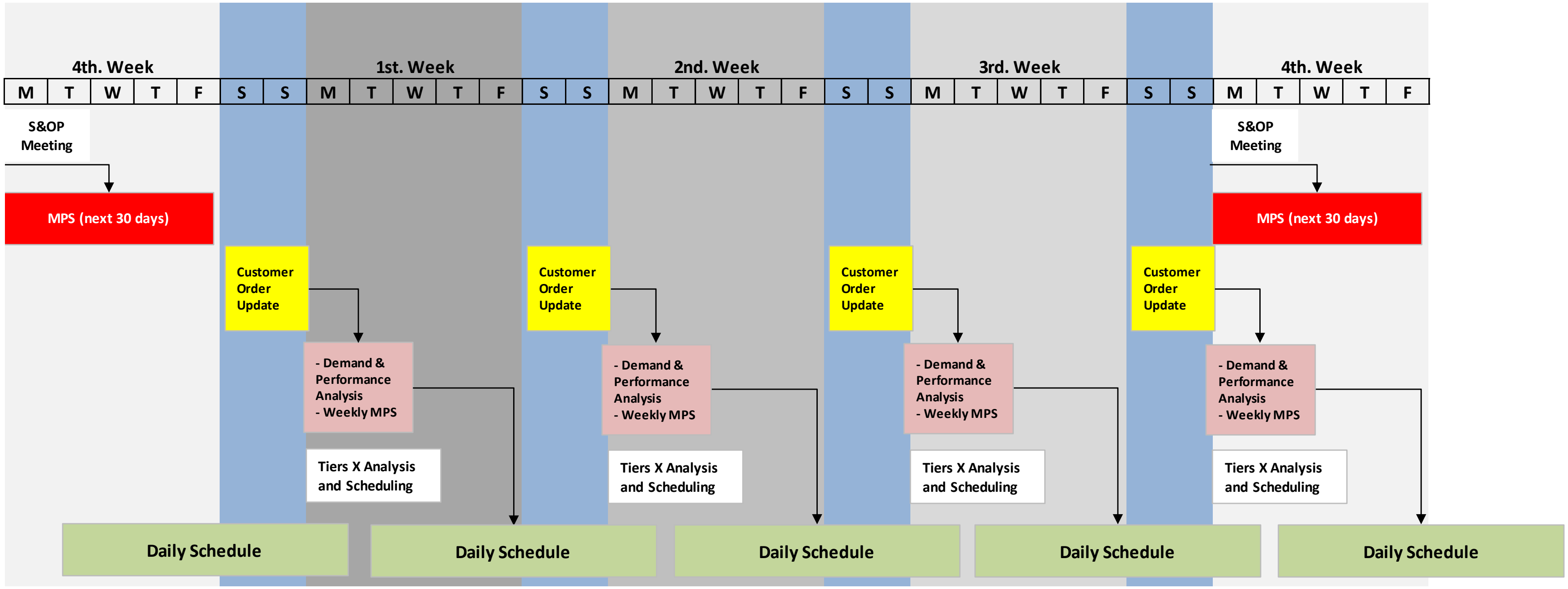
Current Month

Plant Production Plan (By Day)

Model	Day1	Day2	....	Day Nth
A	400	400	....	400
B	150	150	....	150
C	50	50	....	50
Total	600	600	....	600

Master Production Schedule: Typical Agenda

(Example)



- Weekly Master Production Schedule (MPS) Plan established and reviewed by Logistic (Production Planning & Control Area), Manufacturing and Supply Operations Team.

S&OP & MPS Process

S&OP Process

INPUT

- Product Family
- All customer demands (sales / new product)
- Ressources availabilities (workforce / ind. Capacities / Material & Components / Tier X)
- Site strategic Plan
- Process improvement projects
- Financial availabilities

OUTPUT

- Production Level
- Stock Level and target
- Human Ressources needs (training)
- Material & Components needs
- Scenario to adapt full capacity of the plant
- Master investment plan
- Margin/financial result forecast
- Cash flow

Fix plant capacity

MPS Process

INPUT

- S&OP Data
- Confirmed customer demands (sales)
- Service rate & stock level target
- Confirmed Ressources availabilities (Workforce / Real Industrial capacity / Material & Components)
- Project & works to be done
- Preventive maintenance plan

OUTPUT

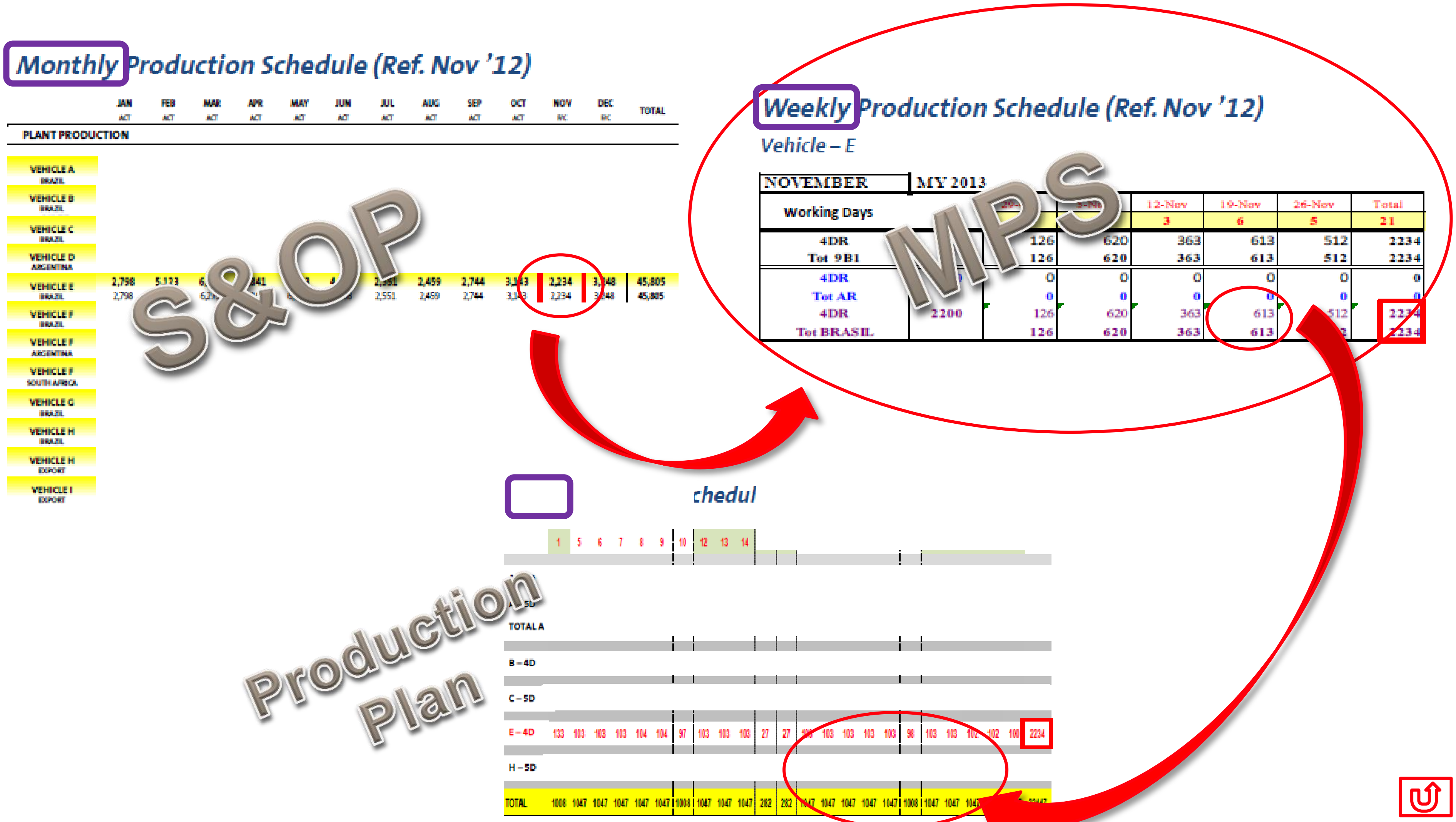
- Production volume by product (inc batch size)
- ressources needs not covered
- material & components needs by product
- level of compliance to customer demand
- action plans to treat the deviations
- Consolidated margin forecast & turnover

Contracts between manufact. & logistics
manufact. & maintenance

Daily Production Plan

- **The Manufacturing and Production Planning & Control team shall deploy the MPS in a daily production plan**
- **The team shall take into consideration at least the following elements in order to establish the daily production plan:**
  - Equipment and Resources Availability
    - Current % of utilization
    - Planned Maintenance
    - Hours available
    - Planned Changeover/Tool Changes
    - Net minutes/hours available
  - Up to date OEE
  - Constraints

S&OP and MPS deployed in Production Plan



Forecast versus Real Production Control

(Example)

TIP Hourly Performance Sheet

Date: 1/8/2008
Shift: (1) 2 3

Area: Underbody
Group Leader: D. Spooner
Target: 500 Jobs/Shift

Note: Record Loss in Red

	Hour	Target Hourly / Cum.	Actual Hourly / Cum.	Difference Hourly / Cum.	Problem	Counter Measure	Owner
1	6:00-7:00 A	66 / 66	60 / 60	6 / 6	Sta.10 Good parts mixed with bad parts	Material sort parts and investigate the mix up of parts and contact the part supplier	T. Jones
2	7:00-8:00 A	66 / 132	65 / 125	1 / 7	Sta. 50 part present switch faulted and caused 2 minutes of downtime	Clean the switch or install a new switch	M. Spark
3	8:00-9:00 A						
4	9:00-10:00 A						
5	10:00-11:30 A						
6	11:30-12:30						
7	12:30-1:30P						
8	1:30 - 2:30 P						
9	2:30 - 3:30P						
10	3:30 - 4:00P						

- An ongoing control related to planning versus current production shall be established and monitored.
- Reasons for deviations shall be recorded
- Escalation Process shall be defined

MMFM 15 : TO BE PROVIDED

Equipment Availability Improvement

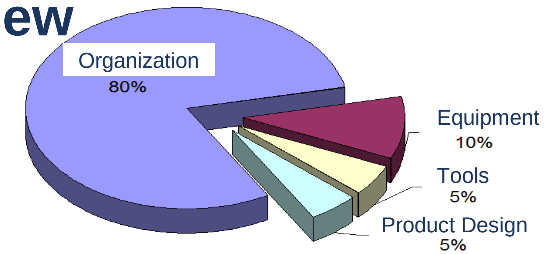
- The Organization shall establish a process to improve the equipment availability through:
- Minimize Set-Up Time:
  - Create Tool Change Team
  - Analyze Model Changeover
  - Analyze Current Tool Changes
  - Apply Single Minute Exchange of Die (SMED).
- Minimize Breakdowns *(refer to Maintenance)*:
  - Create Equipment Improvement Team
  - Analyze and Improve Machine Reliability
  - Implement / Improve TPM
  - Analyze / Improve Existing PM System
  - Expand Predictive Maintenance.

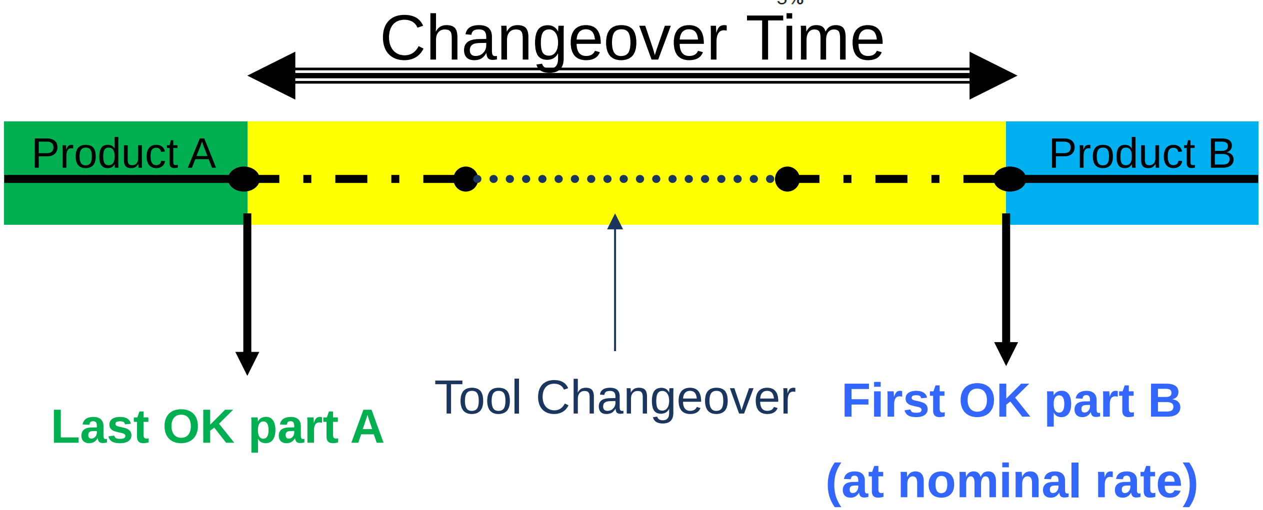
SMED – Quick Overview

***S**ingle*
***M**inute*
***E**xchange of*
***D**ie*

- SMED is a methodology used to reduce changeover time
- It increases the **flexibility** of the organization and allows to reduce the stocks and batch size

SMED – Quick Overview





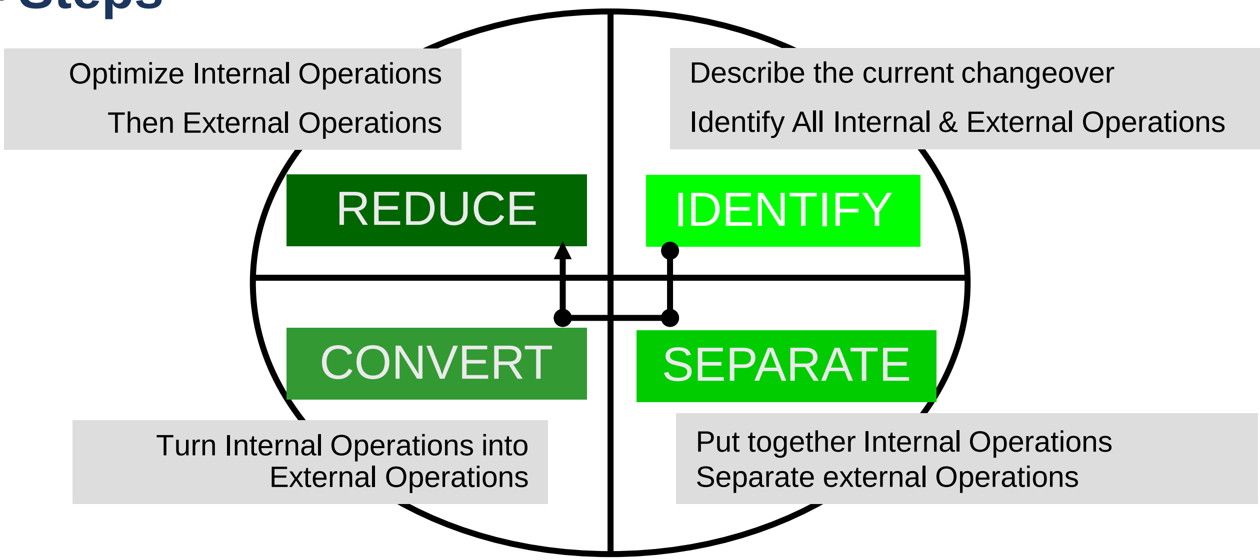
Changeover ➔

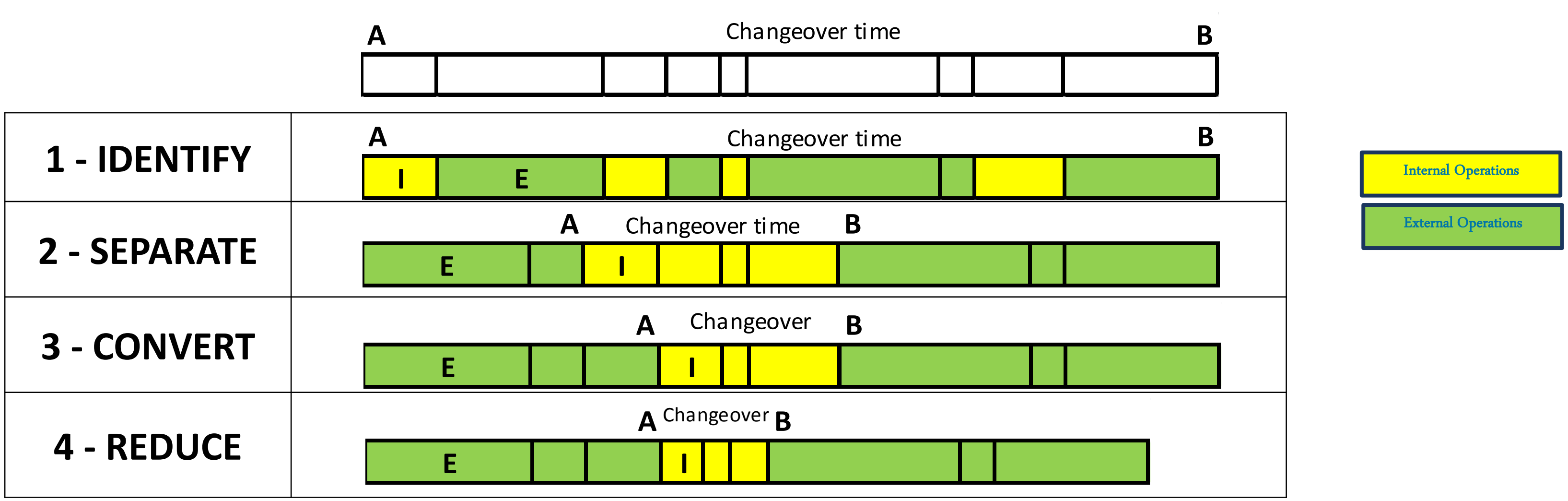
Internal operations (Machine stop needed)

+

External operations (Machine still running)

SMED – 4 Steps


Optimize Internal Operations
Then External Operations
Describe the current changeover
Identify All Internal & External Operations
REDUCE
IDENTIFY
CONVERT
SEPARATE
Turn Internal Operations into External Operations
Put together Internal Operations
Separate external Operations


A
Changeover time
B
1 - IDENTIFY
A
Changeover time
B
I
E
2 - SEPARATE
A
Changeover time
B
E
I
3 - CONVERT
A
Changeover
B
E
I
4 - REDUCE
A
Changeover
B
E
I
Internal Operations
External Operations

Step #1 - Identify

- **Tool 1: Set up documentation in a worksheet**
  - Document all the setups activities

SET UP IMPROVEMENT PROCESS

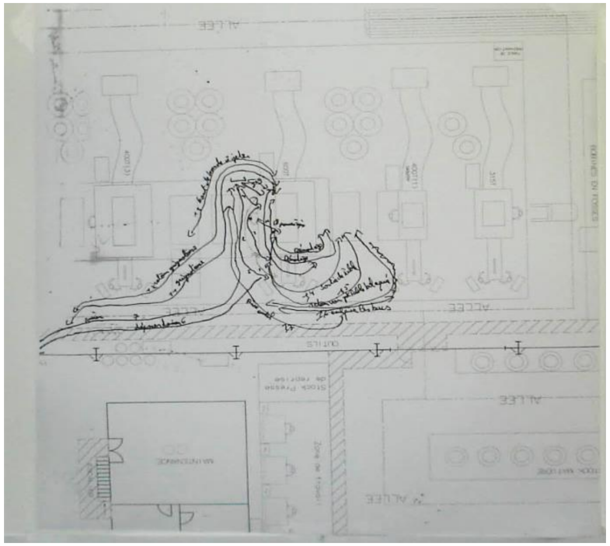
MACHINE: ____________ OWNER: ______________

DATE: ____________ Page 1 of ___

SEQ#	START TIME	ELEMENT	TIME	INTERNAL	EXTERNAL
1	0	Shut down machine	0:30		
2	0:30	Get change parts	3:00		
3	3:30	Remove change parts from machin	3:30		
4	7:00	Place new change parts on machin	3:30		
5	10:30	Return change parts to storage	3:00		
6	13:30	Load material onto machine	1:00		
7	14:30	Generate test piece	0:30		
8	15:00	Measure and inspect	2:00		
9	17:00	Adjust dies	1:00		
10	18:00	Generate test piece	0:30		
11	18:30	Measure and inspect	1:30		
12	20:00	Generate first good piece	1:00		
		Total Set up Time	21:00		

(Example)

- **Tool 2: Identify on the shop floor (Movement analysis during changeover)**
  - Helps to understand what movement and motions are required by setup personnel



Step #2 – Separate

(Example)

- **All setup activities are identified as either:**
  - Internal Setup: an activity that must be performed by process operator even if it interrupts value add work
  - External Setup: an activity that could be performed while equipment is producing parts or the process operator is conducting other value add work

SET UP IMPROVEMENT PROCESS

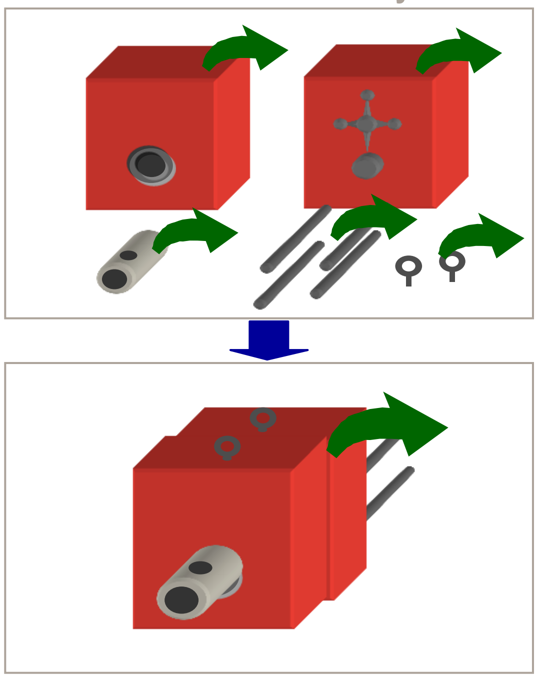
MACHINE: ______________ OWNER: ________________

DATE: ______________ Page 1 of ___

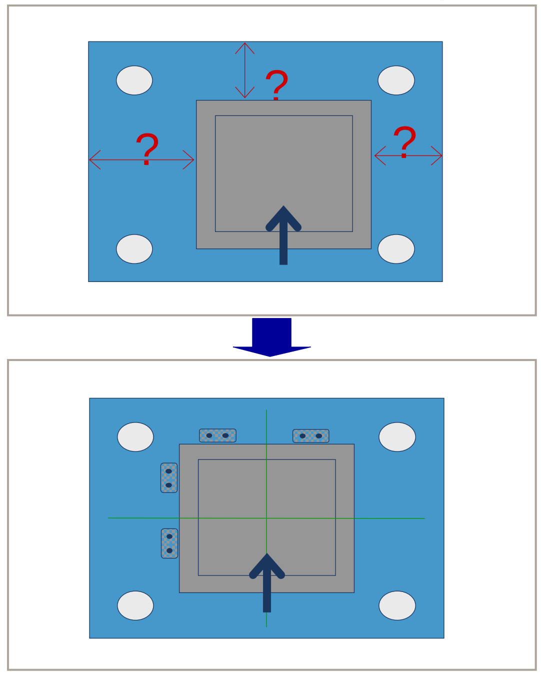
SEQ#	START TIME	ELEMENT	TIME	INTERNAL	EXTERNAL
1	0	Shut down machine	0:30	0:30	
2	0:30	Get change parts	3:00		3:00
3	3:30	Remove change parts from machine	3:30	3:30	
4	7:00	Place new change parts on machine	3:30	3:30	
5	10:30	Return change parts to storage	3:00		3:00
6	13:30	Load material onto machine	1:00	1:00	
7	14:30	Generate test piece	0:30	0:30	
8	15:00	Measure and inspect	2:00	2:00	
9	17:00	Adjust dies	1:00	1:00	
10	18:00	Generate test piece	0:30	0:30	
11	18:30	Measure and inspect	1:30	1:30	
12	20:00	Generate first good piece	1:00	1:00	
		Total Set up Time	21:00		

Step #3 – Convert (Internal Operations in External Operations)

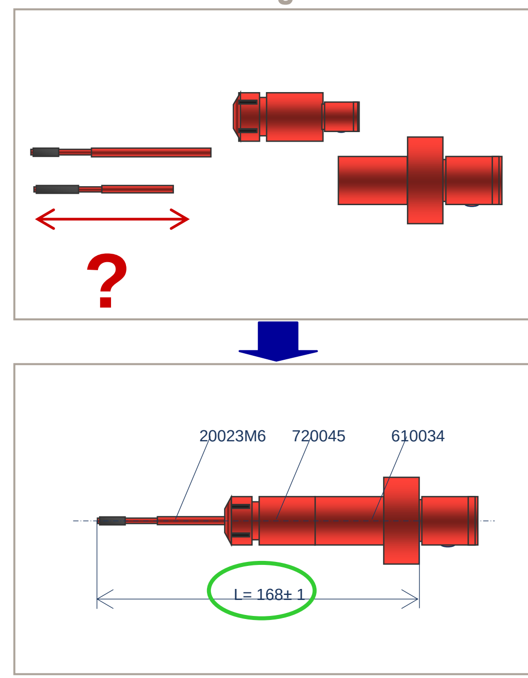
Tools Pre-assembly



Guides et mechanical stops

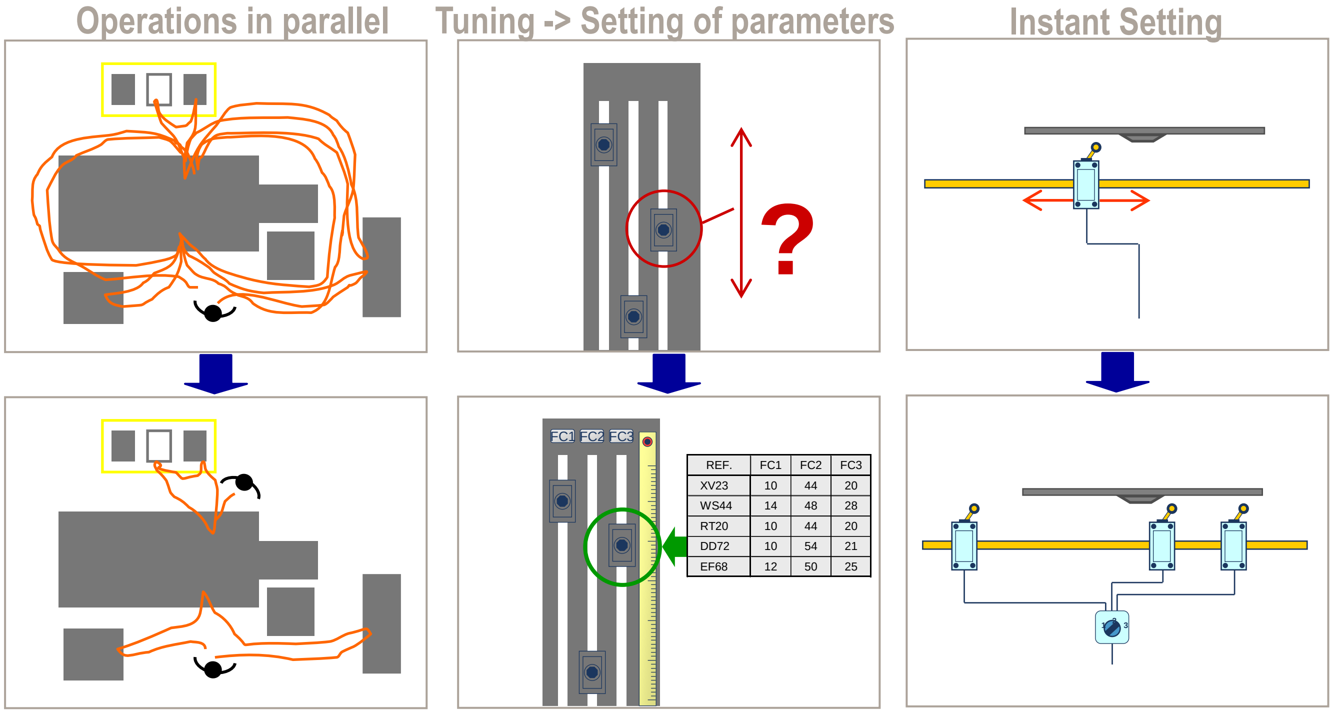


Pre-setting external

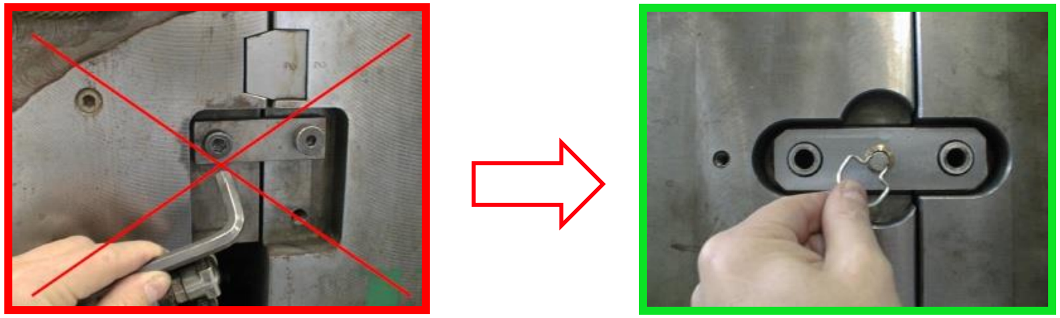


Step #4 – Reduce Time

- Look for ways to make any setup that must be done by the process operator (internal) more efficient.



REF.	FC1	FC2	FC3
XV23	10	44	20
WS44	14	48	28
RT20	10	44	20
DD72	10	54	21
EF68	12	50	25



Auditor hints – a reprendre

- Check long (S&OP) and short (MPS) term scheduling for a product. Verify that:
  - capacity meets long term customer demand,
  - time allocated to other product is part of review,
  - S&OP regularly reviewed based on EDI data,
  - long term demand deployed into short term scheduling,
  - check a tier X demand whether it is in line with tier1 manufacturing schedule.
  - Planned Maintenance time is considered in the equipment availability analysis
- Check product chosen in MMFM1 section and check daily deployment:
  - Manufacturing detailed program,
  - Complete preparation time for a batch,
  - Different programs from a week to another (is it stable or not, level of flexibility).
- The real production level vs. scheduling
- Planning & Minutes of optimization workshops.
- Hourly Board Control for continuous monitoring of production
- A strategy is in place to improve the setup time (e.g.: SMED strategy).

Daily production activity, what are we searching for?

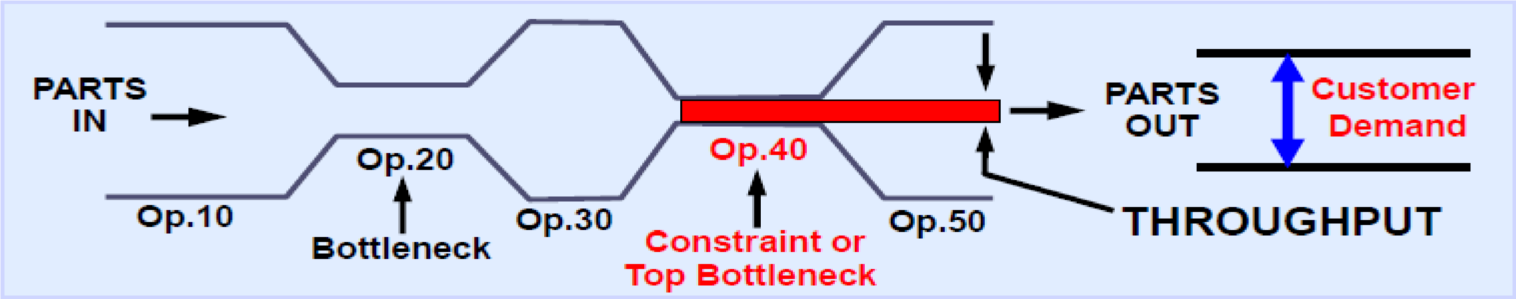
Item	Requirement	#Criteria	Criteria requirement
MMFM2	Constraint operation is identified and specifically managed.	**MMFM21**	**Based on customer demand all the bottleneck operations are identified.**
		MMFM22	**The constraint operation is identified among bottlenecks and prioritized in regard to qualified operators, training, maintenance, scrap, setup and fast reaction in case of any deviation.**
		MMFM23	**The constraint shall be managed identifying problems, establishing action plans and verifying effectiveness of action plans in a regular basis.**
		MMFM24	back-up plans for each bottleneck operations are defined.

Criteria of Requirement
21 – page 36-42
22 – page 43-53
23 – page 50
24 – page 52
Auditor Hints – page 54

Prev. Requirement
Next Requirement

Constraint Management

- The Organization shall establish a constraint management activity in order to eliminate or manage constraints to simultaneously increase throughput and reduce inventory and operations expenses.



Definitions

- **Constraint:** The greatest limitation to the organization. The constraint is the worst bottleneck
- **Bottleneck:** it is any resource whose capacity is less than demand
- **Throughput:** it is the rate at which the system produces product (parts per unit of time)
- **Inventory:** it represents product for which raw material has been purchased, but has not been sold

Constraint Management: Types of constraint

Capacity Output < Demand

Constraint?

Bottleneck?

Market Output > Demand

Policy Hiring, overtime, capital spending, etc...

Constraint Management: Types of constraint

Capacity – Internal Constraint Output < Demand

- Customers want more product than can be supplied
- Symptoms: equipment overworked, no Preventative Maintenance, high premium costs, overtime, high rejection rate, low performance (cycle time > takt time)
- Example: Stamping Press can only make 5,000 parts per day, but the customer requires 6,100

Market – External Constraint Output > Demand

- Customers do not want as much product as can be produced
- Symptoms: wasted equipment, higher costs incurred, low efficiency
- Example: Casting for six hours with the machine idle for the remainder of the day

Policy – Typically the core cause of the capacity constraint Hiring, overtime, etc…

- Management decisions dictate how the business shall operate
- Symptoms: unable to change, high cost solutions instead of low cost
- Example: tag relief not used during a constraint, maximum overtime allowed per week, results in more machinery being used

Constraint Management: How to Improve it – 5 Steps

THE 5 STEPS OF CONSTRAINT IMPROVEMENT

What are the Five Steps to improve the Constraint

- Step 0 – Define the System (& scope)
- Step 1 – Identify the system's constraint.
- Step 2 – Decide how to exploit the system's constraint
- Step 3 – Subordinate everything else to the decisions made in step 2
- Step 4 – Elevate the system's constraint
- Step 5 – If a constraint is broken in step 4, go back to step 1

Constraint Management: 5 Steps

Step 0 – Define the System & scope(Focus - Bottleneck Operations):

- Goal of this step is to determine: “Where are we today?”
- Define the system and scope (Bottleneck Operations)
  - Collect data to define where to apply the 5 Steps
  - Sources to identify the Bottleneck Operations:
    - Customer Demand Attendance Index: fail to attend the customer order
    - Extra Hours Rate: high level due to lack of capacity
    - OEE rate: low OEE
    - Daily Production Plan or MPS: not followed
- Complete the Capacity Analysis Worksheet(s) – System Capacity and/or Shared Capacity Worksheets
  - Logical Process to Identify any Constraint
  - Estimates the Capacity at Each Operation
  - Note Additional Bottlenecks / Constraints
  - Capacity; Market; Policy

Constraint Management: 5 Steps

Capacity Analysis Tool

- Requires a few simple inputs
  - Capacity Requirements
  - Scrap and Rework
  - Downtime – Scheduled and Unscheduled
  - Operation Cycle Times

- Output includes:
  - Estimation of Total Capacity Operation
  - Overall Equipment Effectiveness Measurement
  - Flag for Bottlenecks and Constraint Operations

Constraint Management: Capacity Analysis

Inputs

(Example)

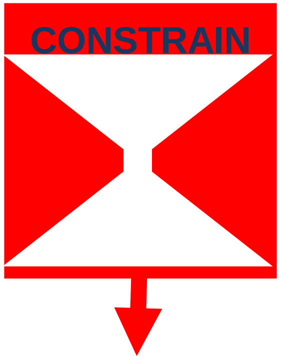
Capability																Requirement		Constraint	
Operation List each separate / discrete operation	**Operators** Number of operators	**Shifts** Total Shifts per Day (3 max)	**Hours** Hours per Shift (hours)	**Duplicate** Number of duplicate machines or operations (1 minimum)	**Gross Minutes** Total Minutes Available per day (minutes / day)	**Lunch** Scheduled Breaks, Lunch, Mtgs etc. (minutes / day)	**Changeovers** Changeovers or Tool Changes (minutes / day)	**Maintenance** Planned Maintenance (minutes / day)	**Other** Time allocated for other components - GM & Non GM (minutes / day)	**Unplanned Downtime** Estimated Unscheduled Downtime (minutes / day)	**Net Minutes** Net Minutes Available per day for Run at Rate Parts (minutes / day)	**Cycle Time** Cycle Time Estimate (seconds)	**Parts Per Cycle** Parts Per Cycle (ie # Cavities) (1 minimum)	**Scrap Rate** Scrap Rate Percentage (%)	**Capability** # of good parts capable of being produce on the operation in one day	**Downstream Scrap** Sum all down stream operations scrap rate %s	**Requirement** # of good parts required to be produced at this operation to allow the final operation to produce the contracted capacity	**Utilization** Requirement / Capability	**Constraint Operation** Select Constraint & Final operation

Outputs

Constraint Management: 5 Steps

Step 1 - Identify the system's constraint:

- Determine which element or resource has the least capacity and most severely restricts the throughput of the system
- If Line and/or operation utilization is > 90%, then a possible constraint exists
- If Line and/or operation utilization is < 90% then:
  - Examine the line and/or operations with the highest utilization or the lowest net capability per
  - Note that constraints may not be immediately visible on the capacity spreadsheet due to interactions between operations (buffers)



Requirement:
450 parts/day

Net Capability per day	Utilization %	X
414	108.7%	X
467	96.4%	X

Constraint Management: 5 Steps

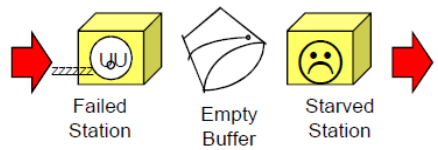
Step 2 – Exploit constraint:

- Run constraint at its basic capacity in isolation
- Run every available minute
- Don't Block / Starve – Parts and Space Buffers
- Schedule Operation Effectively
- Don't Waste Output
  - Eliminate defective parts before they arrive
  - Make sure parts are not scrapped later in the process
  - Eliminate rework that must go back through constraint
  - Improve the tools or gauges used
  - Improve yield by assuring the quality of the process
  - "Rush to" before... / "Handle with care" after

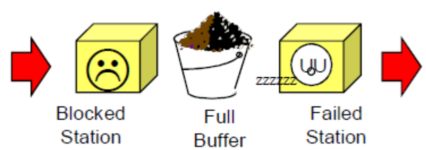
Constraint Management: 5 Steps

Step 2 – Exploit constraint (cont.):

- Operator Rules of Engagement
  - Run machines when you have material
  - Do something productive when you don't have material (setup, PM)
  - Cross-train workers to prevent idle time due to absenteeism
- **Never Starve a Constraint**



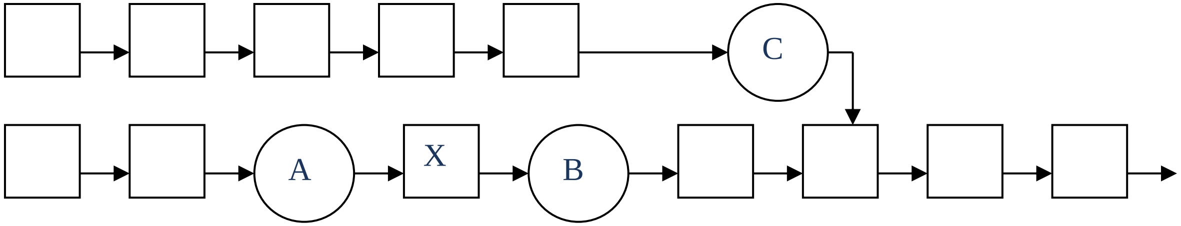
  - Utilize Buffer Management
  - Place buffer inventory ahead to assure it always has parts to run
  - Load parts ahead to ensure constraint runs
- **Never Block the Constraint**



  - De-couple the Operations
  - Assure parts are pulled away so operation doesn't stop (enough racks, containers, space)
  - Unload after the constraint if the system downstream is down

Constraint Management: Step 2
Types of Buffers

- Part Buffers (A)
  - Part placed before constraint to prevent starvation
- Space Buffers (B)
  - Space available after constraint to prevent blocking
- De-coupling Buffers (disconnecting) (C)
  - placed between sub-systems to isolate them from each other's variation.
  - Disconnect long series of dependent operations.

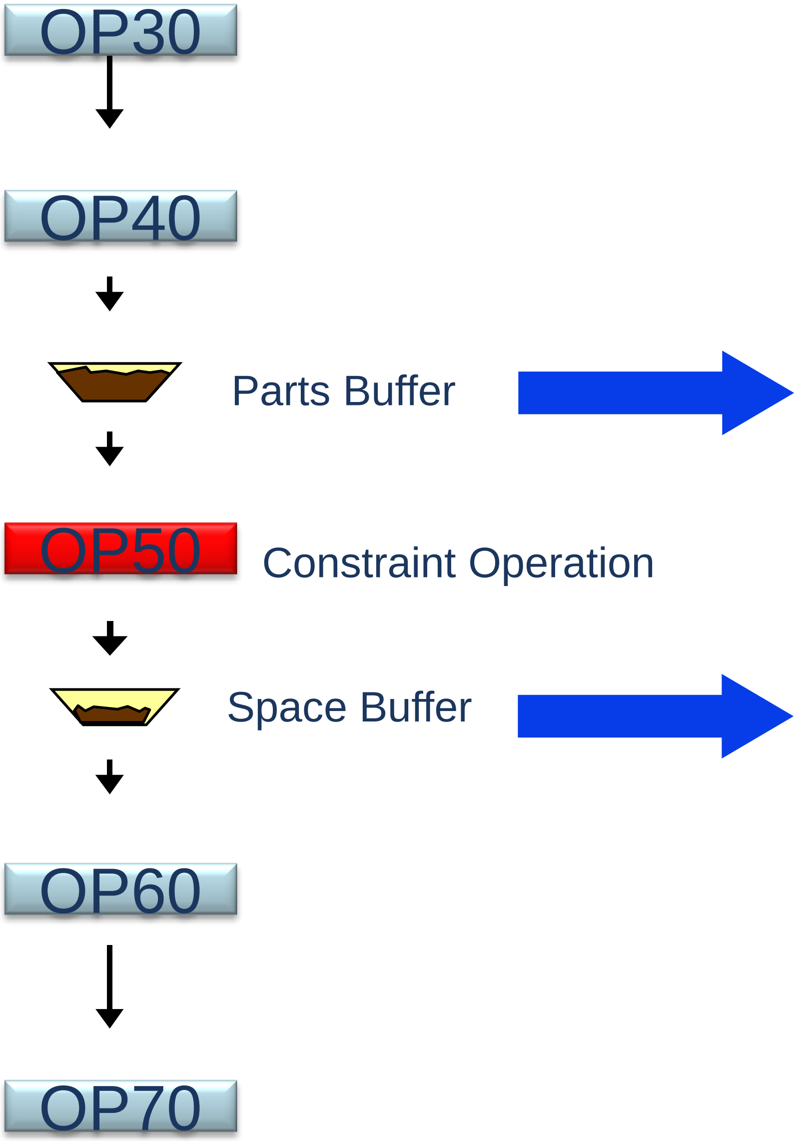


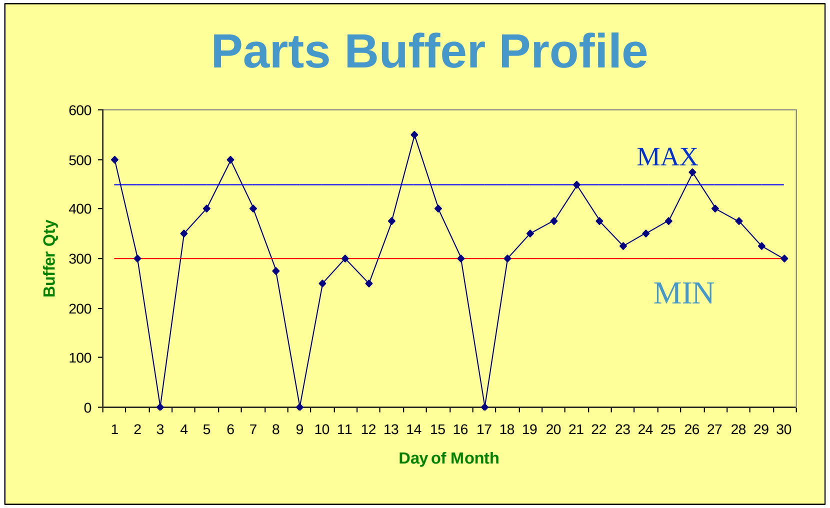
Constraint Management: Step 2
Buffer Management

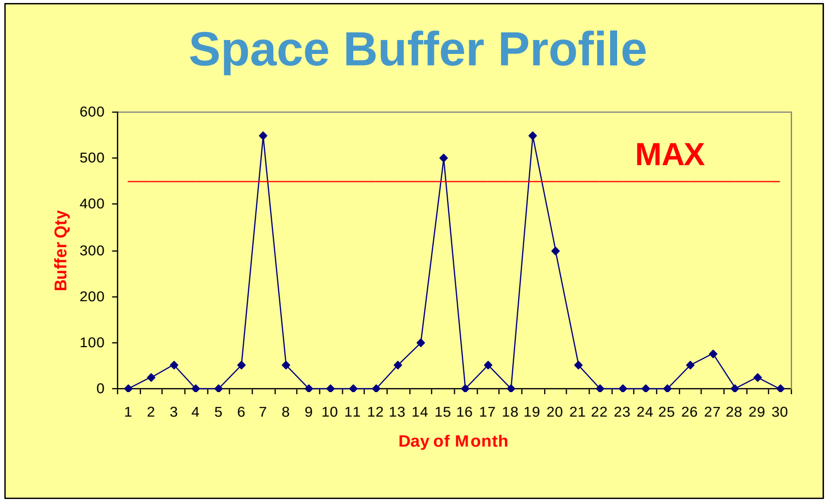
- Buffer management is used to:
  - determine *strategic* buffer(s) *location*
  - determine *buffer size*, min and max based on the *longest interruption* observed (non-catastrophic) in a normal operating period
  - monitor *buffer profile* (EKG of System Variation) - typically a graph of the number of parts in the buffer v/s time
  - *assign* loading and unloading *responsibilities* to and from the buffer

- Good buffer management $\Rightarrow$ *less variation in daily throughput*.
  - On good days buffers would accumulate
  - On bad days buffers would deplete but would protect system throughput

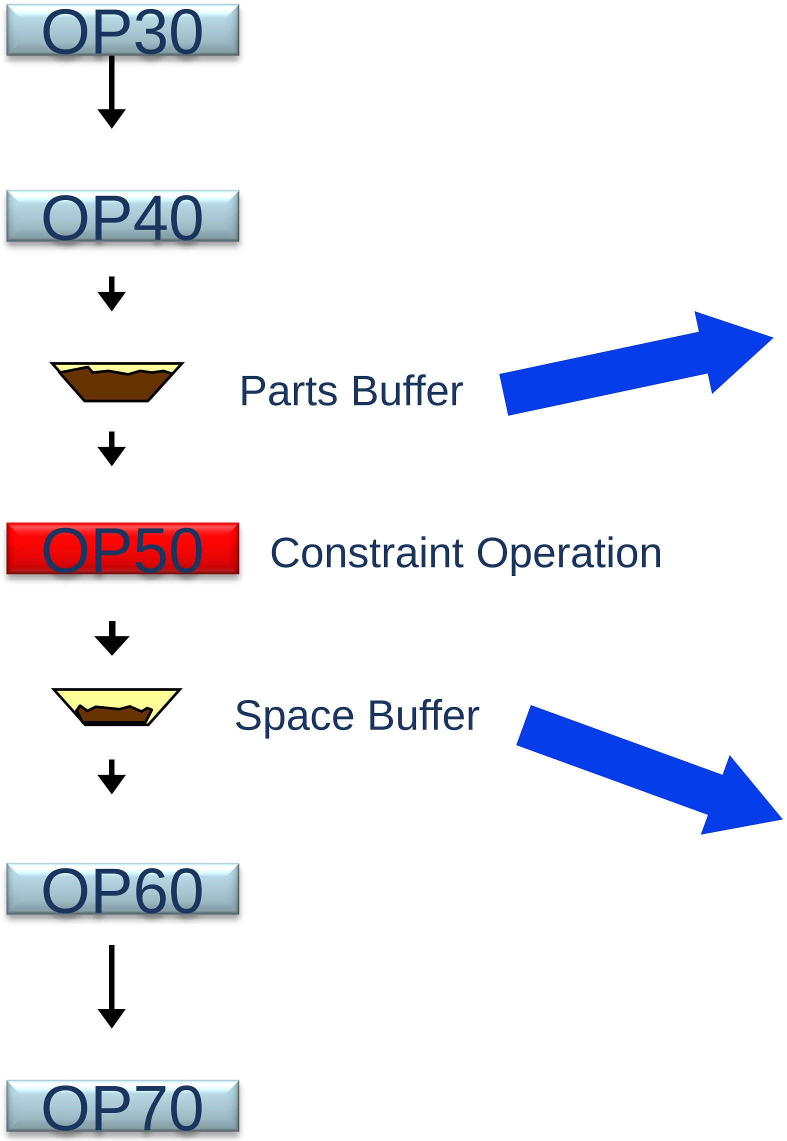
Buffer Management







Buffer Management



Parts Buffer Profile

- A parts buffer before the constraint should never be empty
- an empty part buffer => constraint starved
- Design the max and min such that there is at least one part (or batch) at all times

Space Buffer Profile

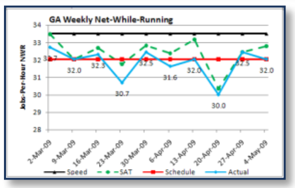
- A space buffer after the constraint should never be full
- a full space buffer => constraint blocked
- Design the max such that there is at least one space (or space for one batch) at all times

Constraint Management: Step 2
Visual Management

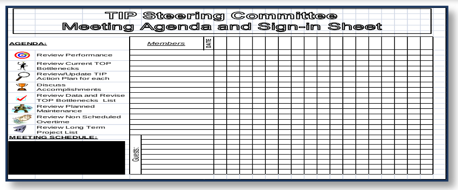
(Example)

Constraint Management Wall (by area)

Throughput

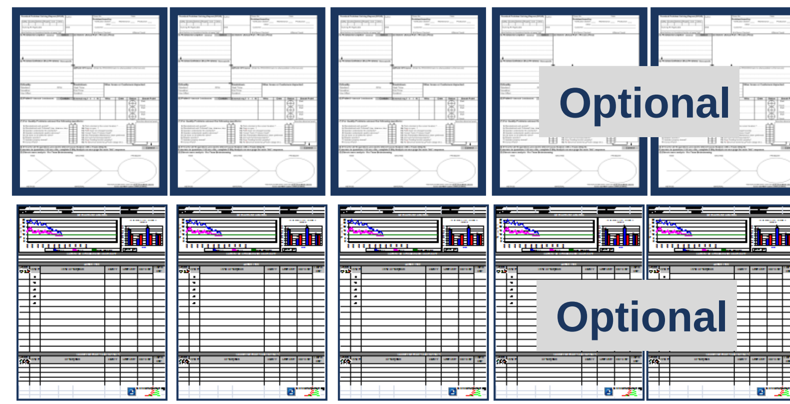


Agenda & Sign-in Sheet

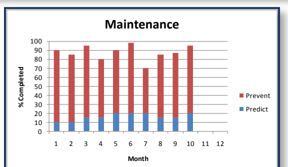


Problem Analysis & Action Plans

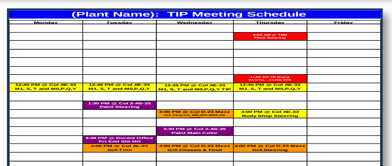
(1) (2) (3) (4) (5)



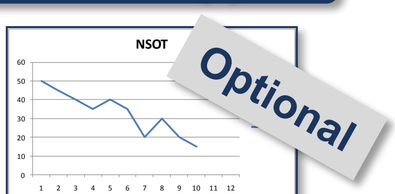
PM



Meeting Schedule

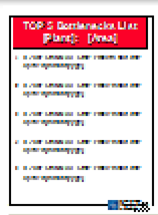


NSOT (*)

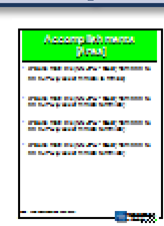


(*)Non-Scheduled Overtime

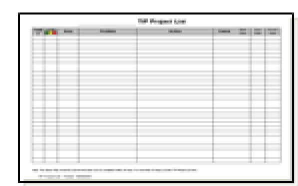
Constraint & Top 3-5 Bottlenecks



Accomplishments



Area Project List



Constraint Management: 5 Steps

Step 3 – Subordinate other operations to run the constraint:

- Subordinate (Optimize) Resources in favor of running the constraining operation
- Move people from non-constraints to constraining operation even if they aren't finished at the non-constraint
- Reduce Workload at Bottleneck
  - Move work to alternate work centers or manufacturing methods
  - Redesign some products to reduce workload of the bottleneck
  - Subcontract bottleneck work
- Prioritize response and perform maintenance on the constraint operation before others
- Optimize Tool Change practices – C/O's per day or sequences
- Identify alternative sources capable of temporarily supplementing capacity
- Run all other machines to eliminate starve/block

Constraint Management: 5 Steps

Step 4 – Elevate the system's constraint:

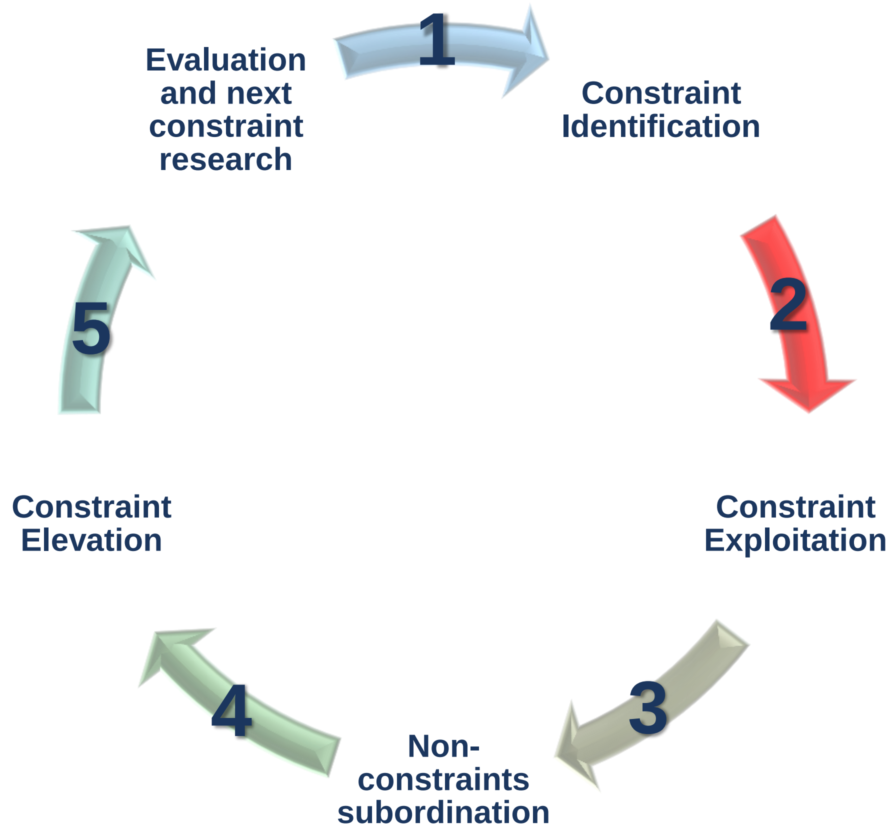
- Exploit all available capacity at zero to minimum cost
- Analyze every element which unnecessarily adds to overall cycle
- Improve tool change methods and changeover times:
  - After changeover, run production simultaneously with first piece approval
  - Reduce number of setups by processing families of jobs that require similar setups
  - Reduce setup time
- Improve preventative maintenance to reduce bottleneck downtime

- Add Capacity to the constraint operation
  - Improve Cycle Time (can it go faster?)
  - Add a Machine/Person
  - Produce More Parts per Cycle

Constraint Management: 5 Steps

Step 5 – If a constraint is broken in step 4, go back to step 1:

- Once data shows that the constraint has been eliminated, apply the same process again .



Auditor hints

- List of bottleneck equipment.
- Check via record that:
    - constraint running continuously,
    - number of qualified people via Flexibility Chart
    - breakdowns and actions against them.
- Check buffers size, ask operators how often they run out.
- Constraint output is considered in production schedule (MPS).

Constraint operation management, what are we searching for?

Item	Requirement	#Criteria	Criteria requirement
MMFM3	Handling and storage Conditions of product (final, intermediate and supplies) are respected in order to protect parts from damage and environmental effects.	**MMFM31**	**Structured approach for organization of storage is defined and applied. Storage Operations are considered as Standardized Work and LPA is implemented.**
		MMFM32	**System in place allows to visualize easily storage operations and level of stock for each reference. Stock levels are periodically verified**
		MMFM33	**The stock management system take into account: product expiring dates, the respect of FIFO and product reference change**
		MMFM34	Where necessary, the conditions of storage are controlled by devices in real time (ex: temperature, moisture, etc). The conditions of storage are recorded. the alert procedures and countermeasures are defined.
		MMFM35	Storage areas are verified via regular quality audits and inventory (E.g.: LPA).

Criteria of Requirement

31 – page 56-60
32 – page 61
33 – page 62-69
34 – page 69
35 – page 70
Auditor Hints – page 71

Prev. Requirement

Next Requirement

Storage Area: Identification and Organization

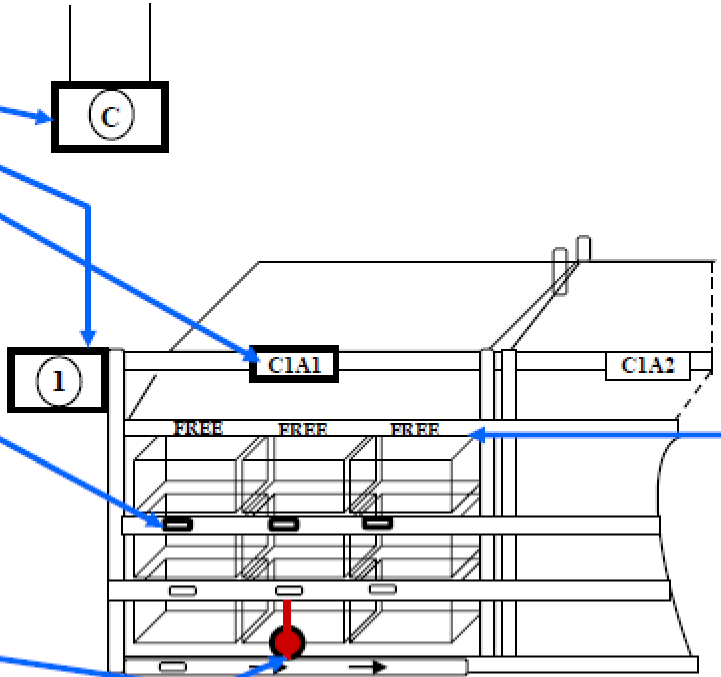
- Incoming components
- Intermediate products
- Finished products
- Specific storage areas (ex: paint, glues,…)

On floor storage with easy access without handling equipment

Storage Area: Identification and Organization

VISUAL AIDS

- Area label (C)*
- Row label (1)*
- Rack label (A1)*
- Part specific label *
- FIFO Control



- Free Area Label
- Additional Material Rows *

Additional Visuals as Required

- Min / Max Status
- Overflow Status
- Engineering Change Status
- Standardized Work Relative to Pull Process
- Rack Contents Info
- Stack Restrictions
- Rack Location Floor Markings

* Indicates label must be posted on both sides of flow rack.

Example of bad WIP handling practices

Not OK

WIP not controlled. No Min/Max control. Material stacked in numerous unmarked locations. Lack of FIFO control.

Example of good WIP handling practices

In Process Buffer
Part
Panel RH
Rack Qty 6 Pc
MFG Date ______

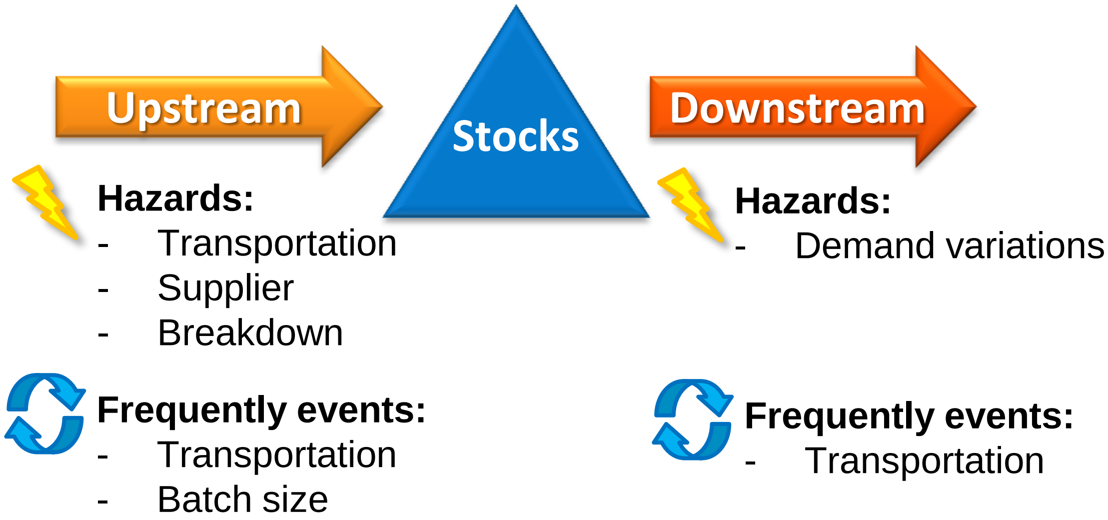
Example – Opel Polska

WIP material racks are labeled with part name, standard pack and the date of manufacture is written to ensure FIFO. Designated storage area for WIP is labeled, marked with tape and Min/Max is controlled using the available rack foot prints.

Note: WIP: Work In Progress

Typology of stocks

- Buffer/safety stock
- Cycle stock (Used in batch processes)
- De-coupling (Buffer stock held between the machines in a single process which serves as a buffer for the next one allowing smooth flow of work instead of waiting the previous or next machine in the same process)
- Anticipation stock / Banking stock (Building up extra stock for periods of increased demand or decreased capacity of production - e.g. ice cream for summer)
- Pipeline stock (Goods still in transit or in the process)



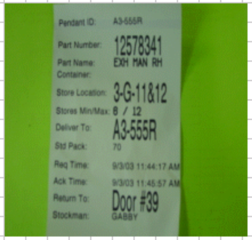
Standardized Work for storage and handling

(Example)

- Job Element Sheets (JES) and Standard Operating Sheets (SOS) are developed & utilized for the storage / delivery process.
- JES is posted in the designated area.

Rev. Date:	JOB ELEMENT SHEET		Page: 1 of 1	
Control Block	Approver/Date	Approver/Date	Area/Cell/Department:	PC&L - CMA
			Operation Number:	Bulk Delivery - EPS
			Process Name:	
			Element Number(s):	

Step 1 & 2



Step 3

Step 5

Step 7

SEQ	- STEP (What) -	SYM	- KEY POINT (How) -	REF	- REASON (Why) -
1	Line up at assigned electronic pull station (EPS) to receive next assignment	Safety	Finishes previous bulk delivery and return to EPS call station		Receive next assignment
2	Scan or enter personal ID Number to receive ticket	Quality	Wave badge in front of bar code reader or enter personal ID manually		Eliminate duplicate parts delivery to POU
3	Wait for printed ticket and remove from EPS printer	Safety	Remove ticket from printer		Guarantees FIFO in delivery process
4	Drive to Bulk Storage area identified on ticket		Leave EPS call station and proceed to bulk storage area - CMA		Material is located in CMA
5	Match ticket storage location with retrieve side of storage address system	Quality	Match ticket to signage & ticket to shipping label		Ensure correct material is delivered to correct POU while maintaining FIFO
6	Pick up parts from CMA and deliver to POU on ticket while keeping ticket until delivery is complete	Safety	Drive fork truck under load and ensure load safety		Provide for pedestrian safety & load integrity
7	Remove lids & stretch wrap if required	Quality	Get off truck, cut stretch wrap, and move lid to empty dunnage area		Present parts to operator in ready to use method
8	Pick up and return empty dunnage to dock	Safety	Secure forks to load & drive to dock (ref: ticket)		Dunnage returned to supplier for next load
9	Return to EPS Ack station for next load	Safety	Ensure forks are cleared of dunnage		Must begin next delivery of bulk parts

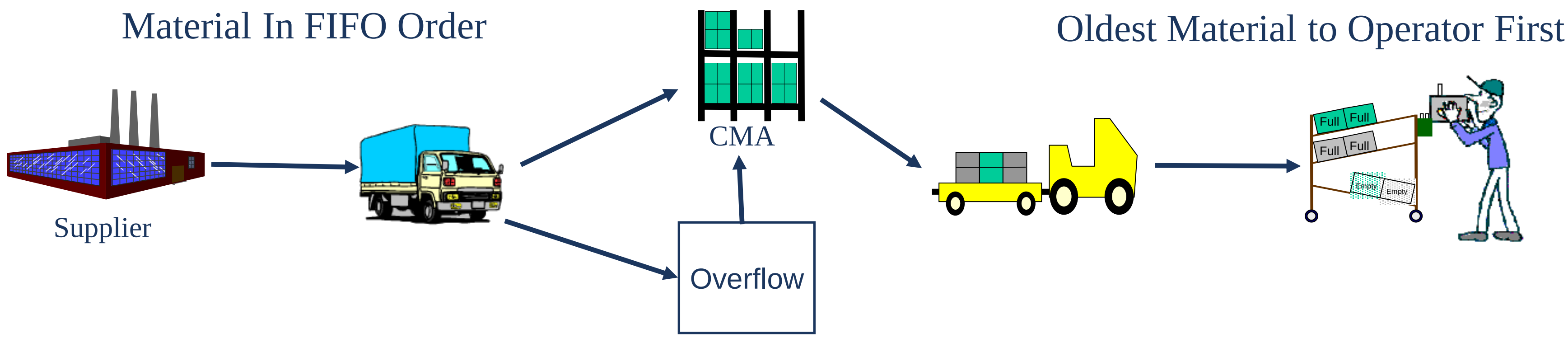
Symbol Legend (SYM): Safety | Ergonomics | Quality | K Knack | File: XXXXXXXX.xls

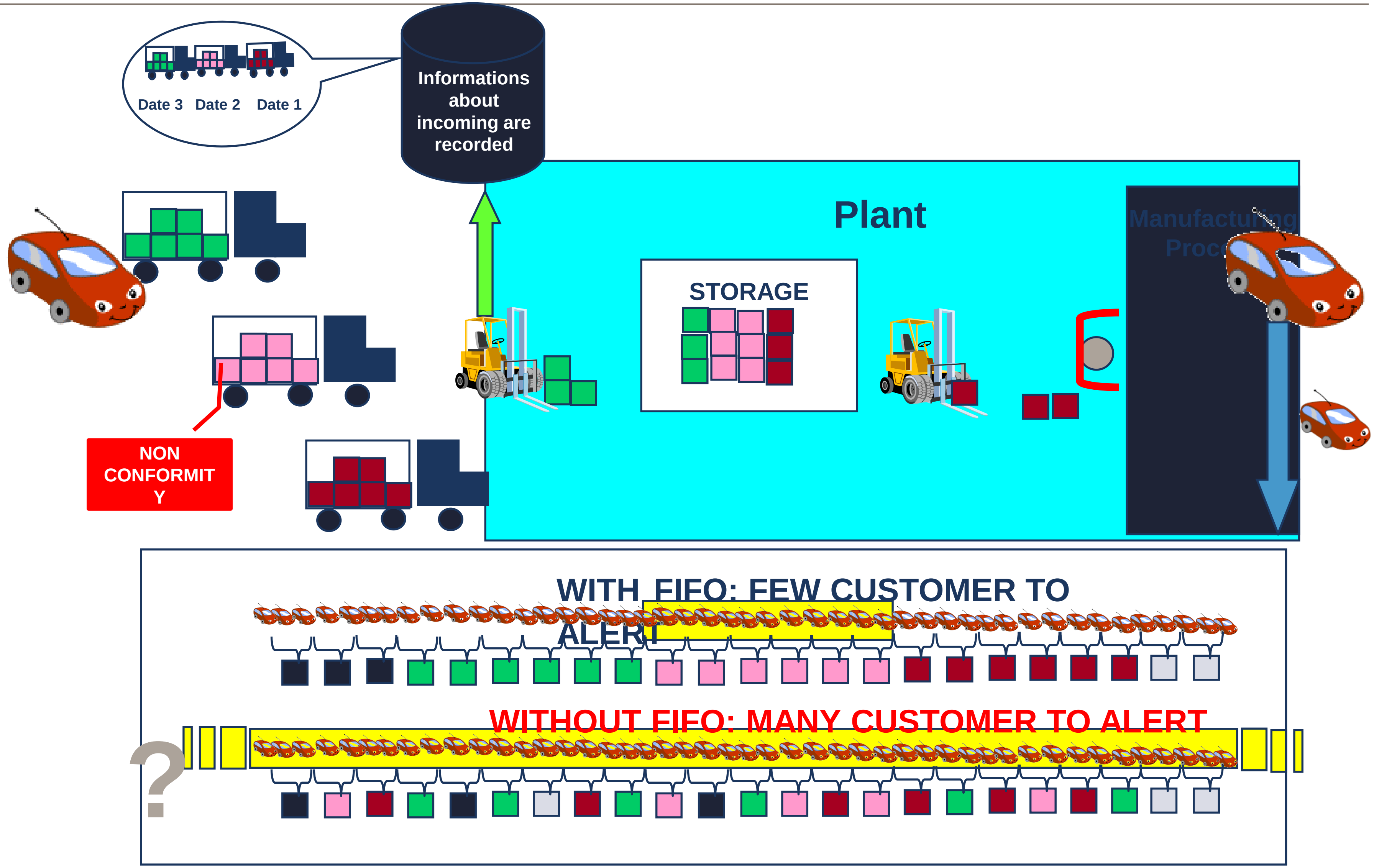
MMFM32 : TO BE PROVIDED

FIFO present in all operations

- Minimize inventory and allows traceability of material.
- FIFO present in ALL OPERATIONS (Including repacking, kitting, buffers, WIP, and any staging areas).
- Visual aids support all operations and standardized work.
- FIFO rotation – FIFO should occur on a daily basis unless otherwise noted by the plant (in these cases FIFO may occur on a weekly basis).
- Ensure that FIFO is part of layered audit process.
- FIFO processes are documented and are part of standardized work.

FIFO Material In All Storage Locations



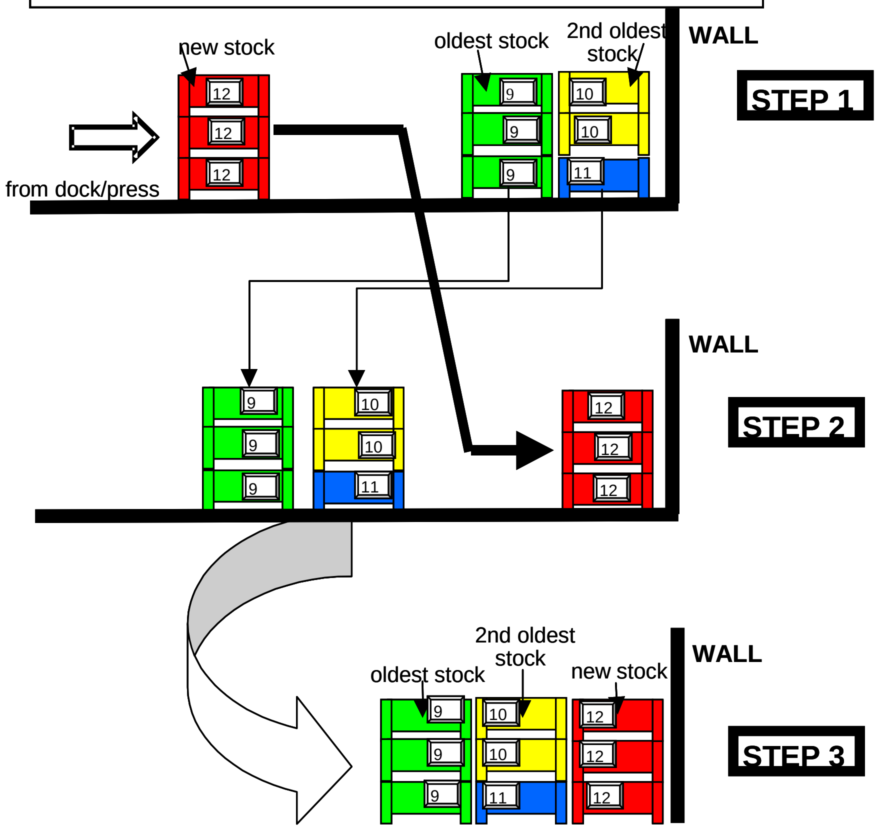


Date 3
Date 2
Date 1
Informations about incoming are recorded
Plant
STORAGE
Manufacturing Process
NON CONFORMITY
WITH FIFO: FEW CUSTOMER TO ALERT
WITHOUT FIFO: MANY CUSTOMER TO ALERT
?

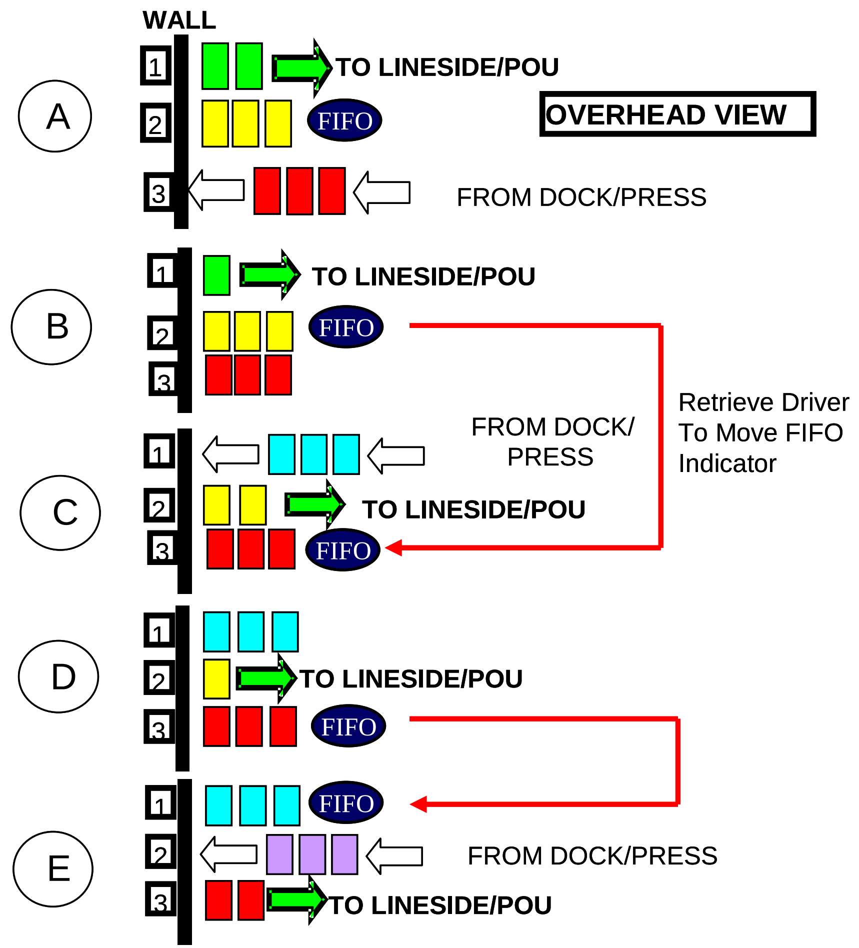
FIFO against wall

SINGLE LANE:

9 represents the oldest stock, 10 represents next oldest, 11 represents next oldest
12 represents the newest



MULTIPLE LANES:

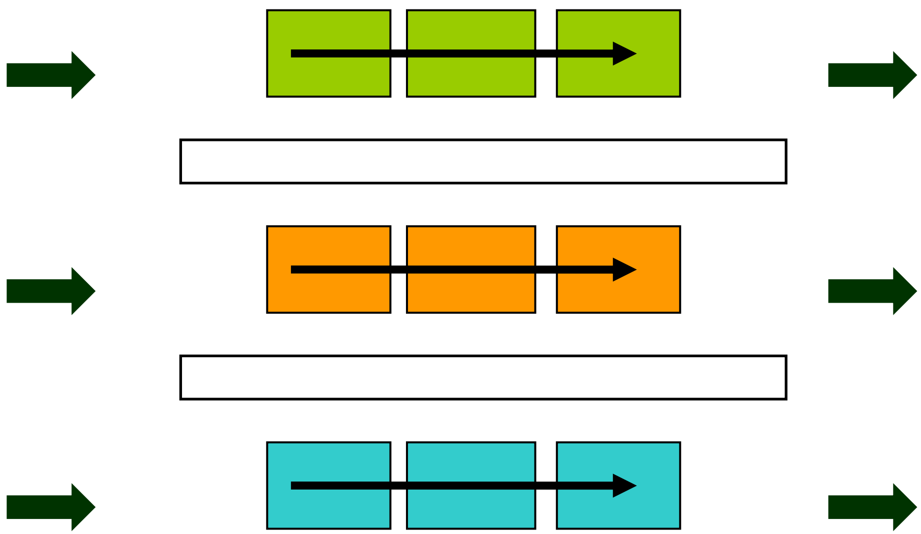


FIFO – single lane flow (flow rack)
(best example of FIFO in a perfect world)

FIFO

TOP VIEW OF FLOWRACK

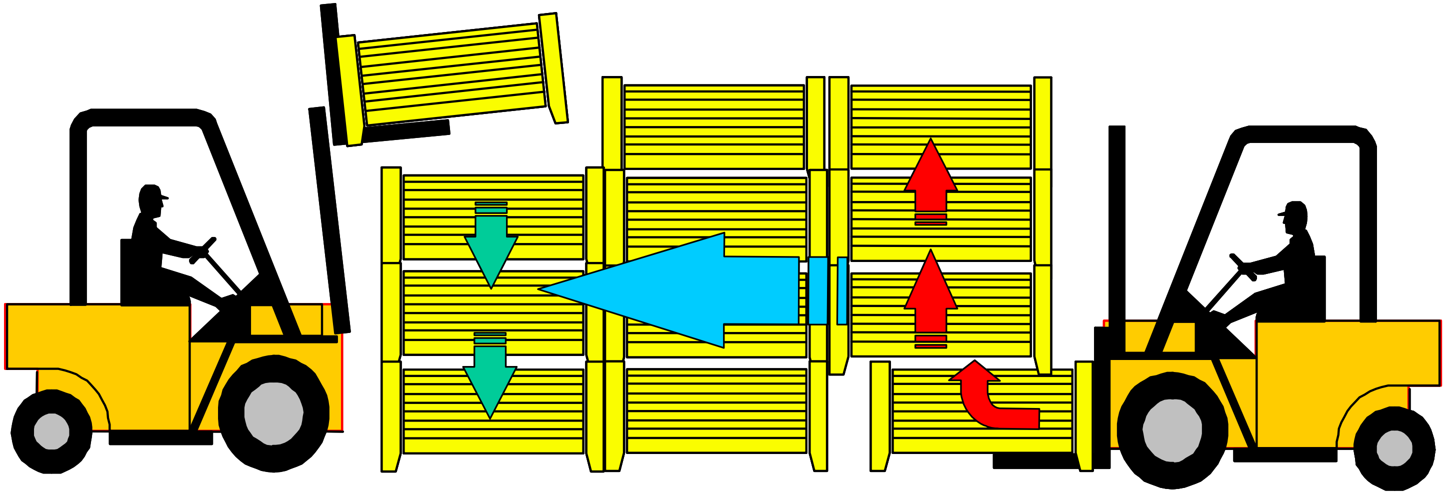
Feed in



Feed Out

FIFO = Queue

FIFO – single lane flow (bulk)



Blue marked floor or visualized with signs (feed out)

Green marked floor or visualized with signs (feed in)

Warning: A stack = F.I.L.O. (First In, Last Out)

FIFO can be guaranteed in the stack only with additional handling operations.

In some case, it's not a suitable solution

Example of FIFO Indicator for Bulk Material

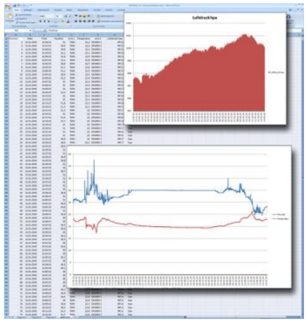
The indicator is a plastic cone with a FIFO sticker attached.
The indicator can be easily moved from lane to lane by drivers on their fork trucks.

Example of FIFO indicator for flow racks

The indicator is a simple sign fixed on a wire rope.
The indicator can be easily moved from lane to lane

Storage condition: special controls

- When applicable, organization shall establish a controlled storage conditions in real time (e.g.: temperature, humidity, etc.)
- Records of stock condition shall be kept
- Reaction Plan shall be defined in procedures/control plan



Stock Management

- Organization shall conduct regular layered audits in the stock area in order to check:
  - Stock Level (min and max conditions are kept)
  - Expiring dates
  - Product change level
  - General rules are being followed: 5S, FIFO, Labeling, etc.

MMFM35 : TO BE PROVIDED

Auditor hints

- Check storage area and condition at several places (incoming, Work in Process, final product).
- Ask operators and material handling personnel whether they are aware of and following instructions.
- Verify that adequate protection in place to protect parts from damage and mixing.
- Condition of storage (temperature, waterproof,…)
- Visual management in place (level mini & maxi are visible, token board for the filo)
- Check expiring dates by reading labels
- FIFO: risky situation to examine: intermediate stocks, double flows/lines (e.g.: 2 paint lines): how do they manage these type of situation (specific rules & procedures)
- Specific management for the high runner references
- Results of audit or inventory
- Associated equipment is suitable for stocking and handling (barcode reader, informatics systems, forklift, racks etc.).
- **TRANSFER BY CNC-RR**

Packaging management, what are we searching for?

Item	Requirement	#Criteria	Criteria requirement
MMFM4	A system is in place which ensures that materials needed for production are organized and available at place of their application.	**MMFM41**	**Supply plan is established and tracked on the shopfloor. Supply equipments are adapted to layout, flows configuration and available space.**
		MMFM42	**All supply activities are considered as Standardized Work and LPA is implemented**
		MMFM43	**Escalation rules are defined and applied (manufacturing & logistic areas)**
		MMFM44	The feeding process is based on a structured methodology (e.g.: pull system) which: - minimizes overflows & non value-added operations (repacking), - guarantees the availability of materials at the workstation during all production period.
		MMFM45	The optimization of flows of materials and components in place, is based on the use of tools such as MIFA or VSM

Criteria of Requirement

1 – page 73-78
2 – page 78
3 – page 79
4 – page 80 - 85
5 – page 73
Auditor Hints – page 86

Prev. Requirement
Next Requirement

Feeding Plan: Plan for Every Part (PFEP)

- Organization shall put in place a process to identify material flow requirements for every part. For example a plan for every part – all planning data including packaging, presentation equipment, transportation method, etc.
- Database should encompass the following information:
  1. Line-side presentation
  2. Part packaging
  3. Internal delivery (including mobile equipment required)
  4. Storage
  5. Receiving
  6. Logistics
  7. Sourcing
- It shall be used during Material Flows continuous improvement process (like VSM).

Element of the Plan for Every Part (PFEP)

All planning must start line-side with the operator and continue back up the supply chain. By following this process, waste is minimized and an efficient material flow is established at the lowest total cost.

1 Line Side Presentation

•Flow Rack
•Dolly
•Lift Device
•Auto. Feed
•Sequenced
•Kitted
•Specialized storage racks

2 Part Packaging

•Small Lot
•Bulk
•Special
•Integrated on
• wheels
•Minomi
•Returnable
•Expendable

3 Internal Delivery

•Tugger &
• Dolly
•Fork Truck
•Conveyor
•AGV/AGC
•Hand-push
•(point of use)
•Pull systems

4 Storage

•Onsite
•Offsite
• (LOC)
•Point of
• Use

These elements (1-4) need to be considered, when developing each segment of the PFEP

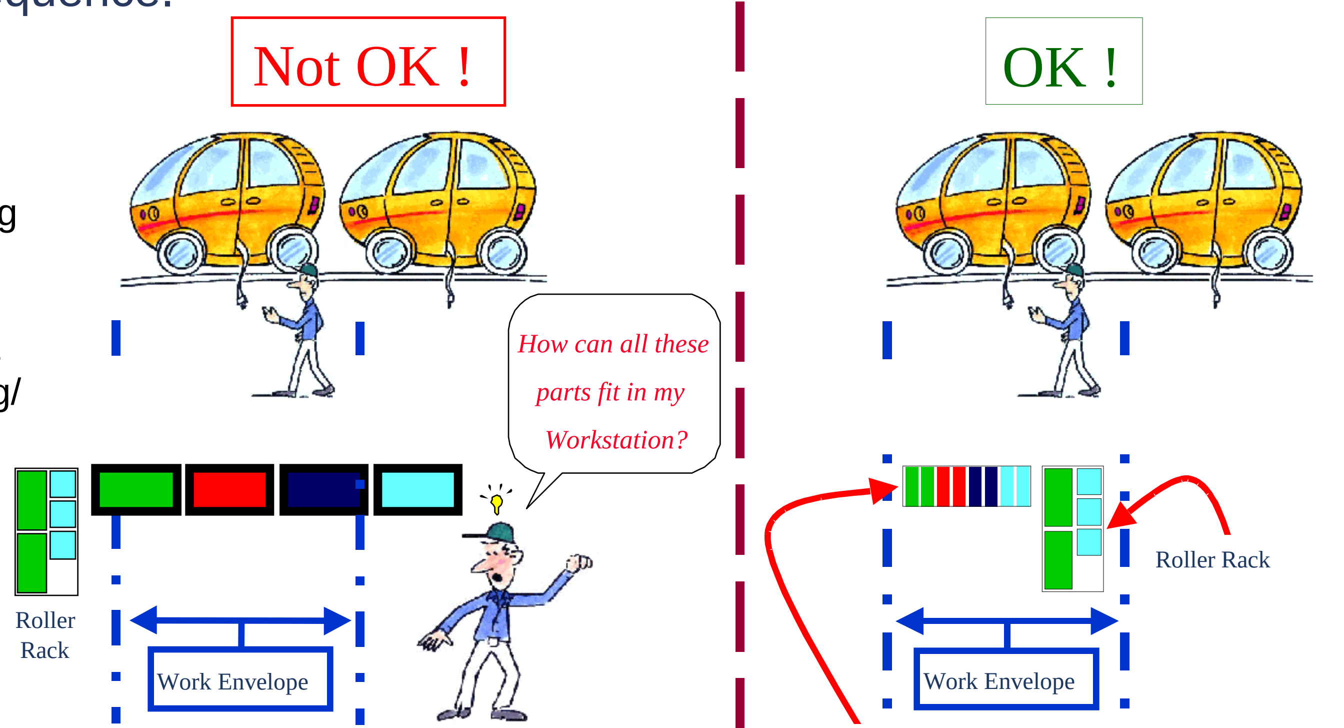
1

Line-side Presentation

- Based on production Team Member requirements.
- Work envelope/part presentation may dictate the requirement to sequence.

Key Points

- Reduced walk time
- Ease of handling/ergonomics
- Interfaces to line-side handling equipment (auto feed etc.)
- Replenished on consumption
- Supports a flexible layout that can facilitate line re-balancing/ layout changes

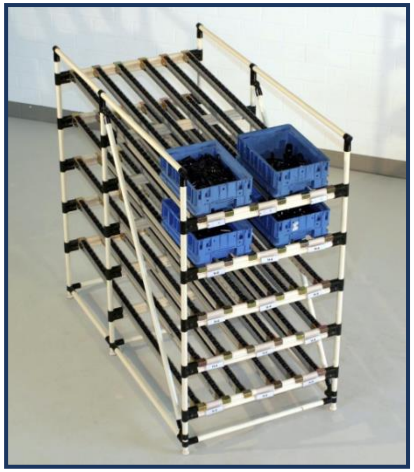


Materials with many options may force the Team Member out of his/her work envelope

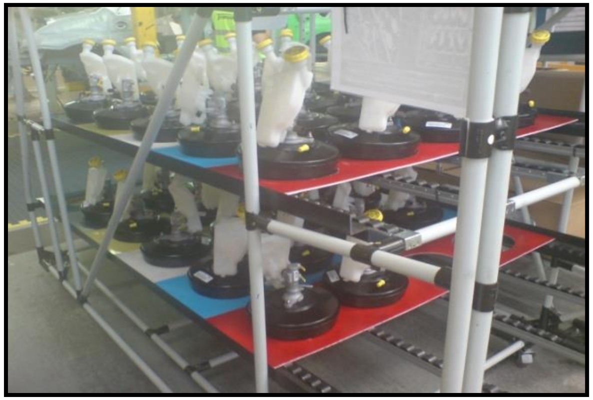
All four part numbers are now packed in one container and are in build sequence order

Storage organization at workstation

- **Small Components**
  - Dynamic racks



  - Dynamic Racks with kanban management



- **Heavy Components**

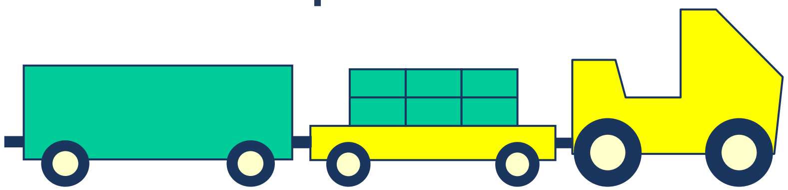
Plant Part Packaging Database

2

- **Developed using the following information:**
  - Physical part, photograph, or drawing (e.g.to show size/shape etc.).
  - Team member requirements (pick ease, space requirements).
  - Quality needs (e.g. part protection of class A surfaces, breakable flanges, pins etc.).
  - Storage requirements (small-lot, bulk).
  - Returnable vs. expendable and back-up packaging information.
  - Gross part weight.
  - Gross packaging weight (ergonomic & health and safety considerations).
  - Standard and scheduled pack information.
  - Dunnage requirements.
  - Special requirements (e.g. walk in rack, on wheels, minomi, etc).

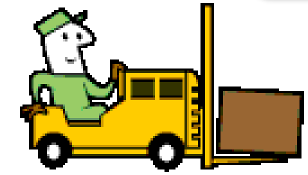
Internal Delivery

- **How will the parts move?**

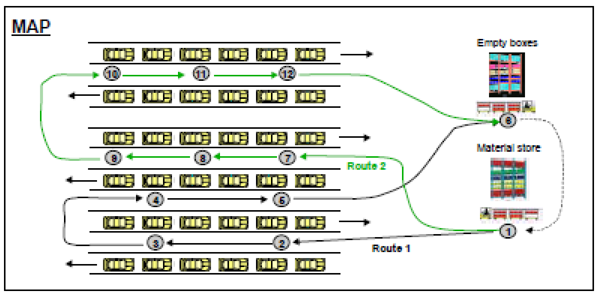


Tugger & Dolly

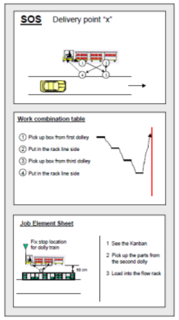
Man & Dolly



Fork truck



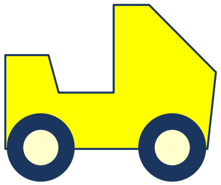
Internal Delivery Route



Std Work

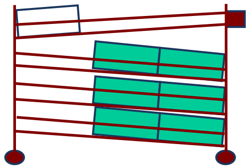
- What equipment is required?

Dollies



Tuggers

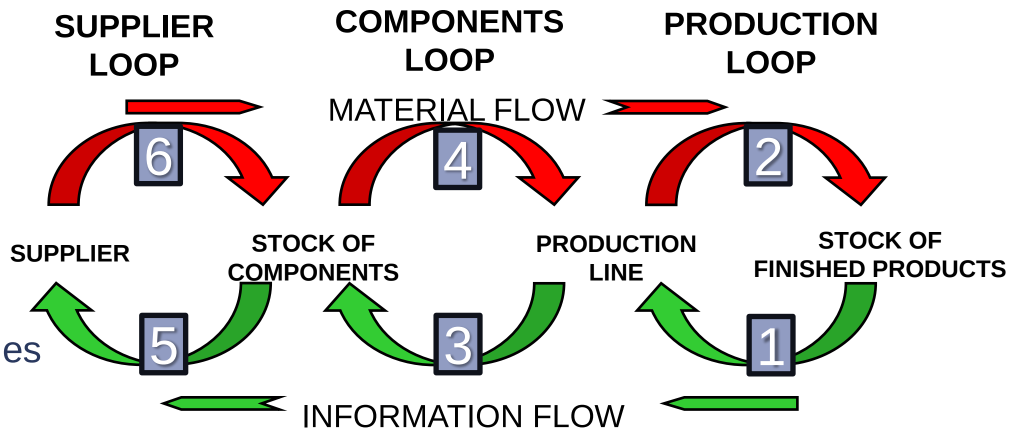
Fork truck



Flow Racks

MMFM43 : TO BE PROVIDED

Pull System: Basics



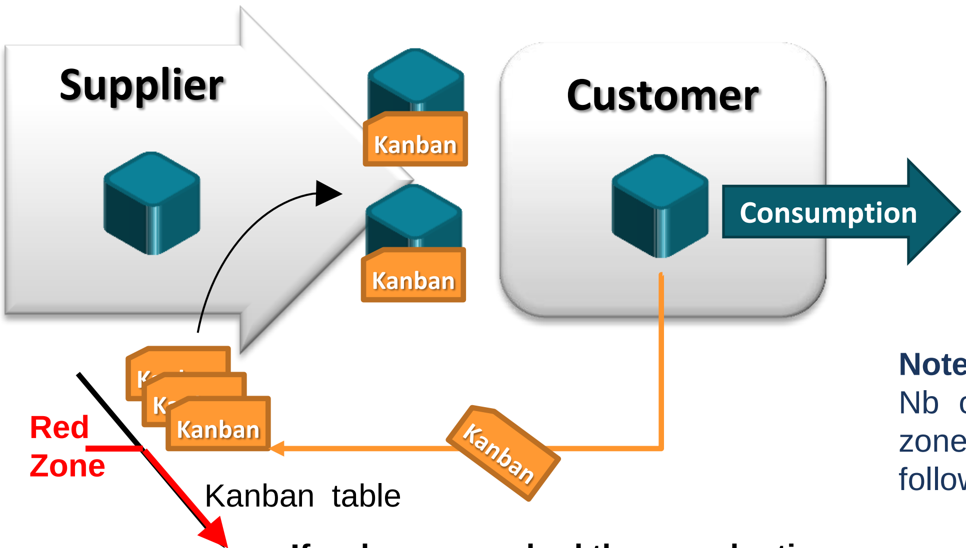
- **Why the pull system ?**
  - Optimizing Manufacturing time
  - Standardizing operations
  - Reducing waste
  - Increasing distribution & supply frequencies
  - Reducing stocks & variations in activities
  - Facilitating flows through scheduling & task division
  - Improving the ergonomics of material handling operations

- **Every process step has:**
  - Upstream Supplier
  - Downstream Customer

- **The production is managed by customer demand and production starts after customer consumption**

Kanban: Basics

- **Benefits**
  - Reduction of the in-progress stocks
  - Reduction of scrap & rework
  - Reduction of waiting times
  - Better respect of the FIFO
  - Increased inventory turnover

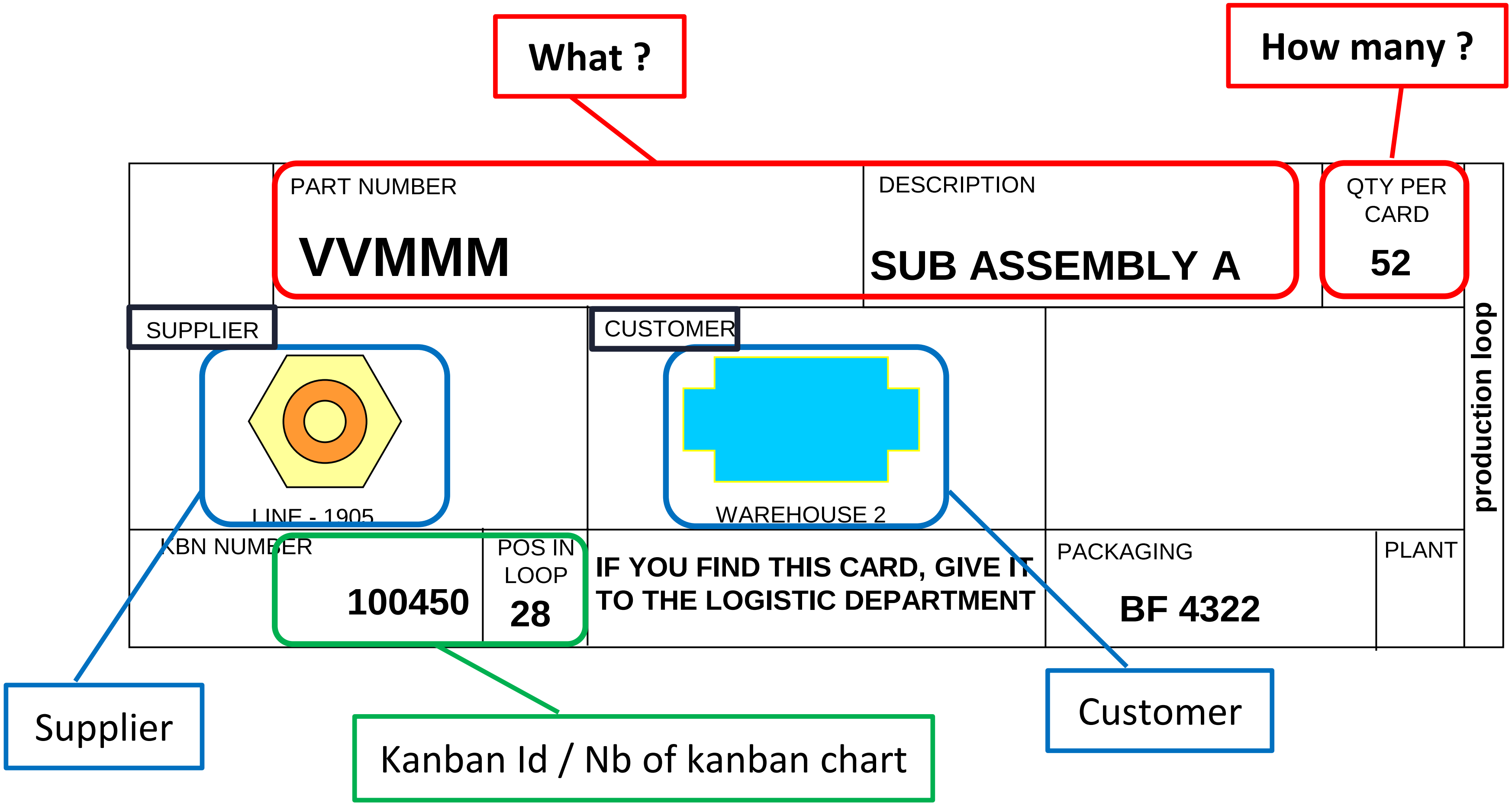


If red zone reached then production (e.g. reconstitution of the consumption)

Note:
Nb of Kanban Cards & red zone must be adapted to follow variation of demand

Kanban chart – 5 important informations

Kanban: Basics



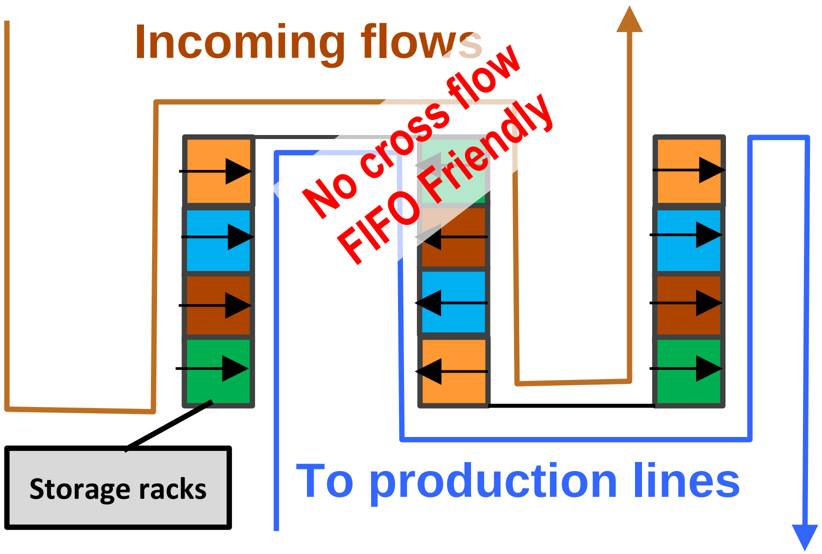
Storage/Staging

4

- Delivery Locations (DLOC)/Material Staging should be as close as possible to the point of consumption to:
  - Minimize material delivery time.
  - Minimize material handling (e.g. do not stage material on dock if it can be delivered straight to the point of consumption).
- Onsite vs. offsite storage decisions should include a study where total costs (e.g. manpower, transportation, storage, equipment, etc.) have all been considered in making the final decision.
- Storage areas should be set up (whenever possible) for flow through storage to enable FIFO process (First-In-First-Out).
- Consider point of use docks when cost justified.

Supermarket: A specific type of storage

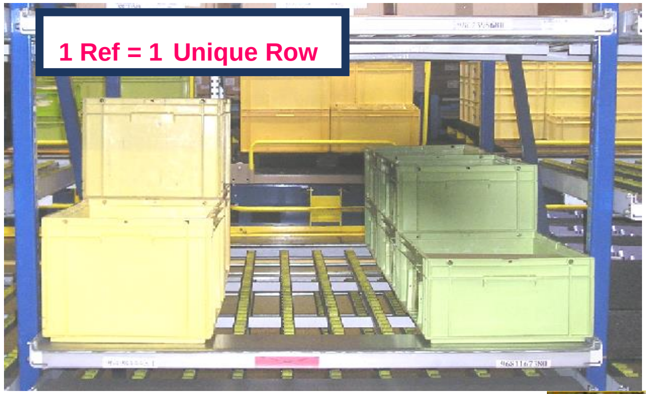
Good Practices



- **Benefits**
  - Safety
  - Ergonomics
  - Respect of FIFO
  - Visual management of References
  - Optimized areas (narrow driveways)
  - Reduced costs
  - No heavy handling equipment
  - Flexible layout

Supermarket: A specific type of storage

Good Practices



- **Dynamic Racks**
- **On floor storage**
- **Light handling equipment**

Auditor hints

- Check if a standardize feed route plan is defined and followed
- Check few workstations and check:
  - Respect of the "pull system" principles,
  - Alerts from the lines and their management: management of the risk of stock out?,
  - Work instructions (line feeding operations, loading, repackaging operations…),
  - FIFO kept (organization of the rack).
- Organization of "supermarket" areas (visual management) if existing.
- Organization of the material flow at the workstation (entry & exit point for each components, packaging, useless movement).
- Optimization activities (minutes of meetings, action plans...).

Effectiveness, what are we searching for?

Item	Requirement	#Criteria	Criteria requirement
MMFME	Indicators are defined and tracked to ensure effectiveness of material flow management.	**MMFME1**	**Indicating follow-up advances delay compared to estimated production**
		MMFME2	**level of stock 'Followed to compared it with the target (min and max)**
		MMFME3	**Monitoring OEE (Operational Operation production ratio) of the bottlenecks."**
		MMFME4	Production losses due to feed missing.

Criteria of Requirement
1 – page 88
2 – page 89
3 – page 90
4 – page 91-93
Auditor Hints – page 94

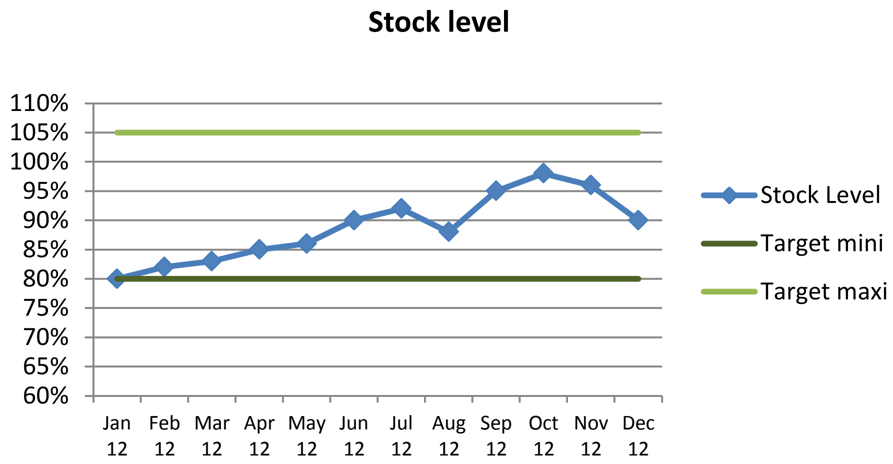
Prev. Requirement
What goes wrong ?

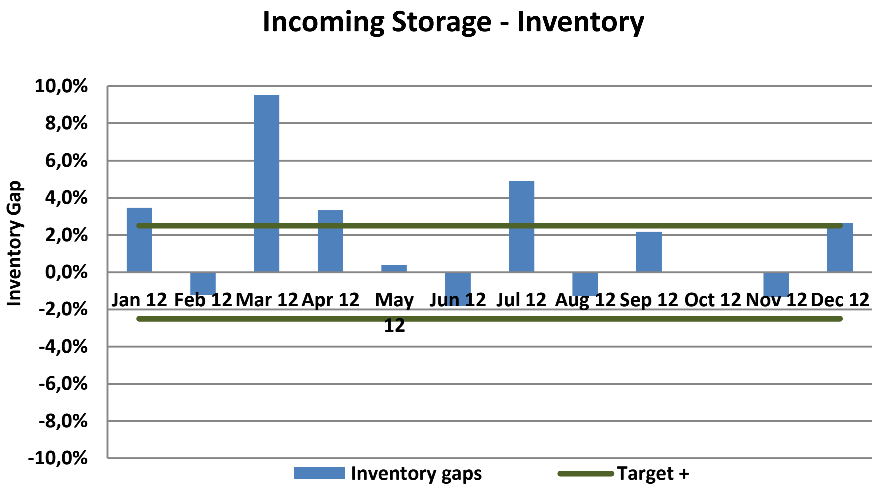
MMFME1 : TO BE PROVIDED

Rolling Inventory

- **Examples of storage management indicators**

		Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
Stock Level	Stock Level	80%	82%	83%	85%	86%	90%	92%	88%	95%	98%	96%	90%
	Target mini	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%	80%
	Target maxi	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%	105%
Rolling Inventory	Nb of references checked	10	15	20	15	17	20	18	16	16	14	15	10
	Physical situation	4832	5630	6900	4340	7680	3240	4720	3850	4700	3200	2960	3900
	Theoretical situation	4670	5700	6300	4200	7650	3300	4500	3900	4600	3200	3000	3800
	Inventory gaps	3,5%	-1,2%	9,5%	3,3%	0,4%	-1,8%	4,9%	-1,3%	2,2%	0,0%	-1,3%	2,6%
	Target +	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%	2,50%
	Target -	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%	-2,50%

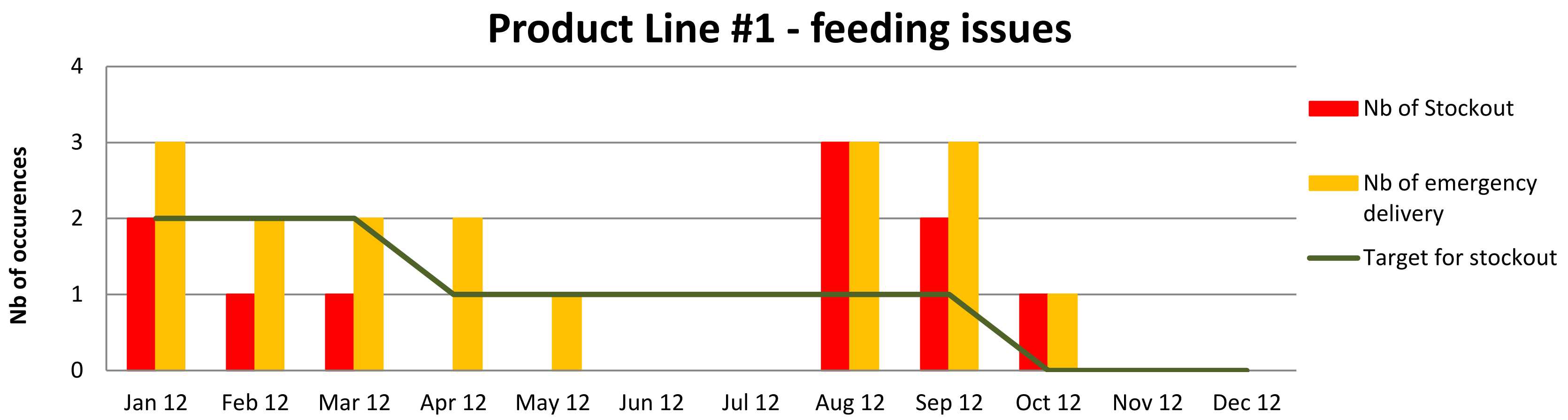




MMFME1 : TO BE PROVIDED

Line Stockout

- **Examples of line feeding indicators**

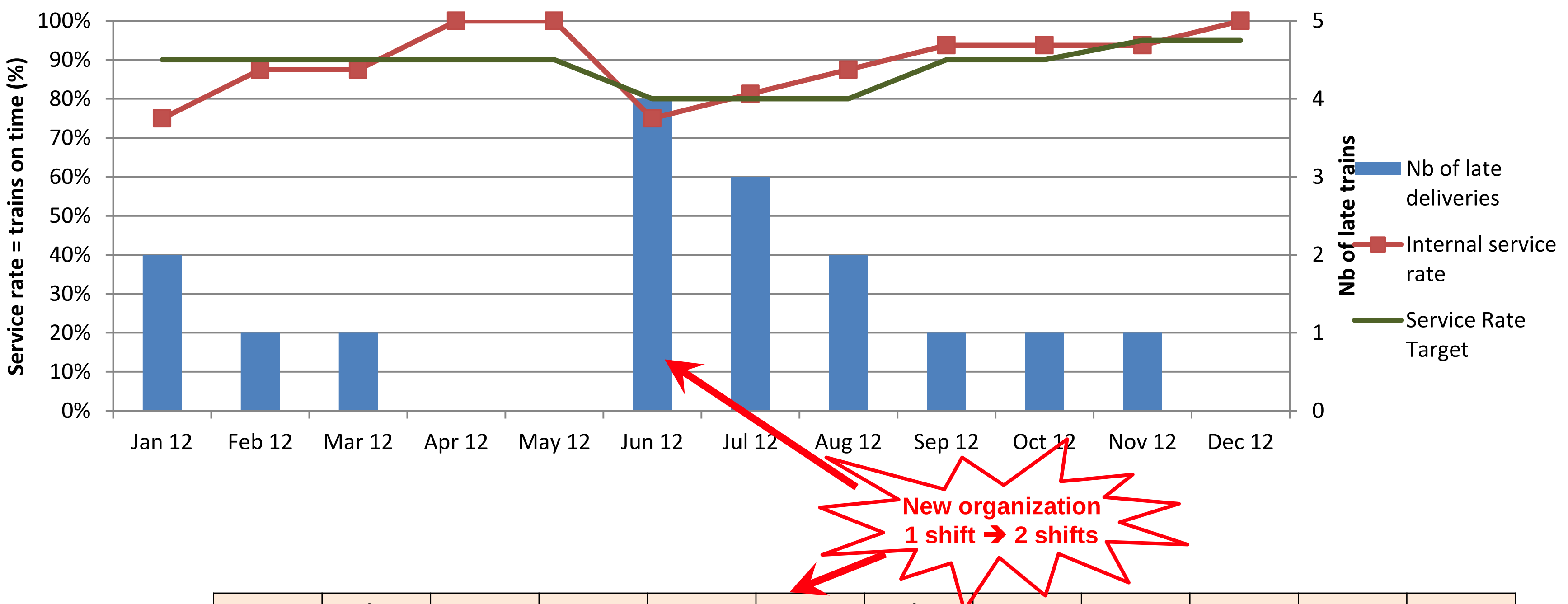


Feeding tracking

	Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
Nb of Stockout	2	1	1	0	0	0	0	3	2	1	0	0
Nb of emergency delivery	3	2	2	2	1	0	0	3	3	1	0	0
Target for stockout	2	2	2	1	1	1	1	1	1	0	0	0

Internal Service Rate

- **Examples of line feeding indicators**

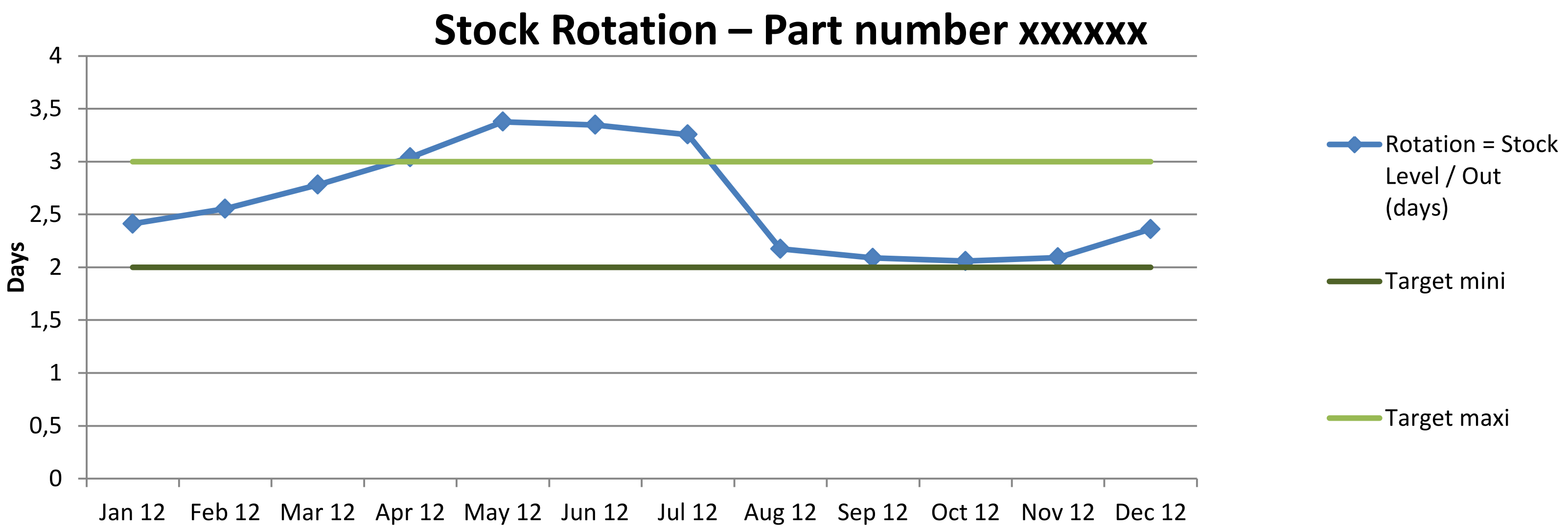


	Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
Nb of deliveries / day	8	8	8	8	8	16	16	16	16	16	16	8
Nb of deliveries on time (+/- 10 minutes)	6	7	7	8	8	12	13	14	15	15	15	8
Nb of late deliveries	2	1	1	0	0	4	3	2	1	1	1	0
Internal service rate	75,00%	87,50%	87,50%	100,00%	100,00%	75,00%	81,25%	87,50%	93,75%	93,75%	93,75%	100,00%
Service Rate Target	90%	90%	90%	90%	90%	80%	80%	80%	90%	90%	95%	95%

Stock Rotation

- **Examples of storage management indicators**

	Jan 12	Feb 12	Mar 12	Apr 12	May 12	Jun 12	Jul 12	Aug 12	Sep 12	Oct 12	Nov 12	Dec 12
In (parts/day)	6000	5000	5000	5000	4000	4000	3500	0	3500	3700	3900	4000
Out (parts/day)	4750	4630	4450	4300	3900	3950	3930	4030	3970	3920	3870	3600
Stock Level (parts)	11450	11820	12370	13070	13170	13220	12790	8760	8290	8070	8100	8500
Rotation = Stock Level / Out (days)	2,4	2,6	2,8	3,0	3,4	3,3	3,3	2,2	2,1	2,1	2,1	2,4
Target mini	2	2	2	2	2	2	2	2	2	2	2	2
Target maxi	3	3	3	3	3	3	3	3	3	3	3	3



Auditor hints

- Prior to audit check any customer complaint issued related to packaging and material handling.
- Layout of areas they are optimized.
- Where applicable, the edges of lines are fed automatically or by little trains (no big boxes or full of components).
- Stock level (min max visual management).
- Workplace visual management of stock (min - max).

What goes wrong ?

- Lack of matching between S&OP, MPS and Daily Production Plan
- Resources not defined/available to attend the production plan
- Overall capacity not defined properly
- Constraints/Bottleneck not identified/managed
- Frequent packaging shortage
- Packaging in bad conditions creating customer issues
- Contamination and mix of parts in packaging
- Lack of storage place definition (storage in anywhere)
- Frequent stockout due to lack of parts
- Workstation buried under components
- Not properly workplace organization due to flow of components (impacting safety, quality and production aspects)
- Lack of feeding plan
- Lack of continuous improvement due to lack of metrics management