



Variability in Supply Chain Planning

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PICS Belgium

SAS Forum, in Cooperation with PICS Belgium
October 9, 2014

Agenda



- 15.00 – 15.50 – NYO Alatus

Embracing the variability in your supply chain planning

- 15.00 – 15.10 **Academic overview by Prof. Nico Vandaele**
 - 15.10 – 15.25 Pharmaceutical case 1 by Carl Verhamme
 - 15.25 – 15.40 Discrete case 2 by Kris Lieckens
 - 15.40 – 15.45 Today's reality by Prof. Nico Vandaele
 - 15.45 – 15.50 Q&A
- 15:50 – 16.20 Break
 - 16.20 – 17.10 - Daan Voets and Jos Polfliet, SAS

Best practices in using sensor data

to increase performance and reliability

Planning Performance History



2000 - 2012 Implementation and further developments at

- Atlas Copco
- Continental Tyres
- Baxter
- JNJ
- GSK
- UCB

2008 Creation of spin-off Nyo Alatus

2012 Partnership NYO & SAS



Note:

**Slides from Carl Verhamme for SAS Forum –
October 2014**

Pharmaceutical Co.



FlowBalancer used as Improvement and Benchmarking tool besides a planning tool.



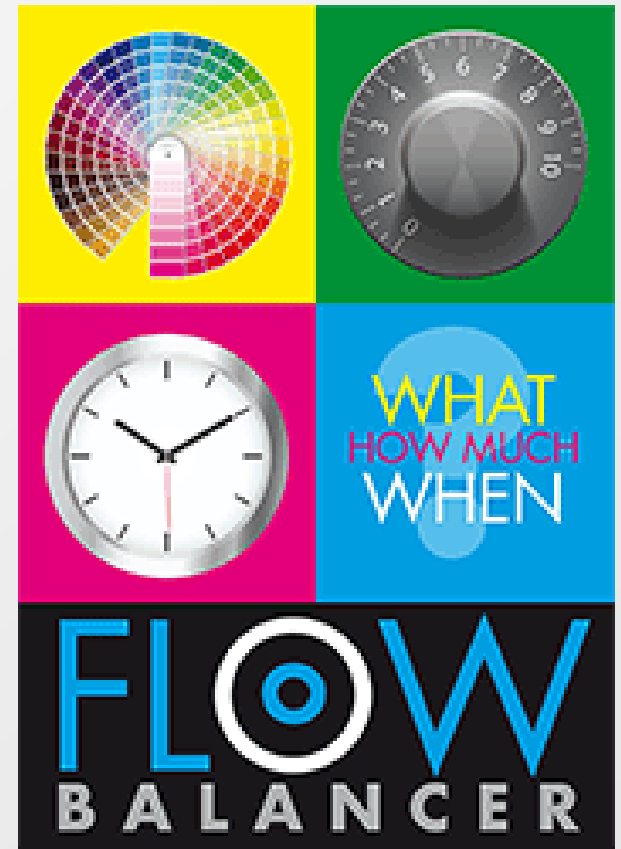
Value Stream Mapping (VSM) as a starting point during an implementation



Test scenarios lead to a future VSM

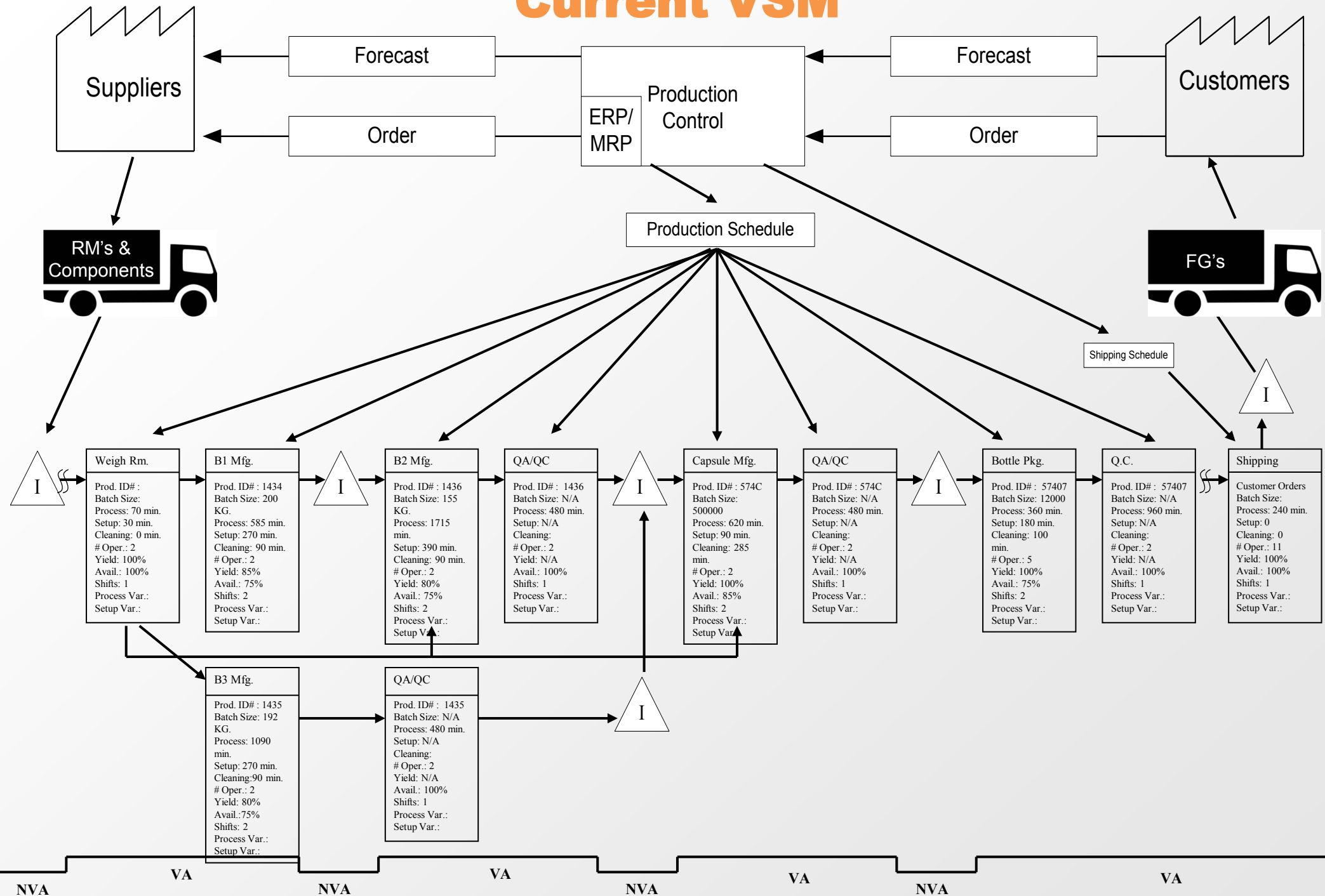


Immediate financial results

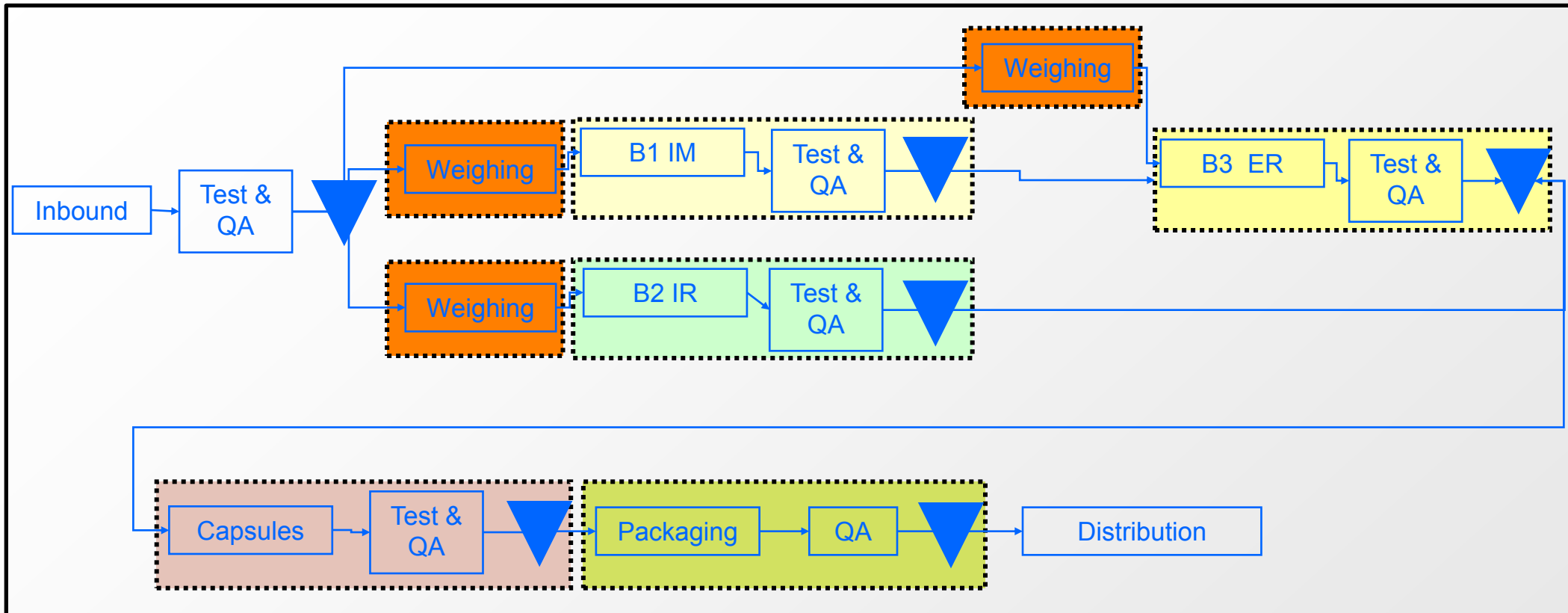


Capsules

Current VSM



Analytical Model - overview



Identify:

- 🏆 Productmix
- 🏆 Routings
- 🏆 Resources (equipment / people)

Scenarios

- Increase of demand
- Installation of an additional shift
- ...

Improvement

- Set-up reduction on the bottleneck
- Increase MTTF
- Reduction of variability
- Optimisation of the batchsize



Simulations: Demand

Scenario	Simulation Parameter	BaseCase	Simulated	% Difference	Criteria	Bead IM	Bead ER	Capsules	Packaging	Shipping	Total
Scenario 0	Base Case				WIP	570.210	734.328	0.442	0.192	11051.933	127.05
					Cycle Time	32.90	47.04	11.85	5.15	30.12	
					Throughput	17.330	15.612	0.037	0.037		
					Utilization	88%	88%	59%	68%	88%	
Scenario 1	Increase demand in finished products by 5% 10% is too much for the bead				WIP	801.501	1099.701	0.469	0.214	11051.933	158.69
					Cycle Time	44.04	67.08	11.98	5.46	30.12	
					Throughput	18.200	16.393	0.039	0.039		
					Utilization	93%	93%	62%	71%	93%	
					Diffence WIP	231.291	365.373	0.027	0.022	0.000	31.64
					Difference Cycle Time	11.14	20.05	0.14	0.31	0.00	
					Difference Throughput	0.870	0.781	0.002	0.002		
					Difference Utilization	5%	5%	3%	3%	5%	
					% WIP	40.56%	49.76%	6.20%	11.29%		24.90%
					% Cycle Time	33.87%	42.62%	1.16%	5.98%		
% Throughput	5.02%	5.00%	5.09%	5.09%							
% Utilization	5.68%	5.68%	5.08%	4.41%	5.68%						

Scenario	Simulation Parameter	BaseCase	Simulated	% Difference	Criteria	Bead IM	Bead ER	Capsules	Packaging	Shipping	Total
Scenario 0	Base Case				WIP	570.210	734.328	0.442	0.192	11051.933	127.05
					Cycle Time	32.90	47.04	11.85	5.15	30.12	
					Throughput	17.330	15.612	0.037	0.037		
					Utilization	88%	88%	59%	68%	88%	
Scenario 2	Reduce available ho				WIP	734.328	0.442	0.318	11051.933	130.42	
					Cycle Time	47.04	11.85	8.53	30.12		
					Throughput	15.612	0.037	0.037			
					Utilization	88%	59%	87%	88%		
					Diffence WIP	0.000	0.000	0.126	0.000		3.38
					Difference Cycle Time	0.00	0.00	3.38	0.00		
					Difference Throughput	0.000	0.000	0.000			
					Difference Utilization	0%	0%	19%	0%		
					% WIP	0.00%	0.00%	65.56%		2.66%	
					% Cycle Time	0.00%	0.00%	65.53%			
% Throughput	0.00%	0.00%	0.00%	0.00%							
% Utilization	0.00%	0.00%	0.00%	27.94%							

**Increase of 5% of demand
increases the Cycle Time by
31 days**

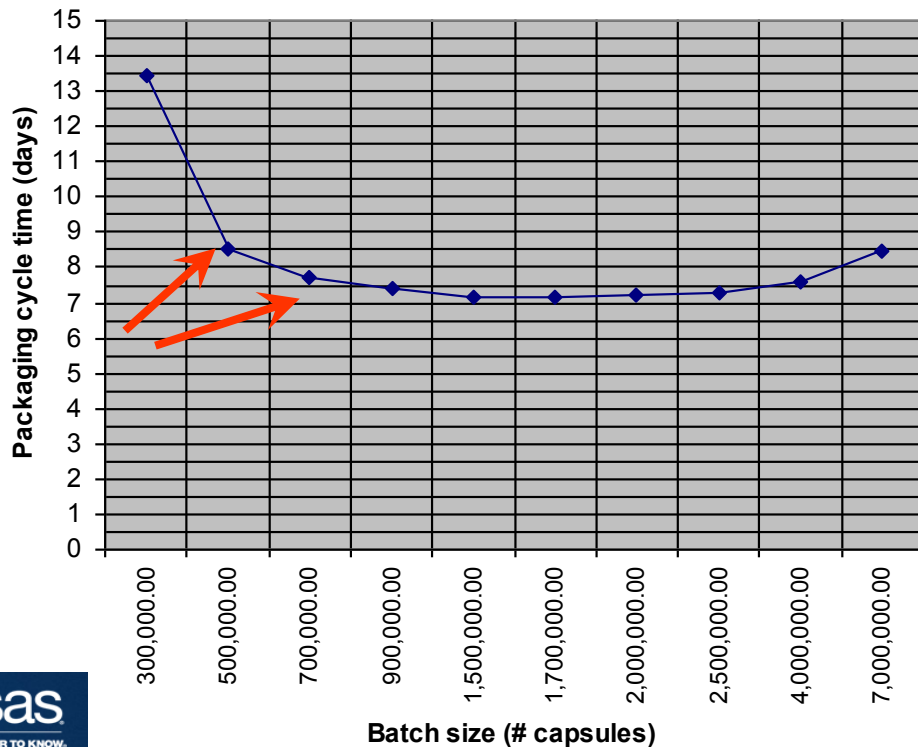
Simulations: Capacity (extra shift)

Scenario	Simulation Parameter	BaseCase	Simulated	% Difference	Criteria	Bead IM	Bead ER	Capsules	Packaging	Shipping	Total
Scenario 0	Base Case				WIP	570.210	734.328	0.442	0.192	11051.933	127.05
					Cycle Time	32.90	47.04	11.85	5.15	30.12	
					Throughput	17.330	15.612	0.037	0.037		
					Utilization	88%	88%	59%	68%	88%	
Scenario 4	Increase 50% for hours available for the bead (additional shift)				WIP	350.6649	378.38	0.442	0.1922	11051.933	91.58339
					Cycle Time	20.2307	24.2366	11.8461	5.152	30.11799	
					Throughput	17.3333	15.61	0.0373	0.0373		
					Utilization	58%	58%	59%	68%	68%	
					Difference WIP	-219.5451	-355.9481	0	0	0	-35.47
					Difference Cycle Time	-12.67	-22.80	0.00	0.00	0.00	
					Difference Throughput	0.0033	-0.0021	0	0		
					Difference Utilization	-30.00%	-30.00%	0.00%	0.00%		
					% WIP	-38.50%	-48.47%	0.00%	0.00%		-27.91%
					% Cycle Time	-38.50%	-48.47%	0.00%	0.00%		
% Throughput	0.02%	-0.01%	0.00%	0.00%							
					34.09%	-34.09%	0.00%	0.00%			-22.73%

Cycle Time **reduces by 35 days**
if extra shift on bottleneck is
installed

Simulations: Batch Size

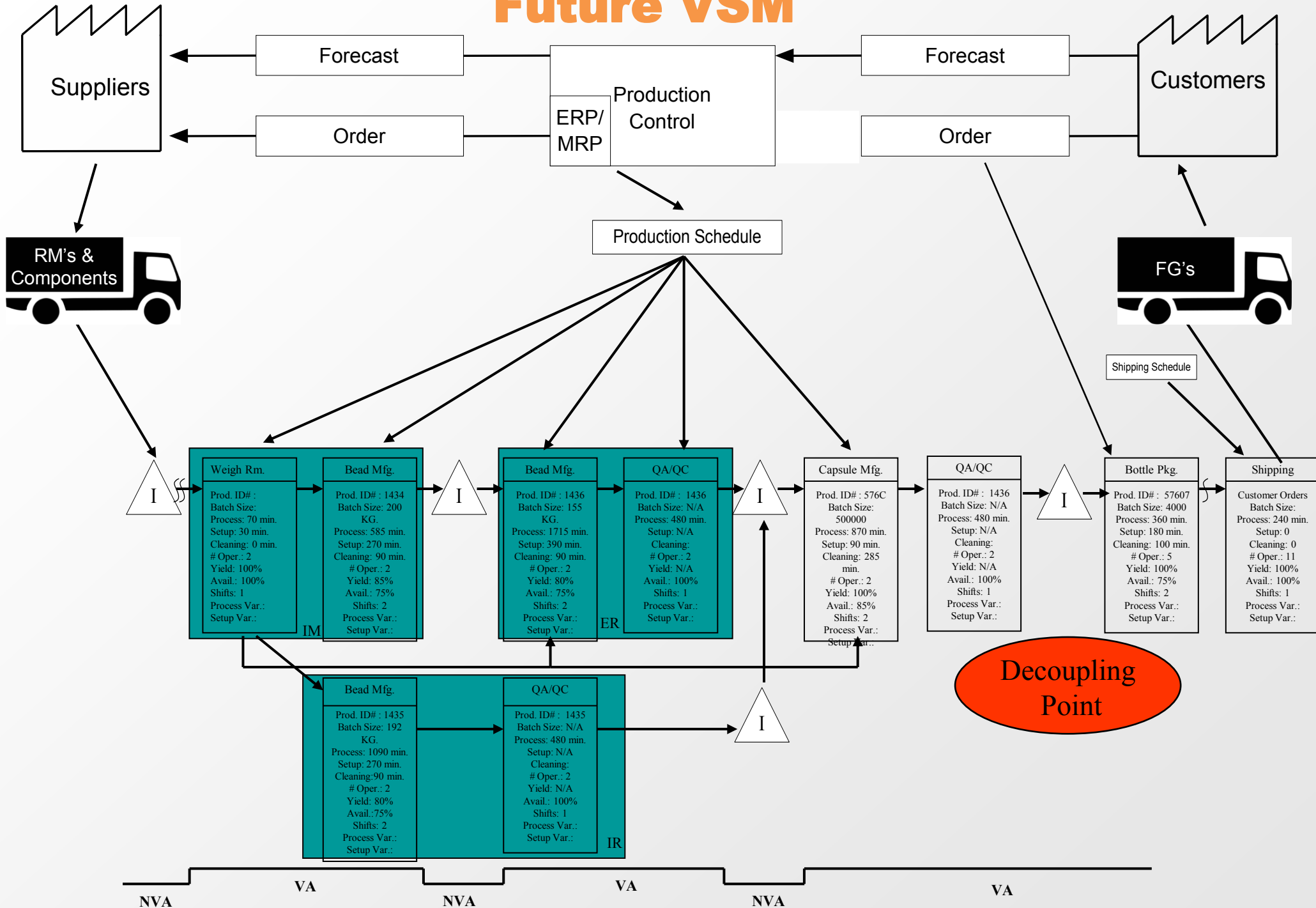
Scenario 2	Reduce available hours per day for packaging 20%	WIP	570.210	734.328	0.442	0.318	11051.933	
		Cycle Time	32.90	47.04	11.85	8.53	30.12	130.42
		Throughput	17.330	15.612	0.037	0.037		
		Utilization	88%	88%	59%	87%		88%
Scenario 11	Reduce available hours per day for packaging 20% Batch size in packaging from 5 to 7 for 10 mg Batch size in packaging from 10 to 12 for 20 mg Batch size in packaging from 5 to 7 for 30 mg	WIP	570.21	734.3281	0.442	0.2528	11051.933	
		Cycle Time	32.8969	47.0359	11.8461	6.7768	30.12	128.67369
		Throughput	17.33	15.6121	0.0373	0.0373		
		Utilization	88%	88%	59%	79%		88%
		Difference WIP	0	0	0	-0.0654	0	
		Difference Cycle Time	0.00	0.00	0.00	-1.75	0.00	-1.75
		Difference Throughput	0	0	0	0		
		Difference Utilization	0%	0%	0%	-8%		0%
% WIP	0.00%	0.00%	0.00%	-20.55%				
% Cycle Time	0.00%	0.00%	0.00%	-20.53%		-1.34%		
% Throughput	0.00%	0.00%	0.00%	0.00%				
% Utilization	0.00%	0.00%	0.00%	-9.20%		0.00%		



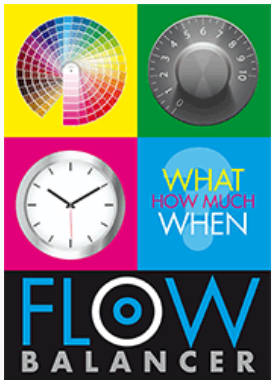
Reduction of available time can be compensated by increase of Batch Size

The optimal Batch Size is **1.7 Mio** (10mg) vs current Batch of **0.5 Mio**

Capsules Future VSM



Results



Reduction of FG inventory by 30 days
→ 6,5 Mio\$ in working capital



8,4% reduction in operational costs

FlowBalancer

**A stochastic and analytical
planning tool @ job shops**



Powered by

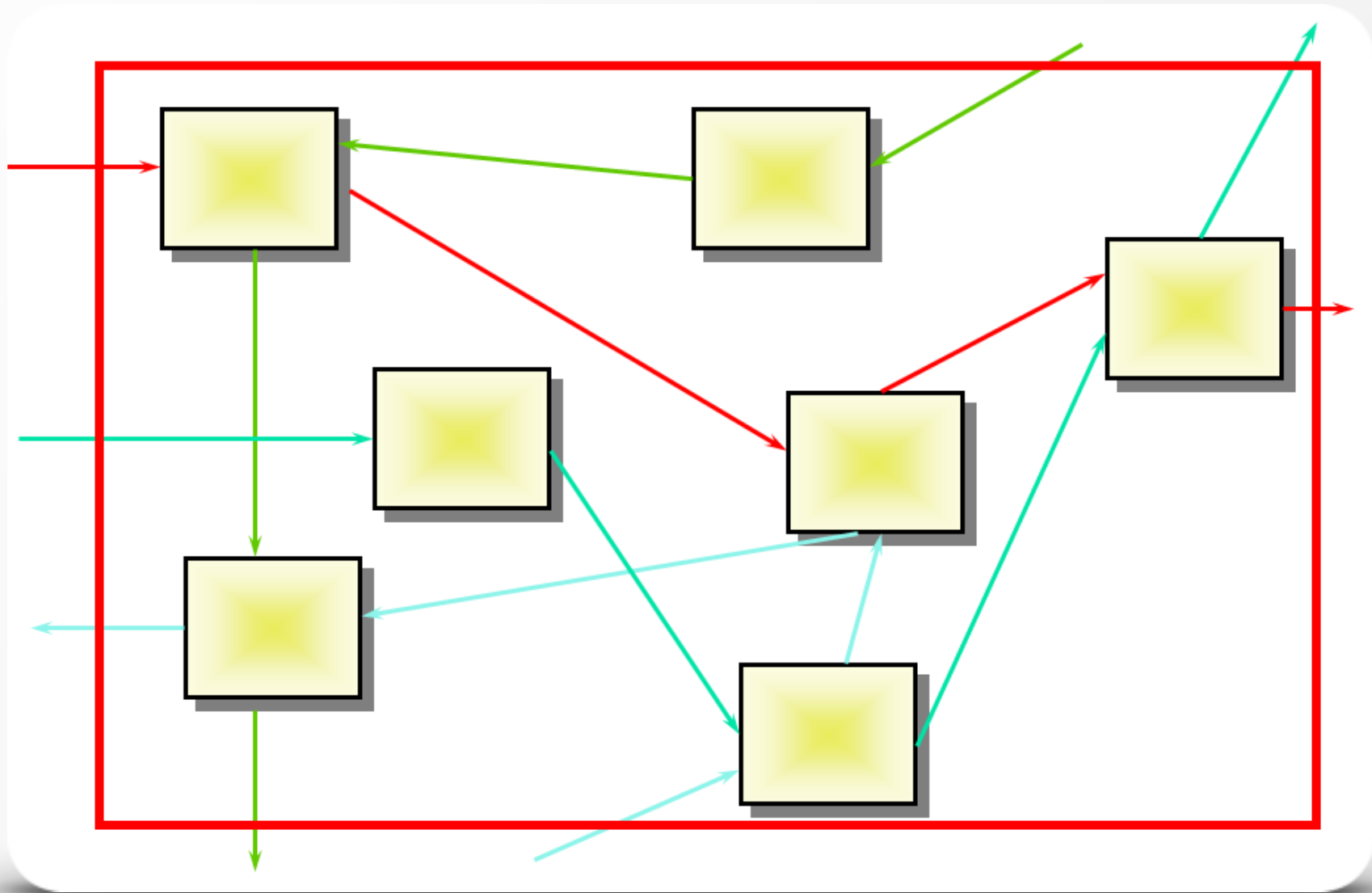


Agenda

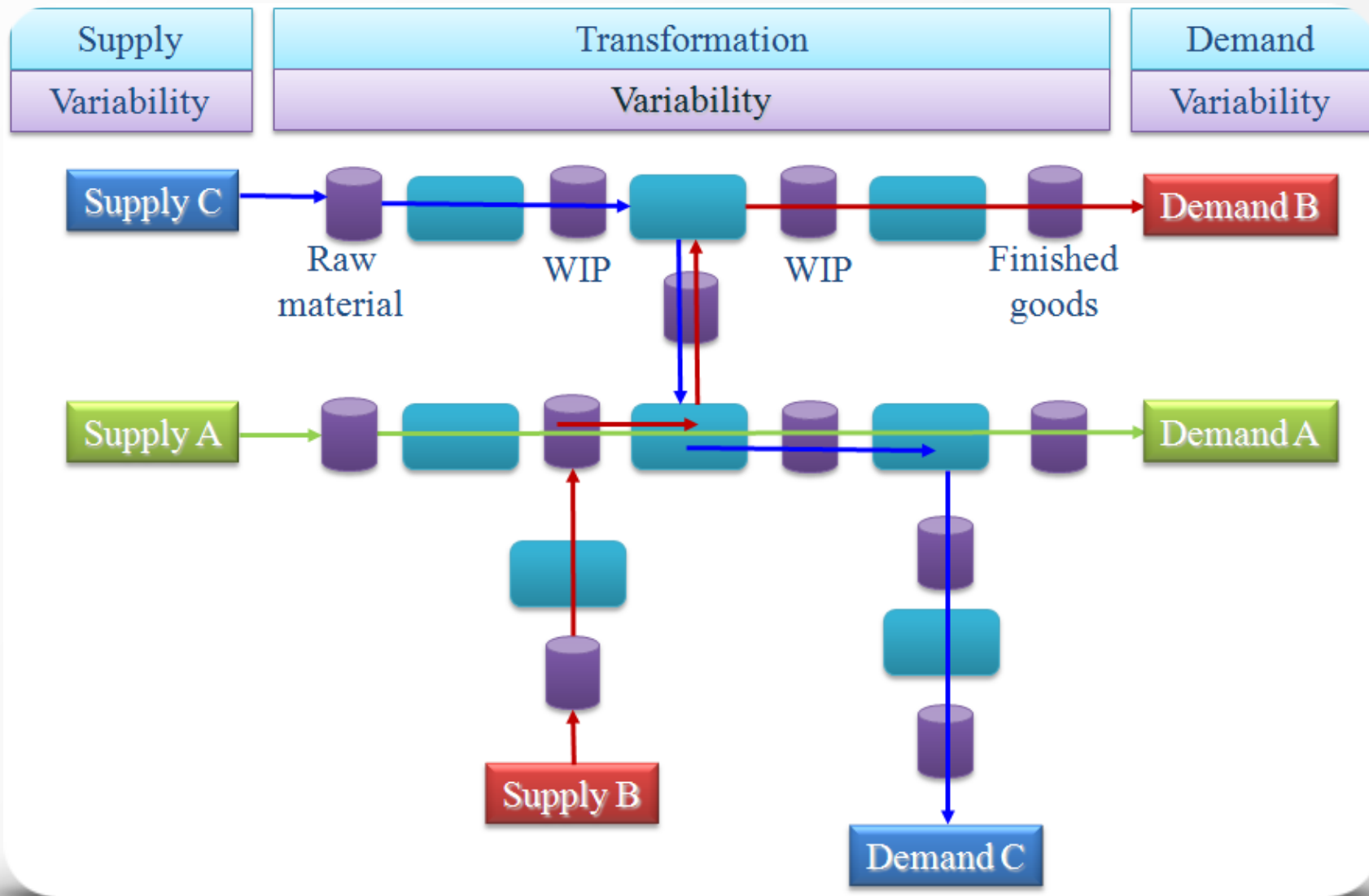
- Flow system approach
- Planning challenges
- Reason and solution for these challenges: ERP vs ARP
- Software integration with examples
- Results from practice



Flow System Approach



Flow System Approach @ Job Shops



Planning Challenges @ Job Shops

Uniform, consistent and advanced decision support tool

Monthly sales &
operations meeting

Yearly/quarterly
process flow design
and engineering

- Capacity-Demand Analysis
- Lot sizing
- Improve delivery performance
- Quickly calculate the impact of decisions during the meeting
- User friendly interface and powerful visualizations
- Integration with ERP system

- Simulation of new products
- Simulation of new layouts

Planning Challenges @ Job Shops

Stochastic nature of the manufacturing system

Demand

- Seasonality
- Product mix changes
- Phasing-in/out

Supply

- Availability of resources changes over the planning horizon
- Alternative routings, outsourcing, ...
- Lot sizes, inventory levels
- Breakdowns, scrap
- Unreliable delivery of raw material/ finished good,...

Planning Challenges @ Job Shops

Job Shop

Decision Problem

Demand Meeting

- Needs vs Supply
- Multiple functions
- Separate tools

Complex

- Interdependent
- Various goals
- Intuition

Data Warehousing

Nyo

Decision Support

Analytical S&OP

- System Approach
- Different views, same world
- One shared database

Modeling

- Flow Theory
- Performance measures
- Software implementation

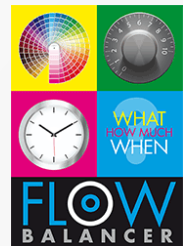
Data Discipline

S&OP Approach @ Job Shops

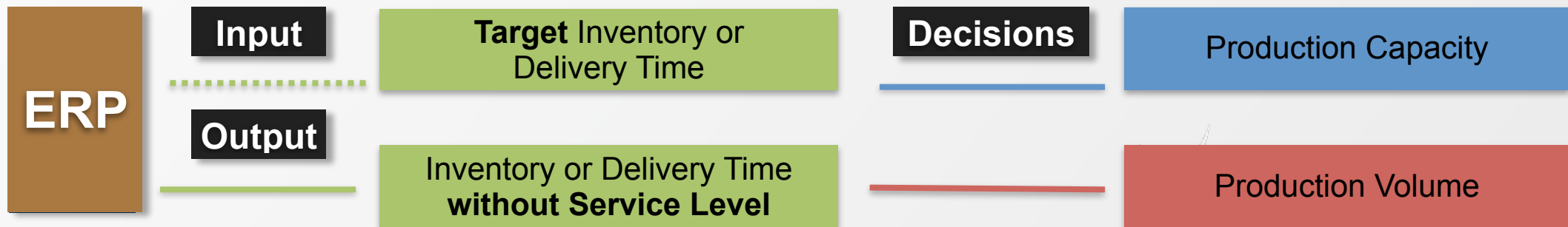
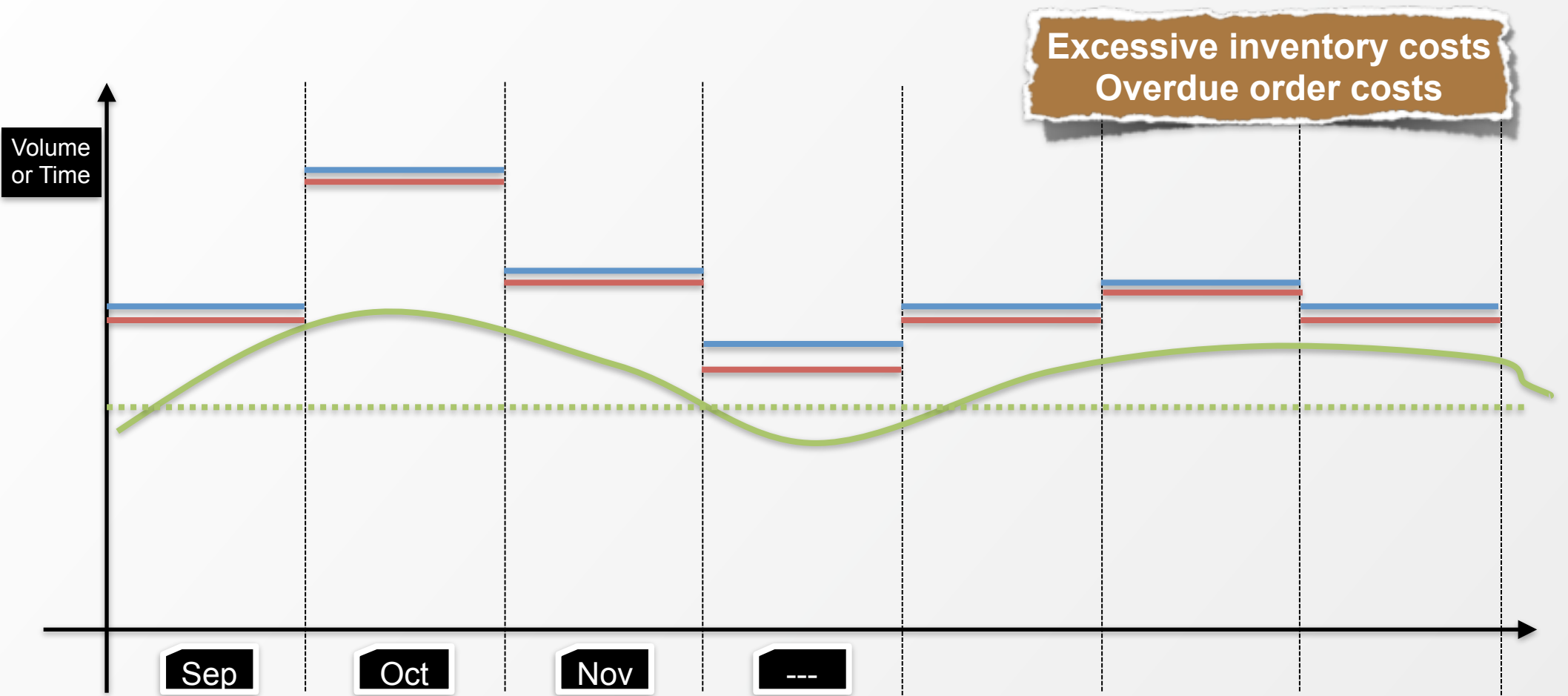
ERP: DETERMINISTIC AND STATIC PLANNING



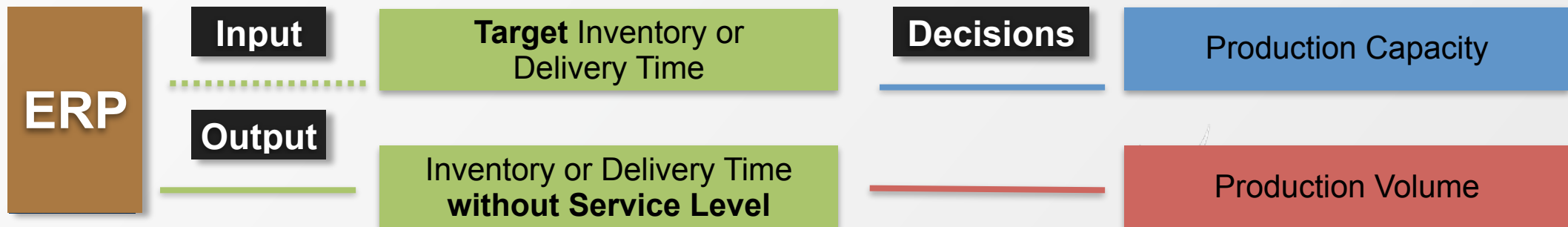
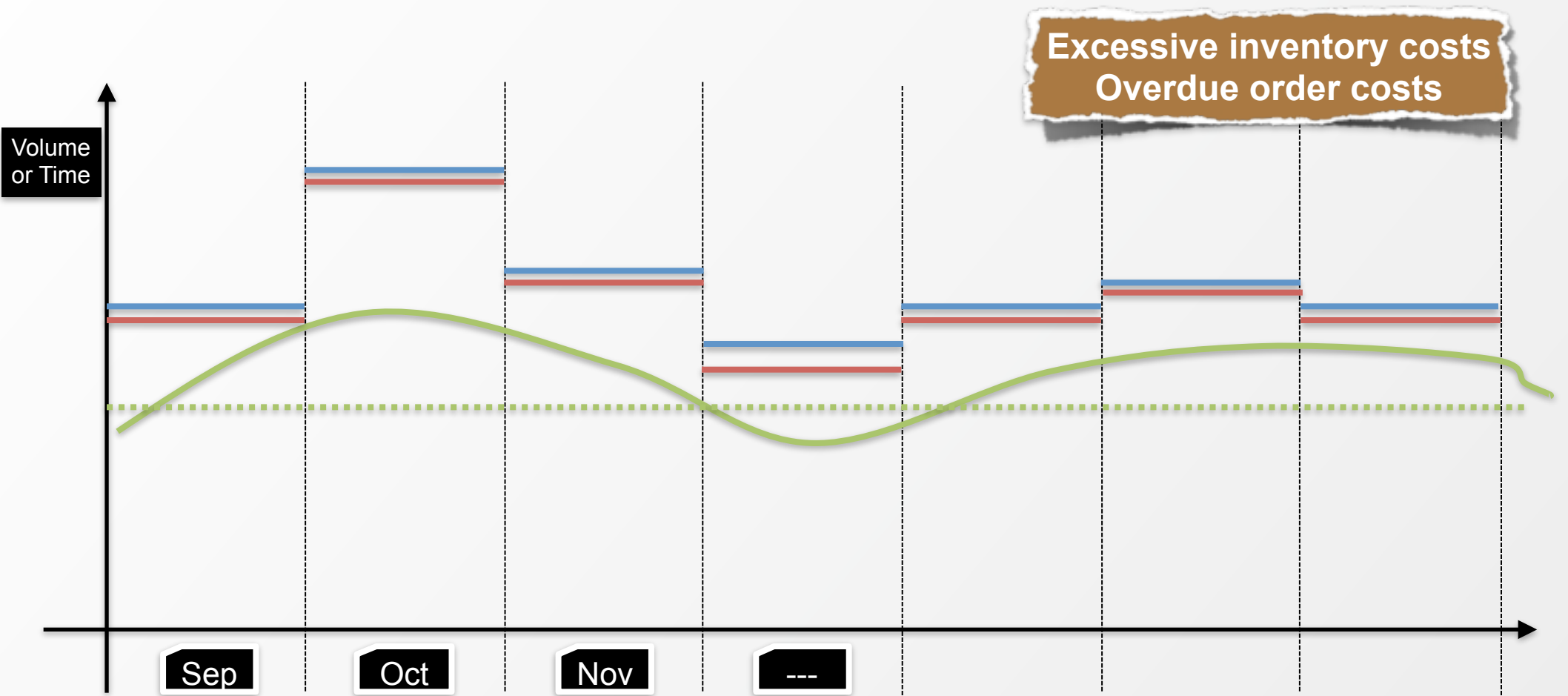
FLOWBALANCER: STOCHASTIC AND DYNAMIC PLANNING



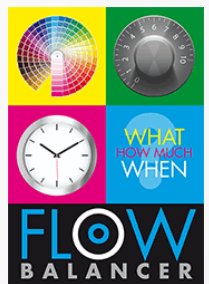
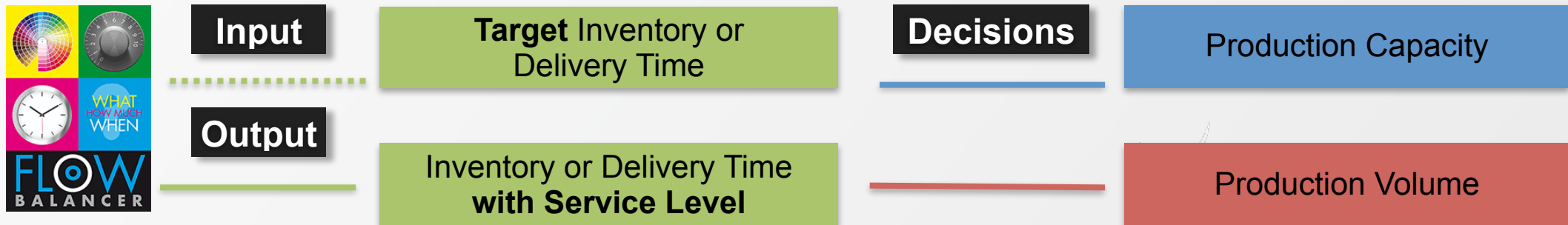
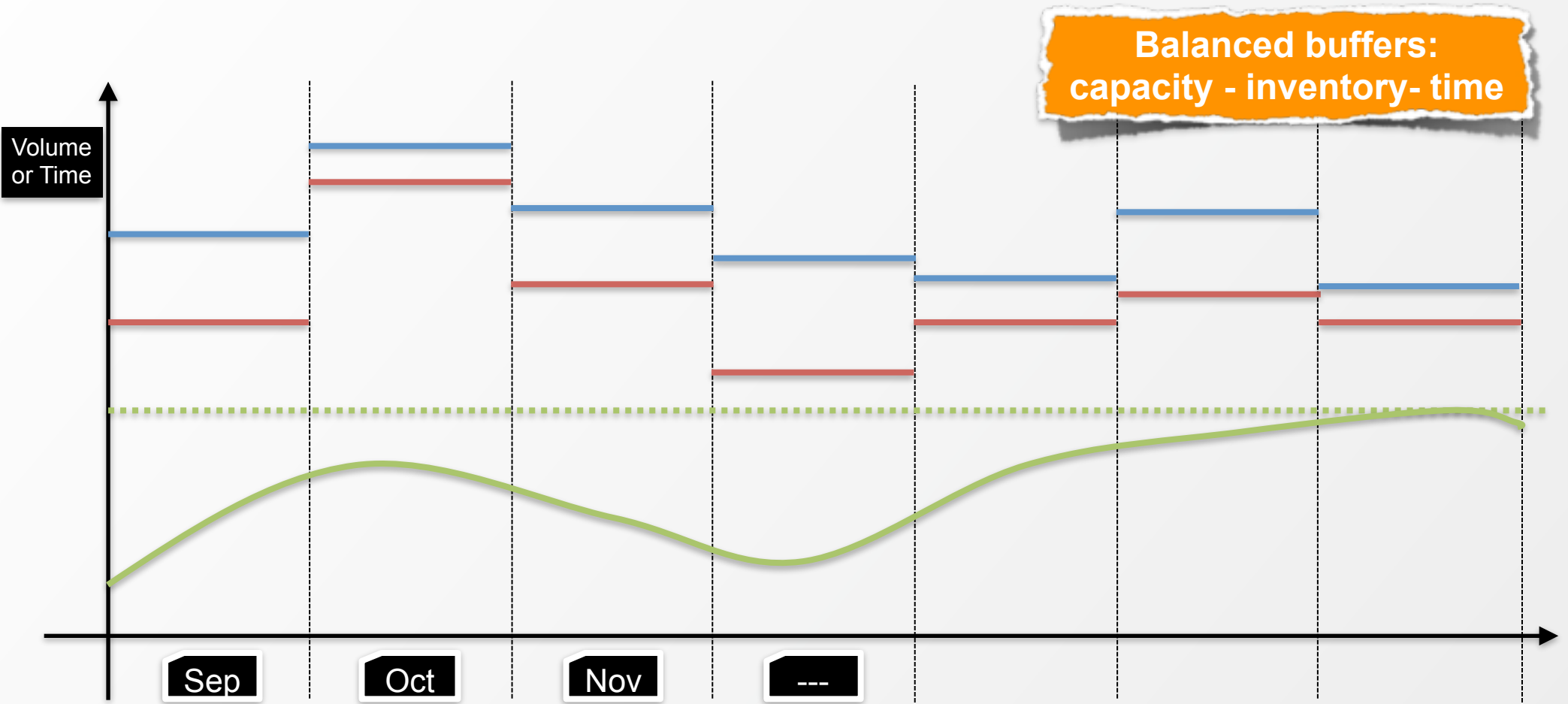
ERP @ Job Shops



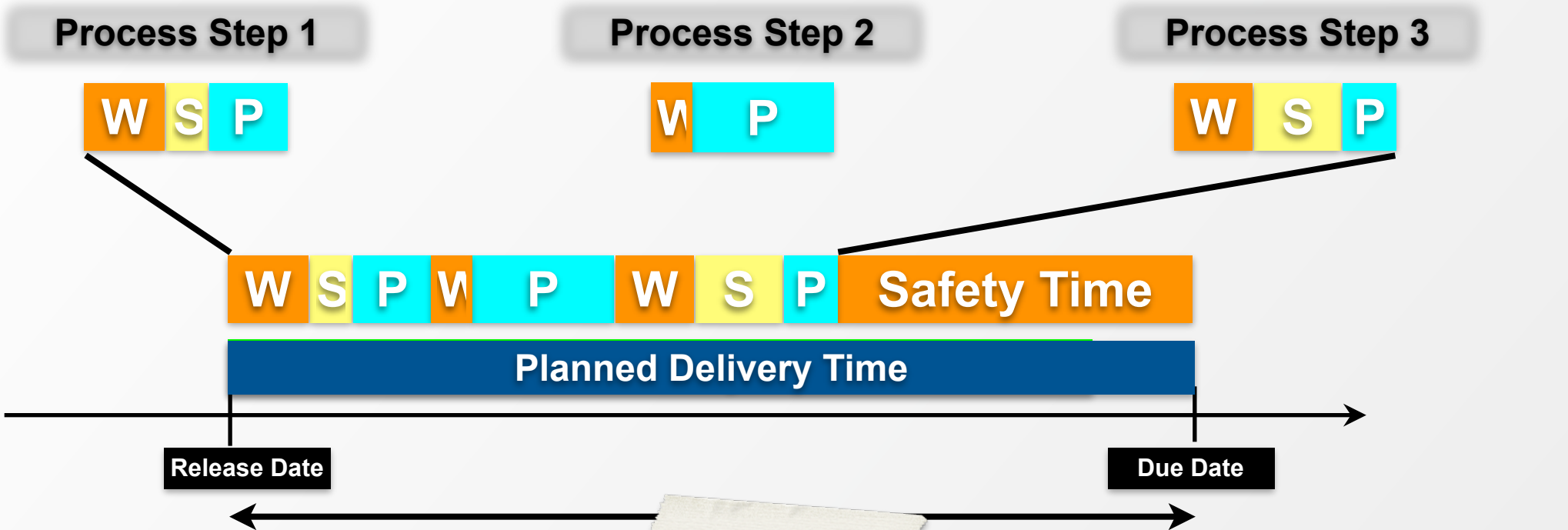
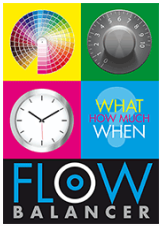
ERP @ Job Shops



ARP @ Job Shops



ARP @ Job Shops



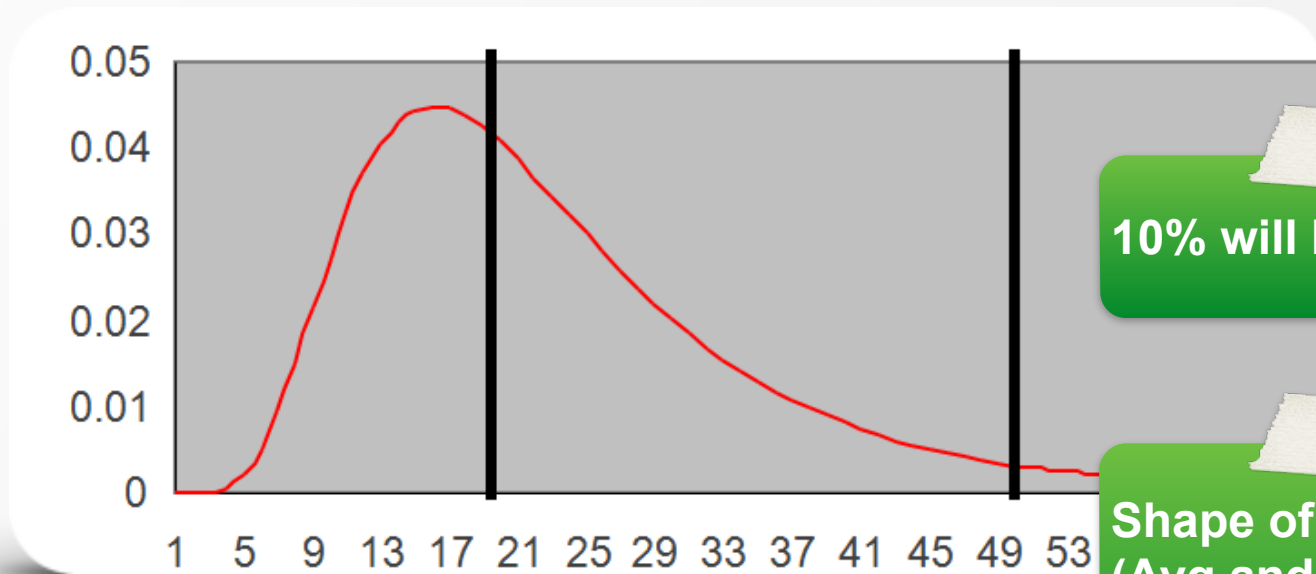
Safety Time is calculated and dynamic

Dependent on
• utilization
• product mix
• lot size
• ...

Performance is consistent:
e.g. 90% on-time

ARP @ Job Shops

If our standard is a quoted lead time to deliver within 50 hours, our customers will have a service level of 90 %



10% will be too late

Shape of the distribution
(Avg and Tail) depends on

- 'Flow System'
- S&OP decisions

Expected
Time

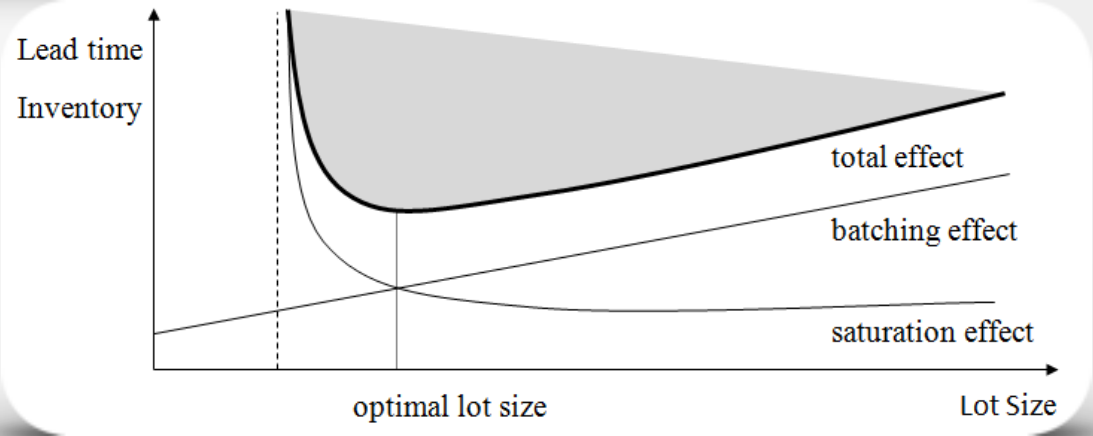
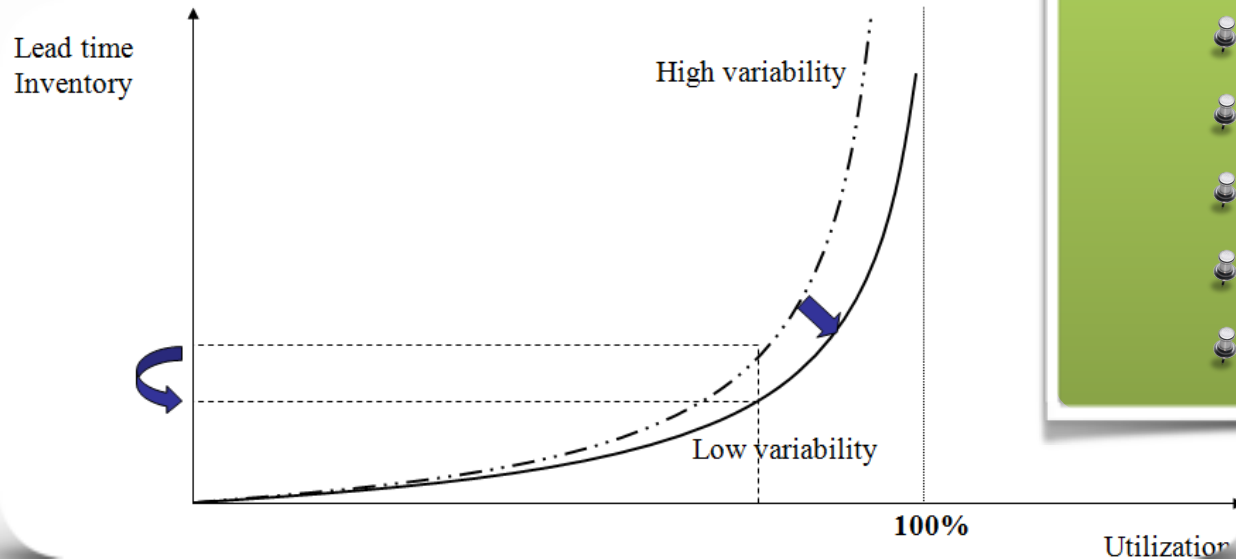
Safety
Time

Quoted Lead Time

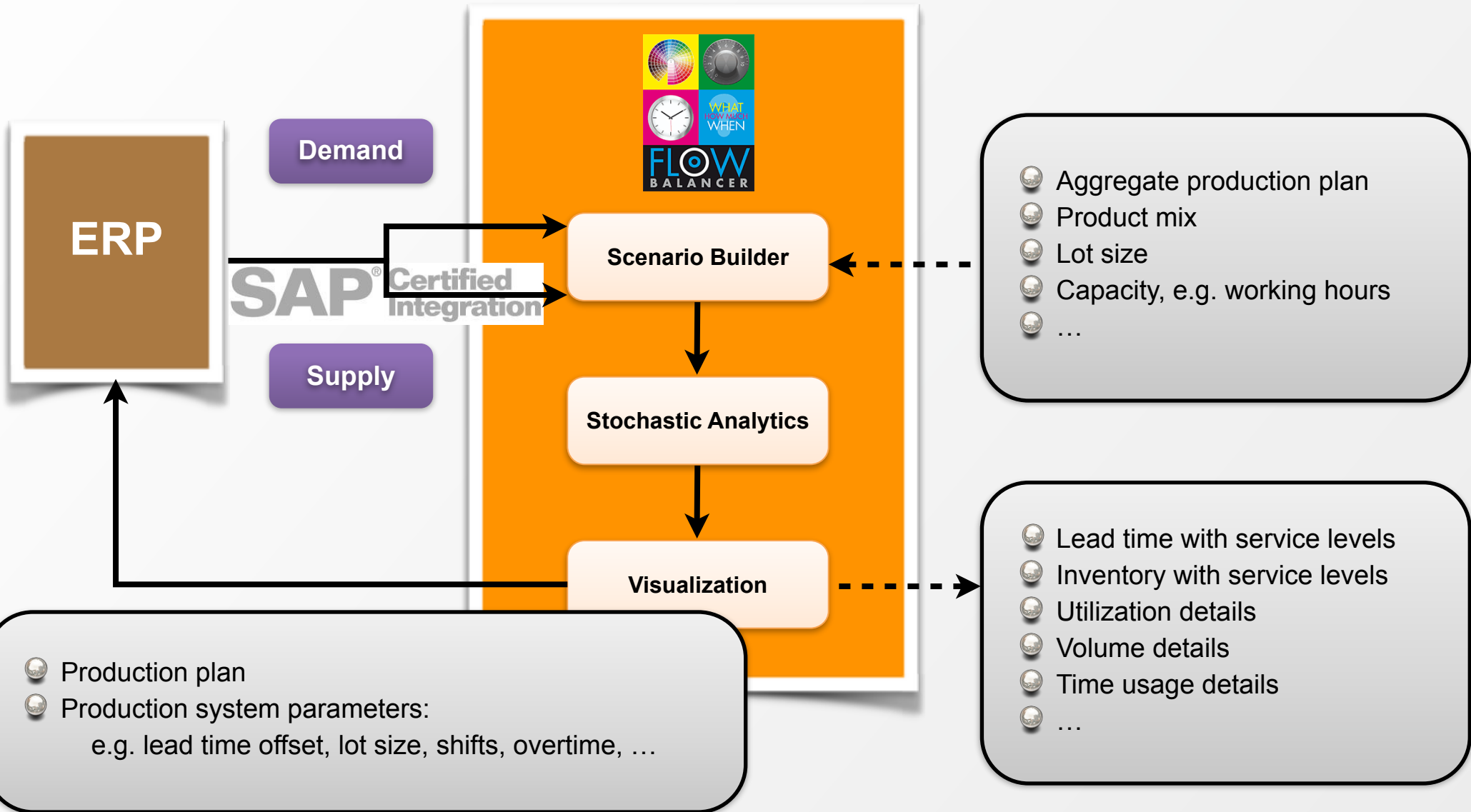
ARP @ Job Shops

KPI (lead time, inventory, ...) depends on

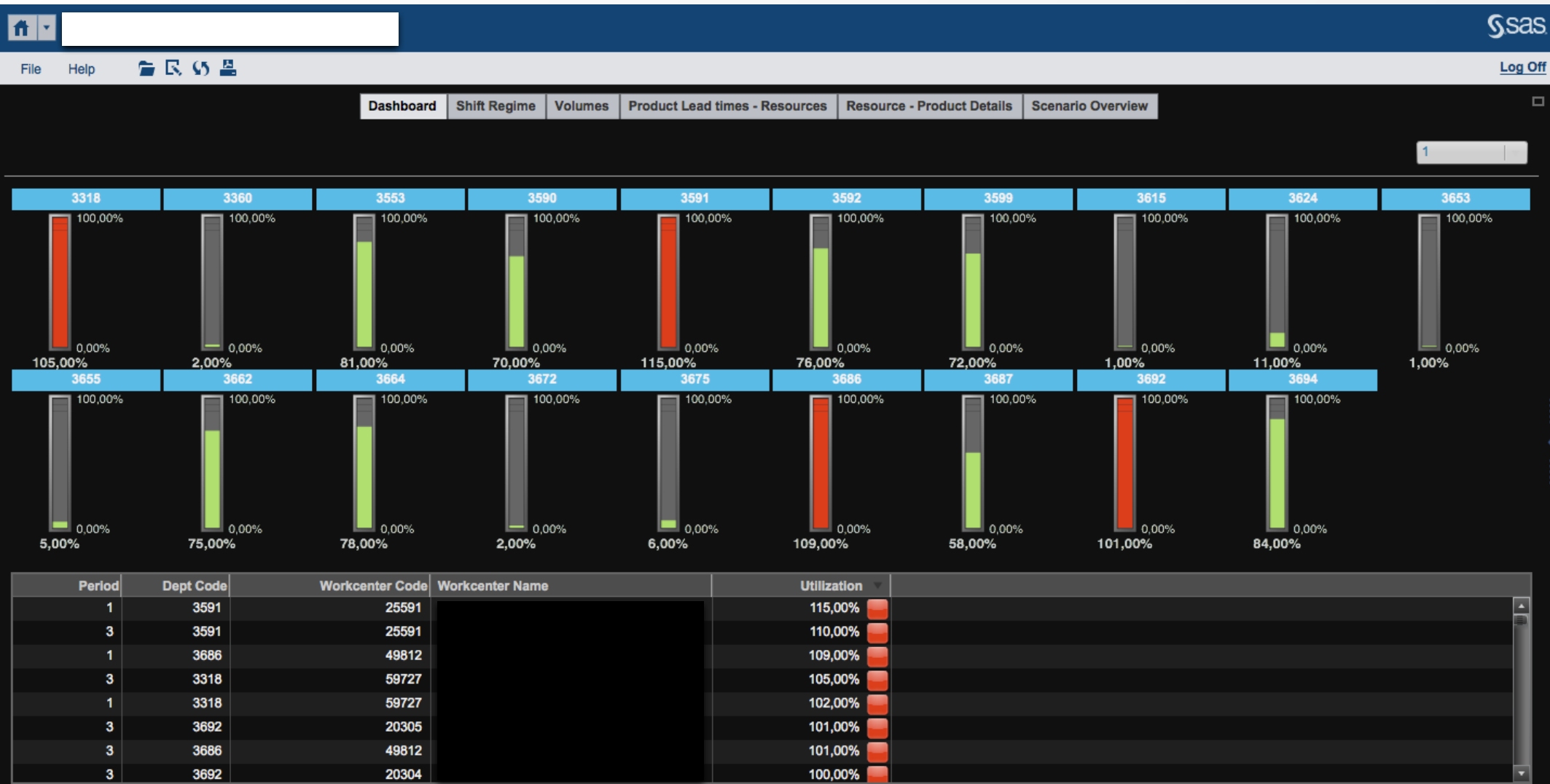
- Utilization
- Process and setup times
- Variabilities, disruptions
- Lot sizes
- Mix of routings and products
- ...



Software Integration @ Job Shops



Dashboard - Scenario 1



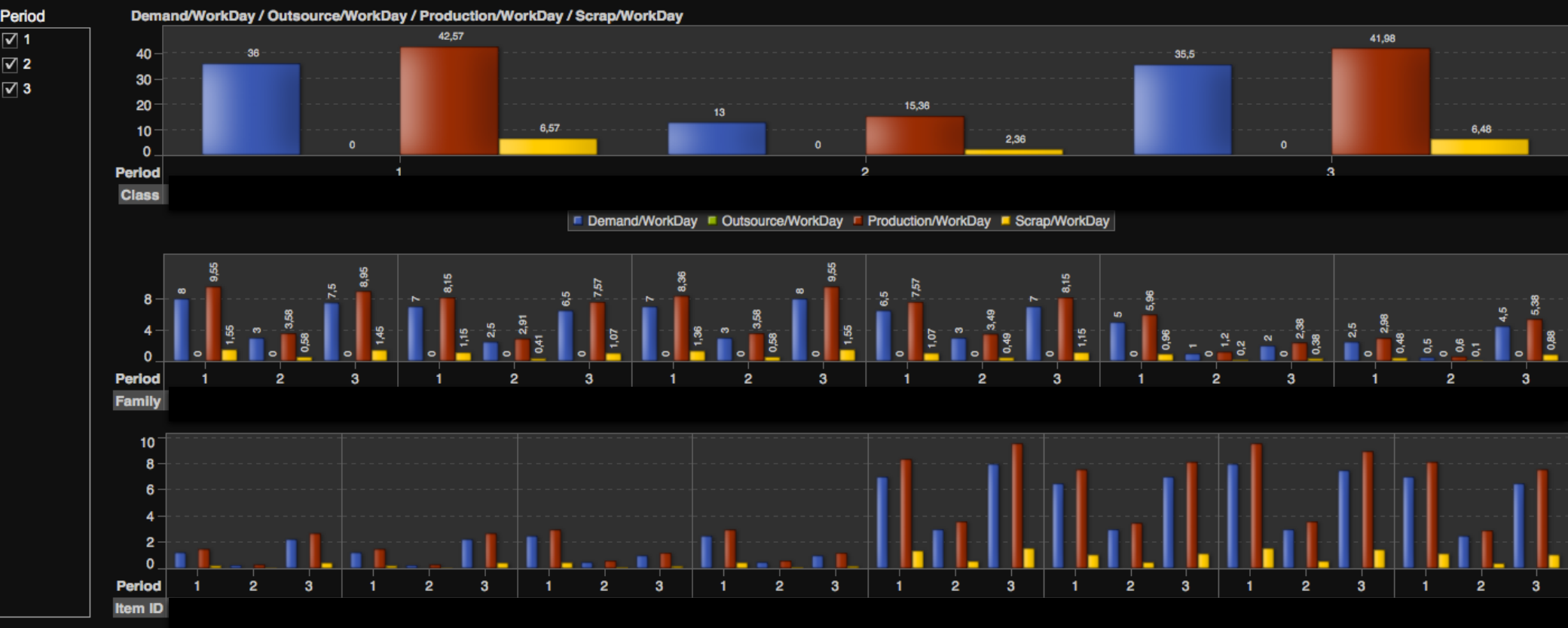
Resource Under/Overcapacity



Scenario: Use more/less shifts-overtime

Product Volumes

0 1 2 3



Scenario: Assign volume Period 1+3 to Period 2

Product Lead Times



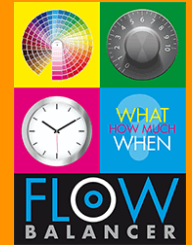
Scenario: Use alternative routing more

Product Lead Times



Scenario: Use alternative routing more

Positioning FlowBalancer



Benefits @ Dana Corporation



- Productivity: +27%
- Manufacturing lead time: -50 to -60%
- Inventory turns: from 3.5 to 6
- Workforce: +41%
- Sales/FTE: +66%
- Operating costs: more than -10%

S&OP process: **85%** of all the improvements with *mid term* planning



Detailed scheduling: the remaining **15%** with *short term* planning

Benefits @ Atlas Copco Airtec

2000 - 2012

Implementation and further development at

- Atlas Copco,
- Continental Tyres
- Baxter
- JNJ
- GSK
- UCB

- Better data quality in ERP system
- Objective and consistent decision tool
- Estimate impact of a S&OP decision on KPIs
- Accurate due date promising
- Dynamic lead time offsets, up to twice as large than used so far

**Better customer service
&
Better delivery performance**

Questions?

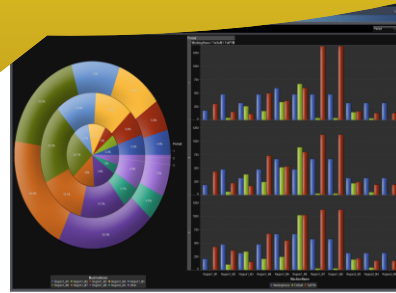


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We explicitly include the stochastic nature of the production system to allow for variability and disruptions. The mathematical expressions for the expected lead time and lead time variance depend on lot sizes. This enables the plant to minimize lead time and thus optimize lot sizes for all parts simultaneously.



If given lead times are unacceptable, adjustments are made to the capacity structure, unloading overloaded equipment or selecting alternative routings. The queuing model responds quickly to these requests, a main reason it has worked.



Rony Cremmery

Former Supply Chain Director @ Spicer-Off Highway, Dana Corp

By using these models, our organization has gained insight into non-evident impact factors like uncertainty, variability and stochasticity. This has enabled us to quantify their influence on lead times and associated costs.

Noel Janssens

Supply Chain Manager Portable Energy Spare Parts, Atlas Copco Airpower NV