

Manufacturing Optimization

Richard Troxell
Director of Business Consulting

velocity
CONNECT + ACCELERATE + INNOVATE

 LOGILITY

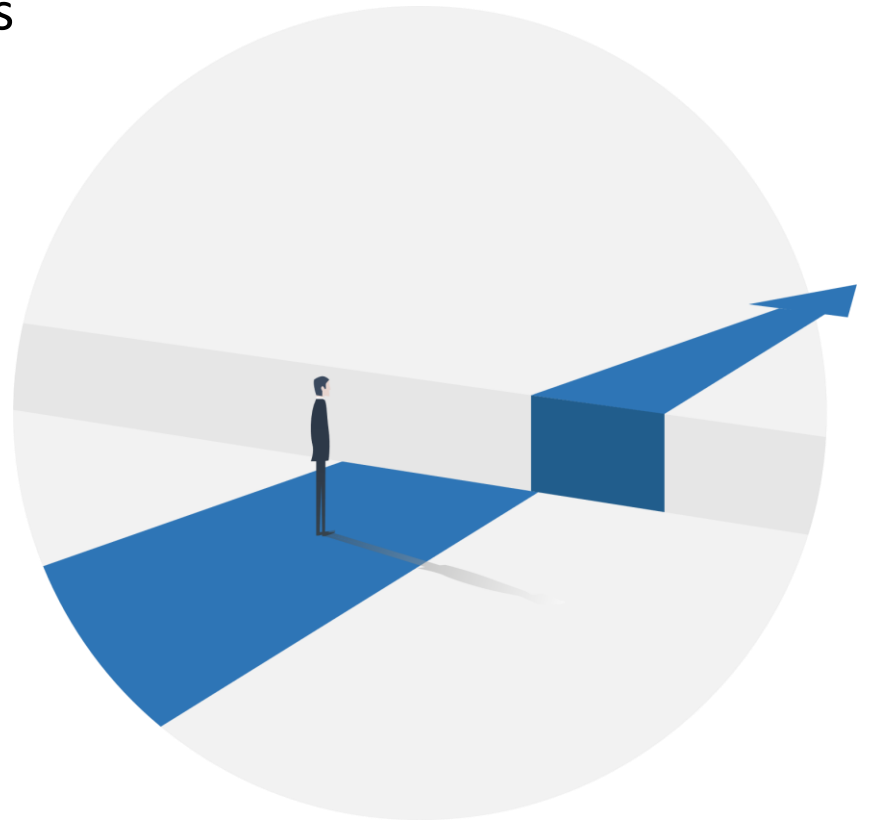
Halo 

 NGC

 Demand
Solutions®

Manufacturing Business Challenges

- ▶ Managing manufacturing complexity while minimizing planning time
- ▶ Re-planning due to demand, supply, or capacity changes
- ▶ Lack of quick what-if analysis
- ▶ Lost production time due to inefficient sequencing

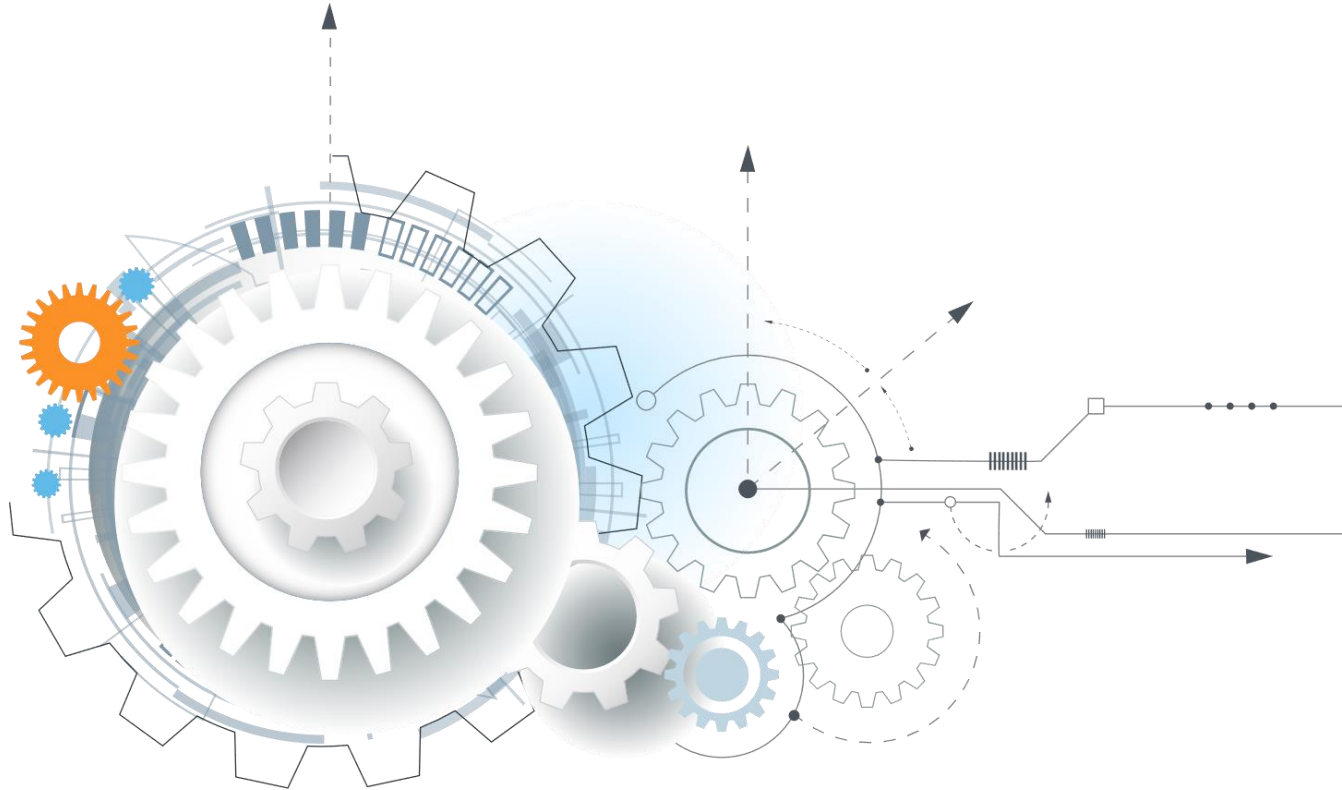


Impact on the Business

- ▶ Low customer satisfaction
- ▶ Lost sales opportunities
- ▶ Higher production costs
- ▶ Higher supply chain costs
- ▶ Lower profitability



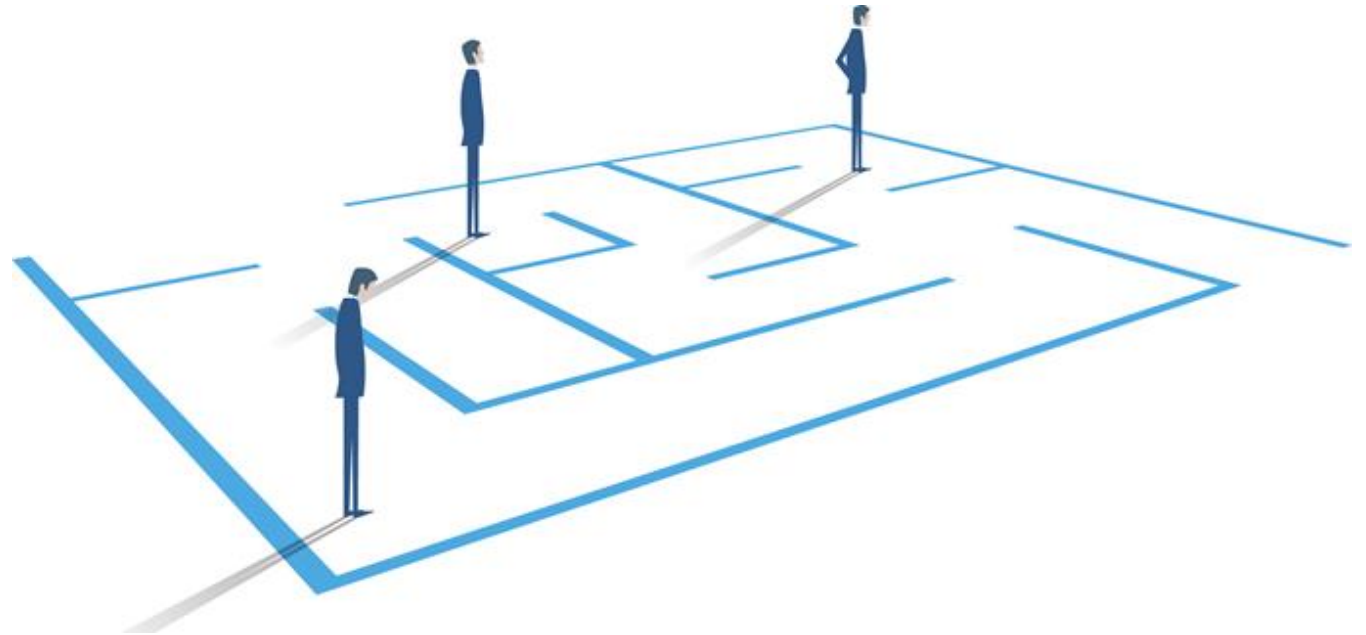
Real World Constraints



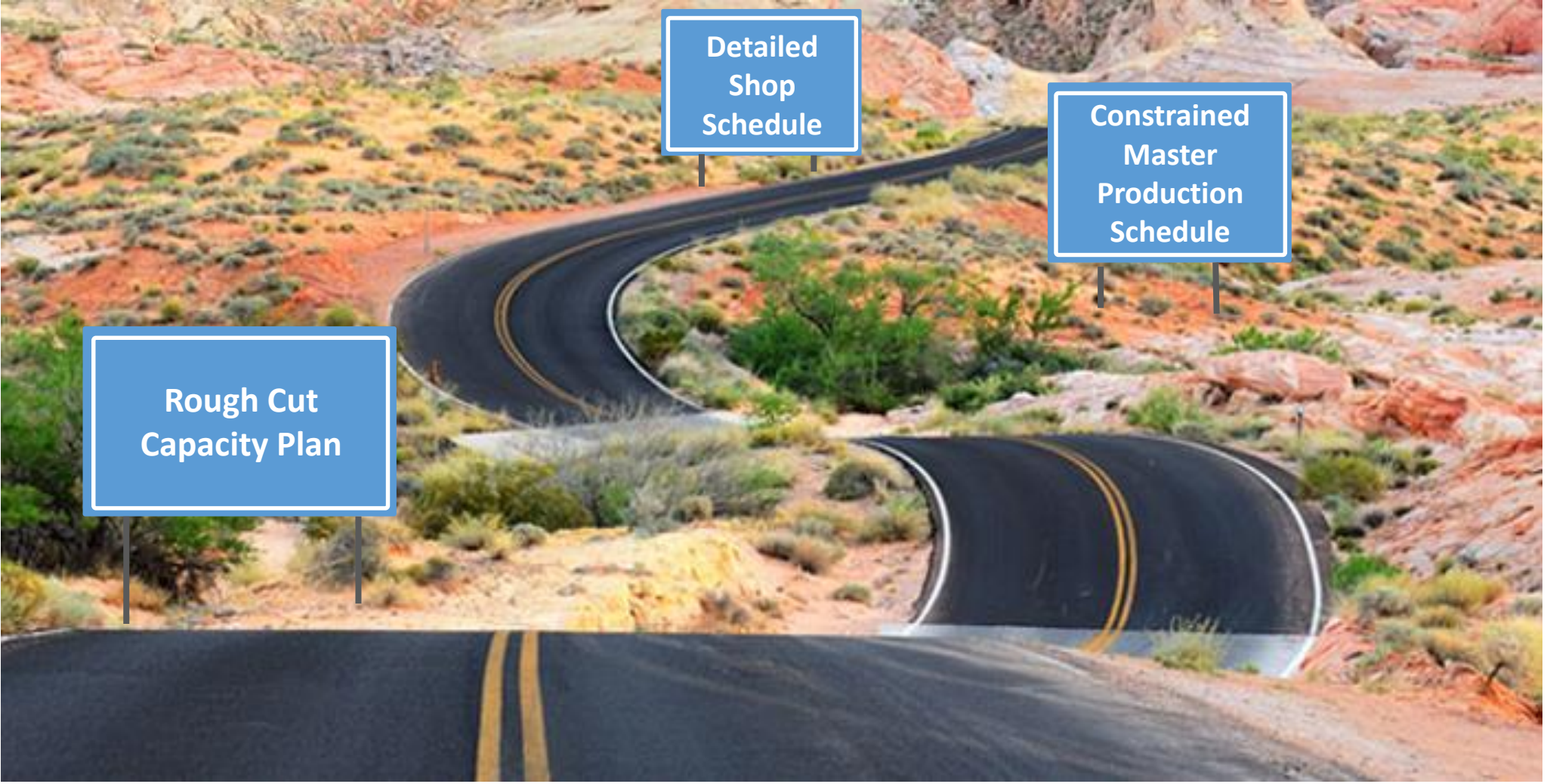
- ▶ Capacity Constraints
 - Material, Labor & Tooling Constraints
 - Lot/Batch Sizes
- ▶ PM/Downtimes
- ▶ Sequence Dependent Changeovers
- ▶ Multi-Step & Alternate Routings
- ▶ Managing Plant Disruptions & Changes
- ▶ Capture Tribal Knowledge

Impact on the Supply Chain Planning Process

- ▶ Unreliable capacity plans and production schedules make it difficult to balance supply and demand
- ▶ Other departments miss their targets:
 - Demand Planners
 - Inventory Management
 - Manufacturing
 - Sales and Customer Service



Production Planning and Scheduling



Rough Cut
Capacity Plan

Detailed
Shop
Schedule

Constrained
Master
Production
Schedule

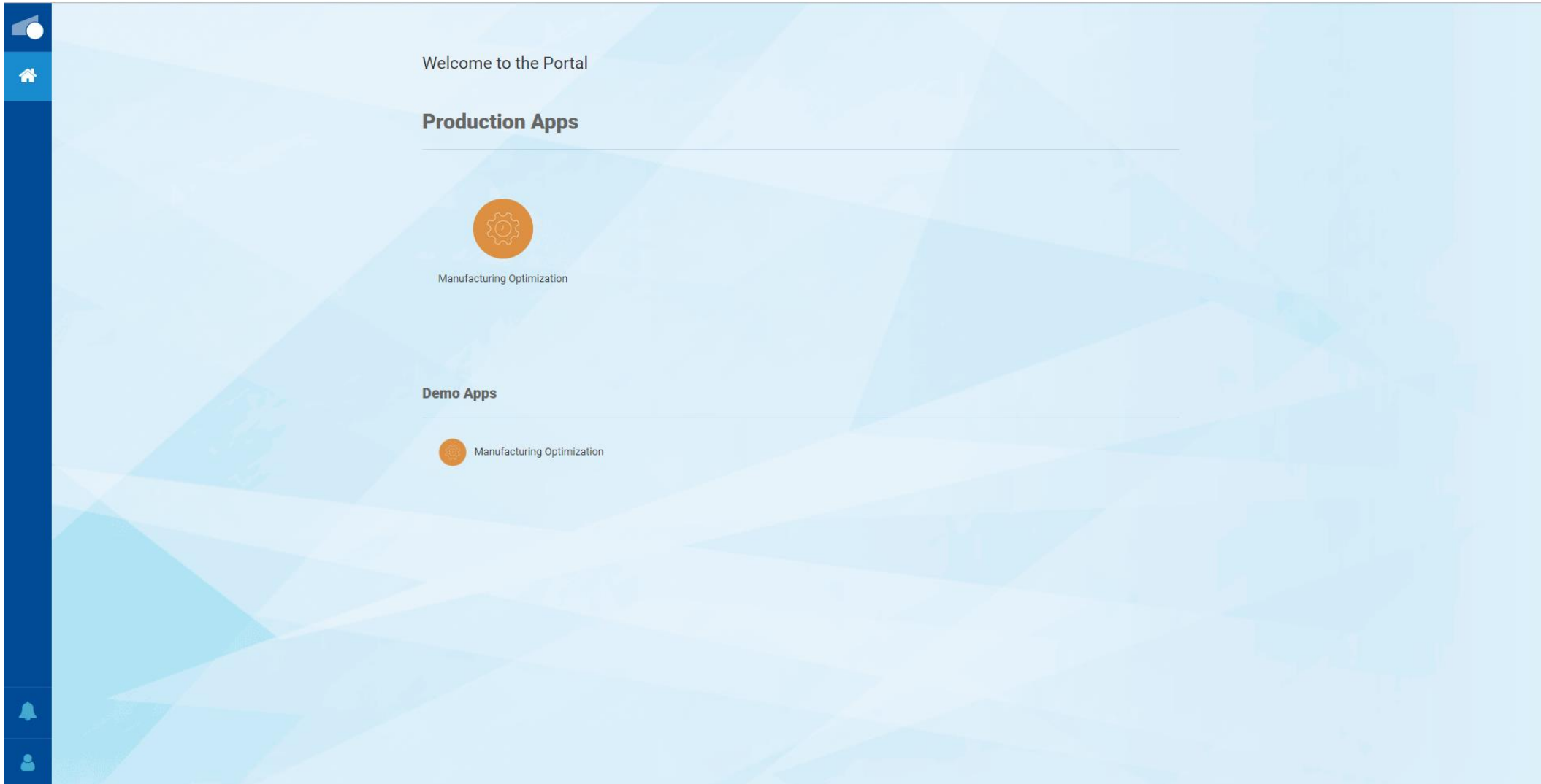
Capacity Planning and Scheduling

10	Department	Machine Type	Efficiency	Lines Avail	Forecasted Hours							
11	Thermoforming PP	Brown-52	85%	1	266	210	193	225	237	207	191	243
12	Thermoforming PP	Lyle-52H	85%	2	1,038	909	1,058	888	1,005	974	862	1,080
13	Thermoforming PP	Total	85%	3	1,303	1,119	1,251	1,113	1,242	1,180	1,053	1,323
14												
15												
16	Department	Machine Type	Efficiency	Lines Avail	Forecasted Hours							
17	Straws	Flex	85%	3	628	439	458	404	421	522	398	529
18	Straws	Straws	85%	14	4,111	3,520	8,133	7,538	7,581	8,617	7,122	8,206
19	Straws	Total	85%	17	4,739	3,959	8,591	7,942	8,001	9,140	7,520	8,735
20												
21												
22	Department	Machine Type	Efficiency	Lines Avail	Forecasted Hours							
23	DK	JK / Pouch	85%	2	24	24	29	21	24	21	21	32
24	DK	Dinner Kits 1,2,3	85%	6	3,057	2,886	2,843	2,710	2,762	2,426	2,568	2,656
25	DK	Dinner Kits 4	85%	2	32	22	28	19	25	35	23	29
26	DK	O.Wrap / CK	85%	2	9	6	4	4	6	4	4	3
27	DK	Total	85%	12	3,123	2,938	2,903	2,755	2,816	2,486	2,616	2,721

45%	41%	48%	50%	34%	45%	43%	39%	47%	41%	38%	43%
23%	18%	15%	15%	18%	18%	20%	16%	16%	12%	14%	17%
74%	75%	69%	78%	60%	70%	75%	63%	68%	60%	61%	69%
28%	30%	28%	24%	25%	29%	29%	29%	20%	22%	19%	26%
10%	11%	8%	14%	10%	11%	12%	7%	15%	8%	6%	10%
15%	14%	11%	15%	17%	11%	14%	17%	13%	15%	15%	15%
42%	31%	32%	24%	27%	32%	29%	32%	34%	68%	50%	39%
46%	42%	42%	42%	35%	41%	43%	39%	37%	28%	26%	39%
50%	45%	46%	48%	42%	44%	45%	45%	45%	41%	41%	46%
45%	41%	36%	37%	31%	40%	41%	39%	33%	27%	24%	37%
57%	54%	59%	59%	53%	54%	57%	53%	54%	51%	52%	56%
32%	27%	27%	27%	27%	30%	27%	23%	22%	16%	9%	24%
69%	65%	72%	72%	67%	72%	67%	67%	67%	67%	67%	68%
84%	78%	87%	87%	81%	87%	81%	81%	81%	81%	81%	84%
69%	64%	67%	72%	64%	59%	64%	70%	63%	64%	64%	66%
62%	63%	57%	67%	56%	59%	62%	61%	58%	55%	50%	60%
17%	12%	9%	10%	10%	9%	14%	14%	19%	19%	11%	14%
10%	8%	10%	8%	8%	8%	10%	9%	7%	9%	5%	9%
43%	39%	39%	40%	36%	40%	40%	39%	38%	35%	32%	39%

1							Jan	Feb	Mar	Apr	May	Jun	Jul	FY
2	Department	Tool	Machine Type	Prod Line	Efficiency	Tools Avail	Forecasted Hours							
3	Injection Molding	F1	KM450	F1	80%	2	340	412	386	428	456	309	332	4,769
4	Injection Molding	F2	KM450	F2	80%	1	248	303	308	279	338	294	275	3,652
5	Injection Molding	F3	KM450	F3	80%	1	129	121	146	113	114	88	103	1,471
6	Injection Molding	H1	KM450	H1	80%	1	435	471	539	457	493	433	441	5,842
7	Injection Molding	H3	KM450	H3	80%	1	178	195	208	208	145	156	136	2,233
8	Injection Molding	H4	KM450	H4	80%	1	75	77	86	53	106	60	45	862
9	Injection Molding	K3	KM450	K3	80%	1	124	74	103	121	97	111	107	1,257
10	Injection Molding	C7	KM450	C7	80%	1	195	217	210	231	244	488	361	3,314
11	Injection Molding	P1/C1	KM450	P1/C1	80%	3	758	836	934	850	791	605	563	10,005
12	Injection Molding	P2/C2	KM450	P2/C2	80%	2	608	595	653	641	652	592	585	7,781
13	Injection Molding	P3/C3	KM450	P3/C3	80%	3	674	810	883	840	711	583	511	9,366
14	Injection Molding	P4/C4	KM450	P4/C4	80%	1	383	363	408	382	389	364	373	4,750
15	Injection Molding	P5/C5	KM450	P5/C5	80%	3	578	596	582	502	474	344	186	6,242
16	Injection Molding	PL2	KM450	PL2	80%	1	481	481	481	481	481	481	481	5,775
17	Injection Molding	PL3	KM450	PL3	80%	1	583	583	583	583	583	583	583	7,192
18	Injection Molding	S1	KM450	S1	80%	2	914	795	925	1,005	902	929	917	11,225
19	Injection Molding	S2/H2	KM450	S2/H2	80%	1	406	396	449	439	415	394	361	5,111
20	Injection Molding	S3	KM450	S3	80%	1	74	59	98	103	135	136	80	1,163
21	Injection Molding	S4	KM450	S4	80%	1	61	54	74	62	53	65	39	747
22	Injection Molding	Total			80%	28	7,246	7,438	8,057	7,777	7,579	7,014	6,480	92,756

Manufacturing Optimization (MO)



Master Production Scheduling

From Wikipedia, the free encyclopedia

- ▶ A master production schedule (MPS) is a plan for individual commodities to be produced in each time period...This plan quantifies significant processes and resources in order to optimize production, to identify bottlenecks, and to anticipate needs ...Typical MPSs are created by software with user tweaking.
- ▶ Master Production Schedules do not include every aspect of production, but only key elements that have proven their control effectivity...The choice of what to model varies among companies and factories.
- ▶ The MPS translates the customer demand (sales orders, PIR's), into a build plan using planned orders...Using MPS helps avoid shortages, costly expediting, last minute scheduling, and inefficient allocation of resources...
- ▶ A MPS is not a Final Shop Schedule ... calculating scheduling and execution details after MRP

Capacity Planning with MO

Monthly, Weekly, Daily

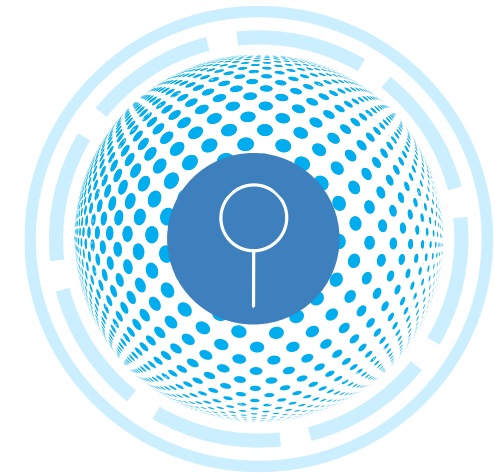
► Constrained Master Production Schedule

- Multiple scenario comparisons – unconstrained vs. constrained
- Handle multiple plants and contract manufacturers
- Take demand, fill in capacity model and
 - Leave things in an overload situation to show
 - Exactly how over utilized key resources are
 - Exactly which products and/or customers are at risk
 - And ...
 - Perform “build ahead” level loading
 - Show how soon to start production to avoid the overloads and satisfy demand



Planning Process Flow

- ▶ **Model any production process:**
 - Batch process – Food, pharma, beverage, paint, CPG, chemical, etc.
 - Discrete Fab/Assembly – Automotive, aerospace, job shop, etc.
 - Make to Order, Make to Stock
- ▶ **Model any calendar:**
 - By plant, department or individual work station
 - Operators as well as equipment
- ▶ **Model any secondary constraint:**
 - Tooling, operators, critical BOM items, etc.
- ▶ **Model set up/changeover/cleanup segments accurately:**
 - Set up/clean up segments calculated dynamically and sequence-dependent



Planning Process Flow



12 – 18 Months

3 – 6 Months

Weeks / Days

Days / Hours

Long Term Sales Plan

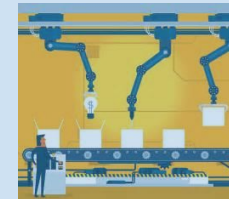
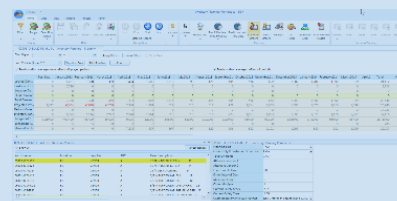
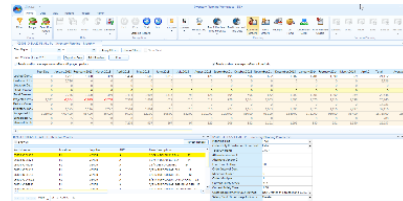
Parts Ordering

Master Schedule

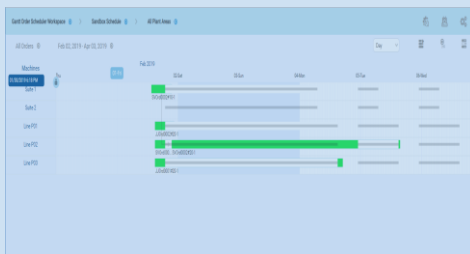
Assembly Schedule

Machining Schedule

Die Cast Schedule



Long Term Capacity Plan



MO Progressive Disclosure Menu

Workspaces >	Plants	
Capacity >	Plant Areas	
Product >	Machines	
Process >	Tooling	
Demand >	Labor	
Reports >	Work Centers	
Settings >	Cycles	
Notifications	Patterns	
	Holidays	

Workspaces >	Work Orders	
Capacity >	Order Filter	
Product >	Due Date Quoting	
Process >	Order Split	
Demand >		
Reports >		
Settings >		
Notifications		

Workspaces >	Routings	
Capacity >	Codes	
Product >	Equations	
Process >	Matrices	
Demand >	Look Up	
Reports >		
Settings >		
Notifications		

MO Tailored Workspaces

Gantt Order Scheduler Workspace > Sandbox Schedule > All Plant Areas

All Orders Feb 02, 2019 - Apr 03, 2019 Day

Machines

01/30/2019 6:18 PM Suite 1

01-Fri Feb 2019 02-Sat 03-Sun 04-Mon 05-Tue 06-Wed

SVOrd0002#10-1

JJOrd0002#20-1

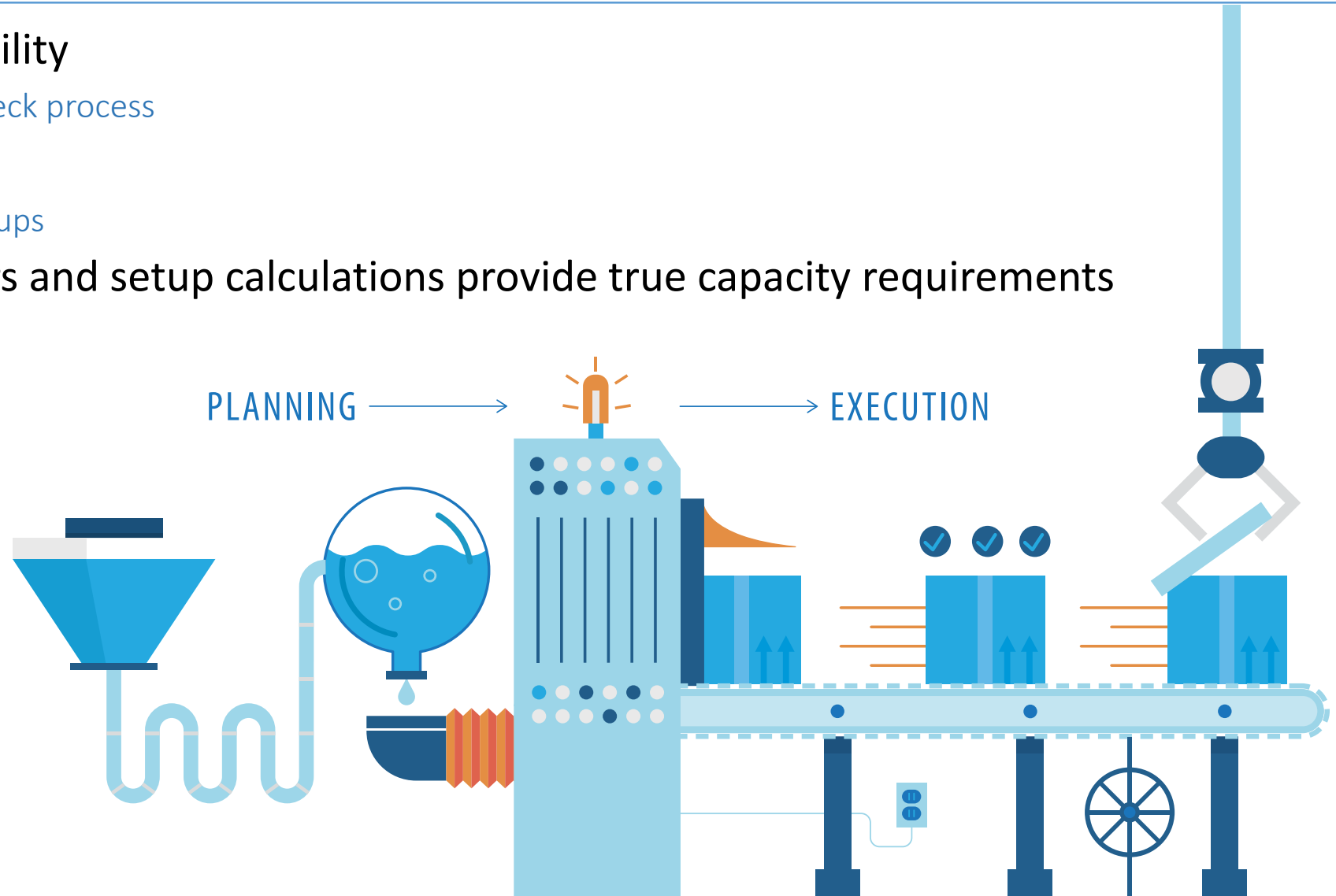
SVOrd000...SVOrd0002#20-1

JJOrd0001#20-1

<input type="checkbox"/>	Order Number	# of Operations	Status	Customer Name	Due Date	Earliest Start	Schedule Start	Schedule End	H
<input type="checkbox"/>	JJOrd0001	2	Early	Johnson and Johnson	02/11/2019 10:06:00	02/01/2019 10:06:00		02/04/2019 12:00:00	0
<input type="checkbox"/>	JJOrd0002	2	Early	Johnson and Johnson	02/15/2019 10:08:00	02/01/2019 10:07:00		02/01/2019 05:30:00	0
<input type="checkbox"/>	SVOrd0001	2	Early	Suave	02/08/2019 10:12:00	02/01/2019 10:12:00		02/01/2019 04:00:00	0
<input type="checkbox"/>	SVOrd0002	2	Early	Suave	02/15/2019 10:13:00	02/01/2019 10:13:00		02/05/2019 10:36:00	0

Capacity Planning Model

- ▶ Increase schedule visibility
 - Can be driven by bottleneck process
- ▶ Production schedule
 - Sequence dependent setups
- ▶ Detailed shop calendars and setup calculations provide true capacity requirements



MO Environment

This screenshot shows the MO Environment interface. The breadcrumb navigation at the top reads "Gantt2 > Sandbox Schedule > DefaultPA". A dropdown menu is open under "Sandbox Schedule", listing three options: "Choose the schedule", "Live Schedule", and "Sandbox Schedule". The left sidebar contains a vertical menu with icons for various functions: a gear (settings), a calendar, a factory floor, a machine, a document, a gear, a bell with a red notification circle, and a globe.

This screenshot shows the MO Environment interface with a different dropdown menu open. The breadcrumb navigation at the top reads "Gantt2 > Sandbox Schedule > DefaultPA". The dropdown menu under "DefaultPA" lists three options: "Your Plant areas", "All Plant Areas", and "DefaultPA". The main content area shows a table with columns for "All Orders", "Machines", and "TestMach". The "All Orders" column contains the text "Jan 01, 2018 - Mar 02, 20...". The "Machines" column contains "27-...". The "TestMach" column contains a yellow bar. The left sidebar is identical to the first screenshot.

MO Tailored Workspaces

Gantt w Stats and Orders > Sandbox Schedule > All Plant Areas

Three Days

All Orders Feb 02, 2019 - Apr 03, 2019

Feb 2019

Machines	30 Jan 12:00 AM	02 Feb 12:00 AM	05 Feb 12:00 AM	08 Feb 12:00 AM	11 Feb 12:00 AM	14 Feb 12:00 AM	17 Feb 12:00 AM	20 Feb 12:00 AM
Suite 1		SVOrd0002#10-1						
Suite 2								
Line P01		JJOrd0002#20-1						
Line P02		S... SVOrd0002#20-1						
Line P03		JJOrd0001#20-1						

Orders

- Completed
- Suspended
- Expected Late
- Late
- On Time

System Order Statistics

Total 4

Completed 0

Suspended 0

Active 4

Schedule Operation Statistics

Total 8

Complete 0

Suspended 0

Scheduled 8

Unscheduled 0

Total Active 8

On Time 0

Expected Late 0

Late 8

Operations

- Completed
- Suspended
- Expected Late
- Late
- On Time

<input type="checkbox"/>	Order Number	# of Operations	Status	Customer Name	Due D
<input type="checkbox"/>	JJOrd0001	2	Early	Johnson and Johnson	02/11
<input type="checkbox"/>	JJOrd0002	2	Early	Johnson and Johnson	02/15
<input type="checkbox"/>	SVOrd0001	2	Early	Suave	02/08
<input type="checkbox"/>	SVOrd0002	2	Early	Suave	02/15

MO Scheduling and Capacity Planning Settings

Gantt2 > Sandbox Schedule > DefaultPA

All Orders Jan 01, 2018 - Mar 02, 2018 Day

Generate Schedule

Gantt2 > Sandbox Schedule > DefaultPA

All Orders Jan 01, 2018 - Mar 02, 2018 Day

Machines Mar 2018

Get Live Schedule

Generate Schedule

Order Filter Schedule Setting Generate

Select Order Filter:

Select Setting:

MO Scheduling and Capacity Planning Settings

Gantt2 > Sandbox Schedule > DefaultPA

All Orders Jan 01, 2018 - Mar 02, 2018

Day
Global Settings

Configuration ✕

> Units

<p>Setup Units</p> <p>Hours ▼</p> <p>Cleanup Units</p> <p>Hours ▼</p> <p>Transfer Time</p> <p>Hours ▼</p> <p>Step Size in Iterations</p> <p>Hours ▼</p>	<p>Run Units</p> <p>Pieces/Hour ▼</p> <p>Overtime</p> <p>Hours ▼</p> <p>Time Fence</p> <p>Hours ▼</p> <p>Lag</p> <p>Hours ▼</p>
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> Schedule

Base Date

01/01/2018 1:00 AM

Predecessor Operations

▼

Successor Operations

▼

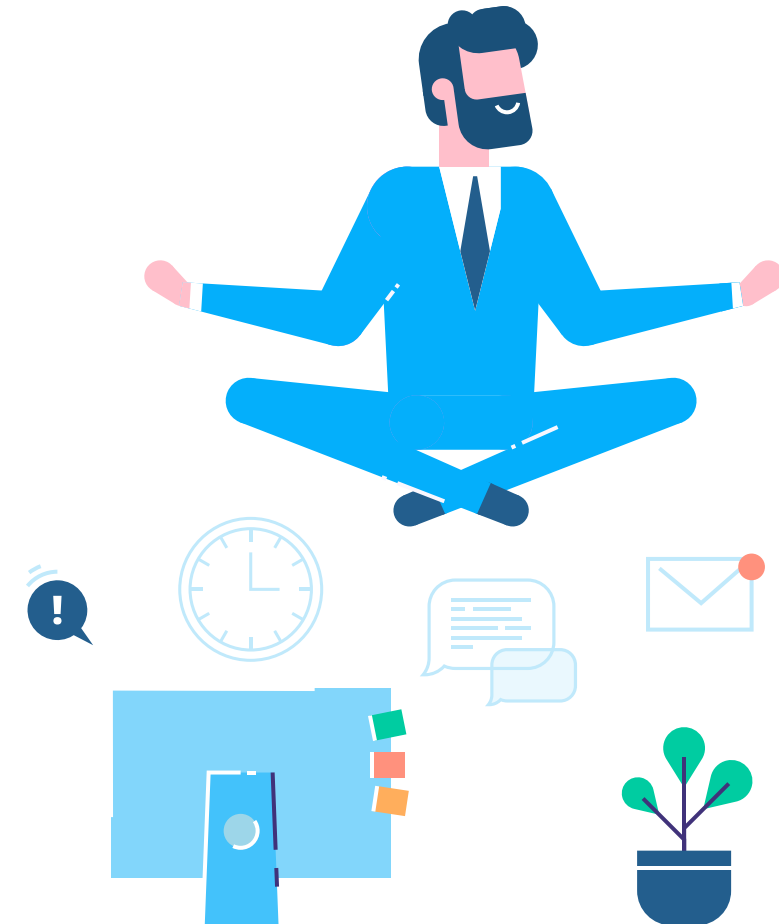
<p>Lateness</p> <input type="text"/>	<p>Setup Savings</p> <input type="text"/>
<p>Cost Function</p> <input type="text"/>	<p>Promptness</p> <input type="text"/>
<p>Preference</p> <input type="text"/>	<p>Idle Cost</p> <input type="text"/>

JIT

Production Updates

The Virtues of Clean Planning

- ▶ Feasible plans
 - Lead to achievable schedules
 - Difficult to do in complex environments
- ▶ Achievable schedules
 - Start with feasible plans
 - Lead to predictable production
- ▶ Predictable production
 - A “Lean” principle
 - Symptom of good planning



MO Master Production Schedule

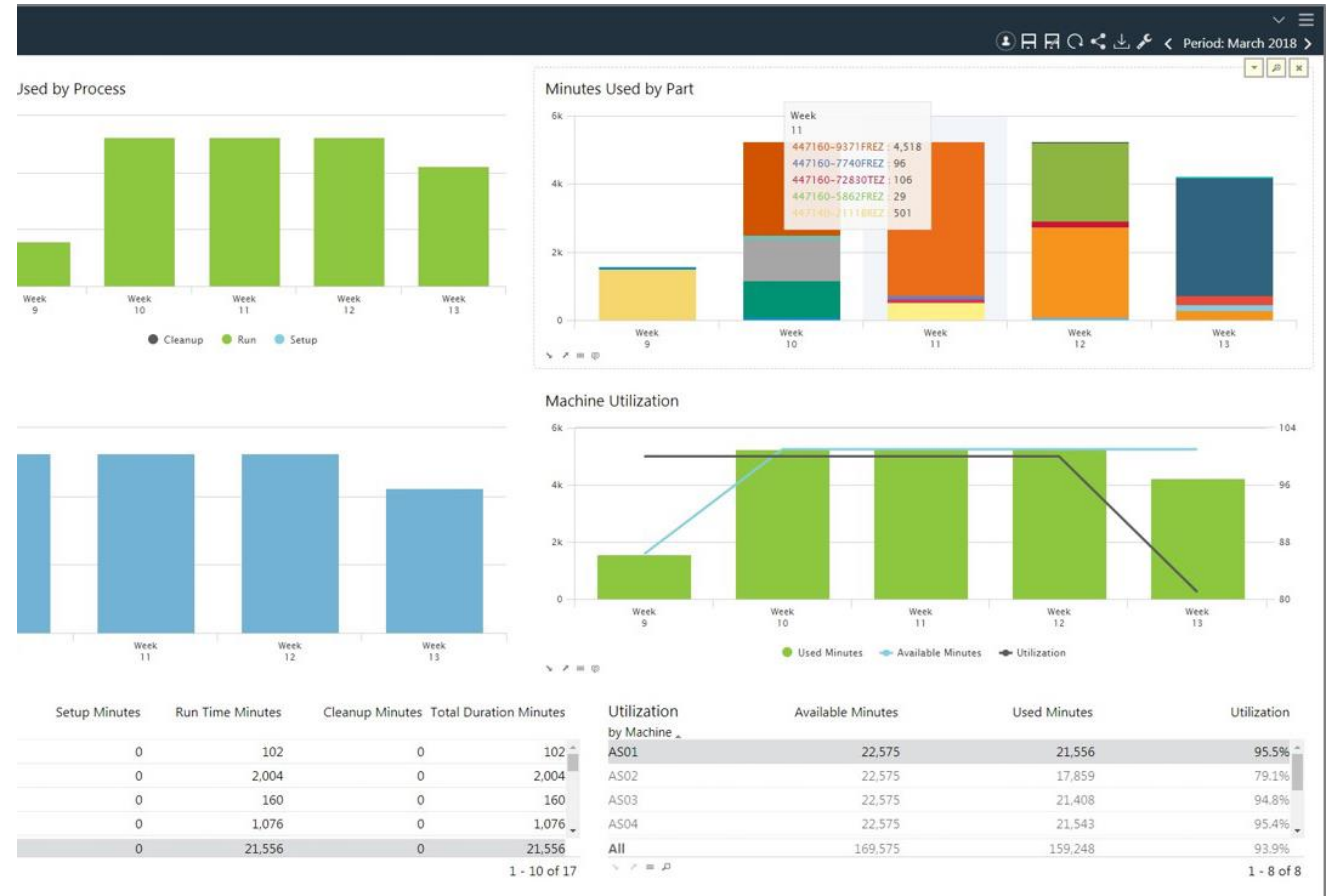
Monthly, Weekly, Daily

- ▶ Evaluating a production plan: Utilization of machines & parts produced
- ▶ Review resource utilization and allocation of time to products
 - Allocation of production lines to products by family, customer, etc.
 - Utilization summaries by production line and / or location and / or facility
 - Total time spent on each machine
 - Overall utilization of the machines



Capacity and Utilization

- ▶ Minutes used by Setup, Run, and Cleanup processes over time
- ▶ Minutes utilized by part by time
- ▶ Total minutes used by machine over time
- ▶ Utilization of machine over time



QUESTIONS?





THANK YOU