Automated Production Planning Tool

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Plastics that Perform — ScotiaPlastics — ISO 9001:2008
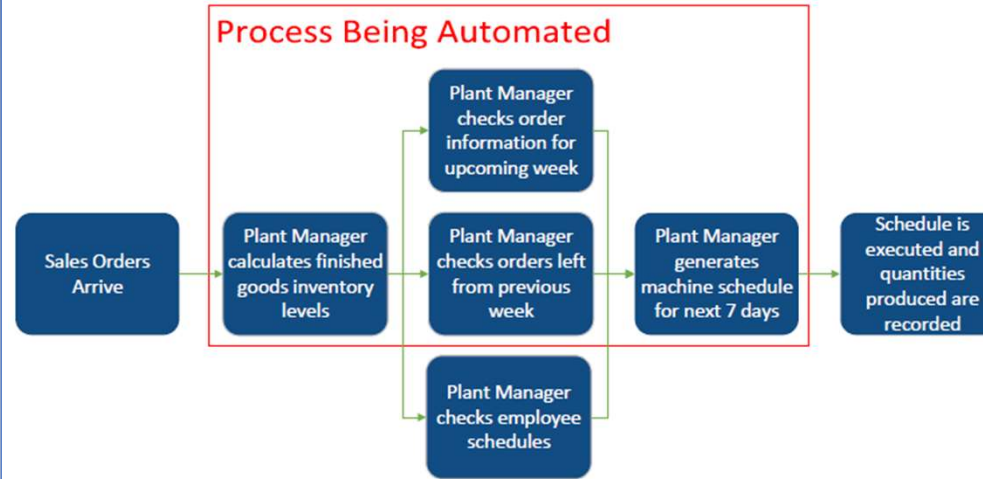
Problem Definition

- Production planning is a historical and manual process, susceptible to risk when the Plant Manager is away
- There is currently no way to evaluate alternate production scenarios, which is an aim of the client

Project Scope

- Determine the maximum number of machines that can be used per shift and their production rates
- Design an Excel tool that will optimally schedule all machines for production based on demand
- Create an interface that allows the user to easily test alternate scenarios by modifying constraints

Current Production Planning Process

Process Being Automated

Sales Orders Arrive → Plant Manager calculates finished goods inventory levels → Plant Manager checks order information for upcoming week / Plant Manager checks orders left from previous week / Plant Manager checks employee schedules → Plant Manager generates machine schedule for next 7 days → Schedule is executed and quantities produced are recorded

Model Formulation

Decision Variables:
- To start machine i to produce bottle j at time k for l hours

Constraints:
- The number of machines scheduled in a shift must be within the client's capabilities
- A machine cannot be scheduled to produce different bottle types at the same time
- The number of bottles produced of each type must be greater than demand and safety stock required

Objective Function:
- Minimize $Z = X_{ijkl} * t$ hours into the week

Project Parameters

Schedule considers:
- 5 machines
- 9 bottle types
- 3 possible shift lengths
- 192 possible start times

8064 Decisions!!

COIN|OR — SOLVER

The Power of Scenario Testing

The client can choose:
- Weekly machine availability
- Weekly shift availability
- Finished inventory levels
- Desired shift lengths

The tool can produce:
- A full schedule in advance
- An updated schedule during the week
- Daily inventory estimates

		2024-03-29				2024-03-30				2024-03-31			
		Night	Morning	Evening	Daily	Night	Morning	Evening	Daily	Night	Morning	Evening	Daily
	...ll Hours	0	0	0	0	0	0	0	0	0	0	0	0
	Production	0	0	0	0	0	0	0	0	0	0	0	0
	...L Hours	0	0	0	0	0	0	0	0	0	0	0	0
	Production	0	0	0	0	0	0	0	0	0	0	0	0
Uniloy 2	4LW Hours	0	4	8	12	2	0	8	10	2	8	8	18
	Production	0	136	272	408	68	0	272	340	68	272	272	613
	4LC Hours	0	4	0	4	0	8	0	8	0	0	0	0
	Production	0	136	0	136	0	272	0	272	0	0	0	0
Roch 1	500mL Hours	0	0	0	0	0	0	0	0	2	0	0	2
	Production	0	0	0	0	0	0	0	0	22	0	0	22
	473mL Hours	0	8	0	8	0	8	0	8	0	0	0	0
	Production	0	87	0	87	0	87	0	87	0	0	0	0
	250mL Hours	0	0	0	0	0	0	0	0	0	0	0	0
	Production	0	0	0	0	0	0	0	0	0	0	0	0
Roch 2	2LW Hours	0	4	8	12	2	8	8	18	2	8	2	12
	Production	0	59	117	176	29	117	117	264	29	117	29	176
	2LC Hours	0	0	0	0	0	0	0	0	0	0	0	0
	Production	0	0	0	0	0	0	0	0	0	0	0	0
Roch 3	4LW Hours	0	4	8	12	2	0	8	10	2	8	2	12
	Production	0	97	193	290	48	0	193	241	48	193	48	290
	4LC Hours	0	0	0	0	0	0	0	0	0	0	0	0
	Production	0	0	0	0	0	0	0	0	0	0	0	0

A REAL WEEK OF PRODUCTION PLANNING WITH OUR TOOL

The Problem

- Plant Manager was on vacation
- Second biggest machine was down
- A holiday on Friday
- Unsure if they would be able to meet demand

What our Tool Provided

- Allowed the client to test three different production scenarios
  1. Regular working hours
  2. Regular working hours with shifts on Sunday
  3. Regular working hours with night shifts

The Results

- Revealed that regular working hours would not be enough
- Produced an optimal schedule for both other scenarios
- Client chose their preferred schedule
- The schedule was used for the entire week
- Accurately estimated inventory 8 days out
- **Completed all of this in < 5 minutes!**