Capacity modeling

Specialty food manufacturer

Evaluated the capacity requirements for company’s manufacturing processes to identify potential capacity bottlenecks

Identified the processes and timing of capacity bottlenecks based on the client’s sales forecasts for various OEE(Overall Equipment Effectiveness) scenarios

Specialty food manufacturer needs to identify capacity bottlenecks

Picture this…

You're looking to evaluate the manufacturing processes and identify potential capacity bottlenecks upfront so that capital expenditure can be effectively planned to support revenue growth. Revenues are forecasted to grow at a significant rate over the next few years leading to potential manufacturing capacity bottlenecks in the future.

You turn to Accordion.

We partner with your team to identify the processes and timing of capacity bottlenecks based on the sales forecasts for various OEE scenarios, including:

1) Analyzing manufacturing processes and sales forecasts to estimate the capacity requirements of each step of the manufacturing process
2) Calculating availability, performance and quality factors to estimate current overall equipment effectiveness (OEE)
3) Estimating capacity utilization at current OEE to identify potential bottlenecks
4) Identifying the processes and timing of capacity bottlenecks based on the client's sales forecasts and for various OEE scenarios

Your value is enhanced.

Our comprehensive analysis of the manufacturing processes led us to estimate the future capital expenditure based on timing and type of capacity bottlenecks that would occur

CAPACITY MODELING

KEY RESULT

- Impact 1…
- Impact 2…

VALUE LEVERS PULLED

- OEE analysis
- Capacity modeling

Capacity modeling for pe-owned specialty food manufacturer

Situation

- Revenues were forecast to grow at a significant rate in the next few years leading to potential manufacturing capacity bottlenecks in the future
- Partnered with the company to develop a capacity model to evaluate the manufacturing processes and identify potential capacity bottlenecks upfront so that capital expenditure can be effectively planned to support revenue growth

Accordion Value Add

- Analyzed manufacturing processes and sales forecasts to estimate the capacity requirements of each step in the manufacturing process
- Calculated availability, performance and quality factors to estimate current overall equipment effectiveness (OEE)
- Estimated capacity utilization at current OEE to identify potential bottlenecks
- Identified the processes and timing of capacity bottlenecks based on the client's sales forecasts and for various OEE scenarios

Impact

- Our comprehensive analysis of the manufacturing processes led us to estimate the future capital expenditure based on timing and type of capacity bottlenecks that would occur

Capacity scenario analysis for various demand situations

Discusses various scenarios based on capacity and demand forecasts

A Scenarios for base case demand forecast

Scenario	Scenario Description	OEE	Cleaning time	Processes with capacity constraints beginning in		
				2017	2018	2019
A1	Actual capacity (current OEE and 6-hr cleaning time)	Current	6 hours	• FM250 former • Waterwheel former	• Cooler A • Mixer/grinder	
A2	Maximum capacity (85% OEE and 4-hr cleaning time)	85%	4 hours		• FM250 former • Waterwheel former • Cooler A	

B Scenarios for stretch case demand forecast

Scenario	Scenario Description	OEE	Cleaning time	Processes with capacity constraints beginning in		
				2017	2018	2019
B1	Actual capacity (current OEE and 6-hr cleaning time)	Current	6 hours	• FM250 former • Waterwheel former	• Cooler A • Mixer/grinder	• Grinder A • Grinder B • HPP packaging
B2	Maximum capacity (85% OEE and 4-hr cleaning time)	85%	4 hours		• FM250 former • Waterwheel former • Cooler A	

Sample scenario for stretch case demand, 85% OEE and 4-hr cleaning time

Timing of capacity constraints[2] based on various demand growth rates over 2017-2020

Based on average2 end-product mix of 34% product A, 30% product B, 32% product C and 4% product D

Indicates the timeframe in which the particular facility may face a capacity constraint at the mentioned demand scenario

Processes with capacity constraints beginning in

2017 | 2018 | 2019 | 2020 (till 3Q20) | No constraints till at least 3Q20

Company's manufacturing processes and storage facilities

Expected YoY demand growth rate over 2017-20	Haymarket cooler	Grinder A process	Grinder B process	HPP packaging	Cooler A	Mixer/ Grinder	FM250 former process	Waterwheel former process	Freezer A	Dry Warehouse[3]
Capacity	230 pallets	1050K lbs/month	840K lbs/month	2,030K lbs/month	55 pallets	2,170K lbs/month	620K lbs/month	480K lbs/month	125 pallets	1,675 pallets for A and 625 pallets for B
10%					2Q20		2Q20	2Q19		4Q17
15%					2Q19		2Q19	2Q19		4Q17
20%					2Q19		2Q19	2Q19		4Q17
30%					2Q19		2Q19	2Q19		4Q17
40%		2Q20	2Q20	2Q20	1Q19		1Q19	1Q19		4Q17

Methodology used to estimate capacity utilization rates

Inputs

- (A) Demand forecast by SKU
- (B) Yield factor[1] by process
- (C) Theoretical throughput by process
- (D) Actual throughput[2] by process
- (E) Availability factor [3] for each process
- (F) Quality factor[4] of each process
- (G) Maximum monthly available hours of operation[5] by process
- (H) Hours of reprocessing for products that have failed pathogen testing
- (I) Maximum overall equipment effectiveness (OEE) achievable by process
- (J) Capacity of storage facilities in pallets
- (K) Capacity of each pallet by form (in lbs/pallet)
- (L) Average recommended inventory[6] (in pallets)

Demand and capacity calculations

Demand Calculations

(M) Total end-product demand: *(n =number of SKUs)* $\sum_{i=1}^{n}(A)_i$

(N) Total demand for each process: **(L) / (B)**

(O) Total number of pallets demanded for each storage: $\sum_{i=1}^{n} Roundup(A/K)_i$

Actual capacity calculations

(P) Performance factor by process: **(D) / (C)**

(Q) Overall equipment effectiveness: **(P)×(E)×(F)**

(R) Actual capacity by process: **(Q)×(C)×{(G) - (H)}**

Maximum capacity calculations

(S) Maximum capacity[7] by process: **(I)×(C)×{(G) - (H)}**

Theoretical capacity calculations

(T) Theoretical capacity by process: **(E)×(F)×(C) ×{(G) - (H)}**

Utilization rate calculations

Utilization rates for dry warehouse

Utilization rate **(L) / (J)**

Utilization rates for cold storage

Utilization rate **(O) / (J)**

Utilization rates for processes

Utilization rate based on actual capacity: **(N) / (R)**

Utilization rate based on **(N) / (S)**

Equipment with utilization rates (based on maximum capacity) above 95% are bottlenecks in the model.

1 Yield factor of a process is defined as the ratio of the weight of final end-product manufactured to the weight of input at that process step
2 Actual throughput is the average throughput of the process over the past 18 months
3 Availability factor of a process is the ratio of the number of uptime hours to the number of total planned hours of the process
4 Quality factor of a process is the ratio of acceptable products to the total number of products produced at that process step
5 Maximum available hours are based on the number of days of manufacturing operations in a week, number of shifts in a day, number of hours in a shift and the planned downtime hours
6 Calculated based on the recommended average inventory level of product forms, and freeze dried that are stored in dry warehouse
7 The capacity of the process based on the assumption that the process is operating at its maximum OEE achievable. Maximum OEE achievable is assumed to be 85%.