INVENTORY MODELING OF AN INFANT MILK FORMULA MANUFACTURING PLANT

DEPARTMENT OF INDUSTRIAL AND SYSTEMS ENGINEERING **IE3100 SYSTEMS DESIGN PROJECT**

PROJECT SUPERVISORS: Associate Prof. LEE Loo Hay & Assistant Prof. NG Tsan Sheng, Adam **GROUP MEMBERS:** Gian-carlo Tan Pulma, Guo Qing, He Qi & Trinh Thai Duy

PROBLEM DESCRIPTION

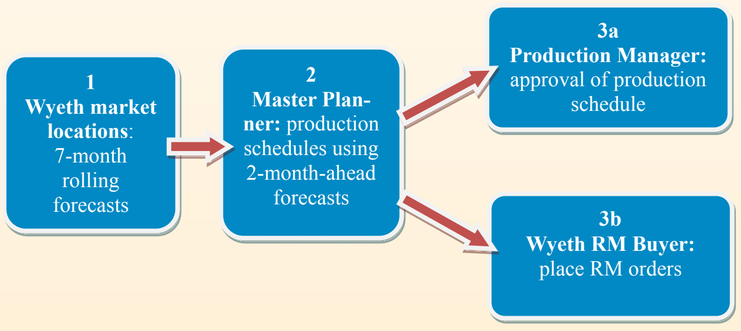
Wyeth currently faces high RM inventory levels – on average 90% of warehouse space is utilized. Capacity will increase by 50% with the opening of a third dryer in 2009.

OBJECTIVES

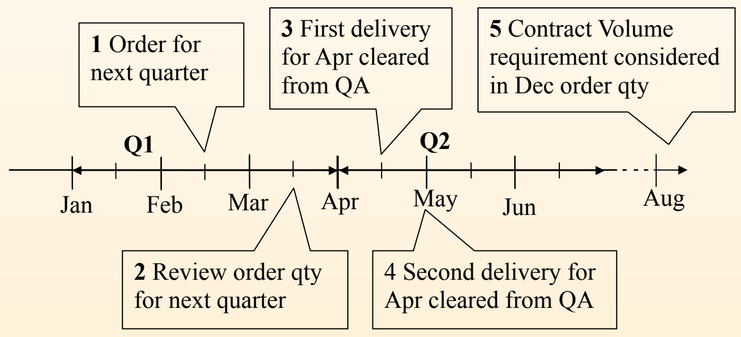
1. Model current inventory ordering and holding practices
2. Identify reasons for high inventory and propose solutions
3. Study Supplier Hub Inventory Program (SHIP)

PROCESS

UNDERSTAND CURRENT PRACTICE



FLOW OF INFORMATION



CURRENT RM ORDERING PROCESS TIMELINE

$$Q_n = C * \left\lceil \frac{(MOH) f_{n+1} + f_n - I_{n-1}}{C} \right\rceil$$

Where:

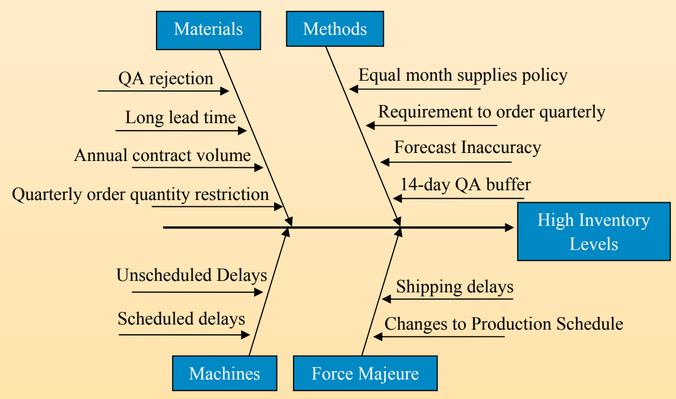
Q_n	order quantity for month n
MOH	month-on-hand
f_n	forecast for month n
I_n	ending inventory level for month n
C	container capacity

ORDER QTY DETERMINATION FORMULA

IDENTIFY CHALLENGES

KEY FINDINGS & RESULTS

REASONS FOR HIGH INVENTORY



SOME CRITICAL REASONS

1. Forecast inaccuracy

- Large forecast error variance
- Bias between planned and actual RM demand

2. Order quantity determination based on forecasts and MOH of 1.8

- Does not account for the demand variability

3. Long lead time

- Implies utilizing more inaccurate forecasts

PROPOSE SOLUTIONS

2-PRONGED STRATEGY

1. Improve order quantity determination process

- Include FE std. dev. in order quantity determination
- Reduce bias between RM planned demand and actual usage.

2. Introduce Vendor Managed Inventory (VMI)

- Involving supplier, buyer and a third party logistics provider.
- Study Wyeth's implementation of VMI: SHIP

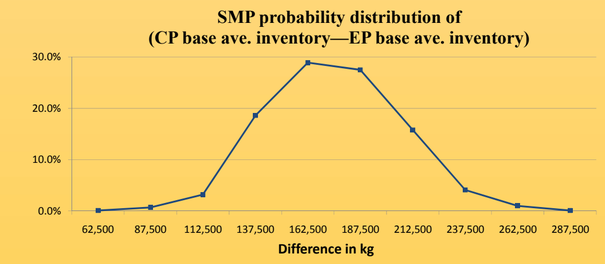
PROPOSED ORDERING POLICIES

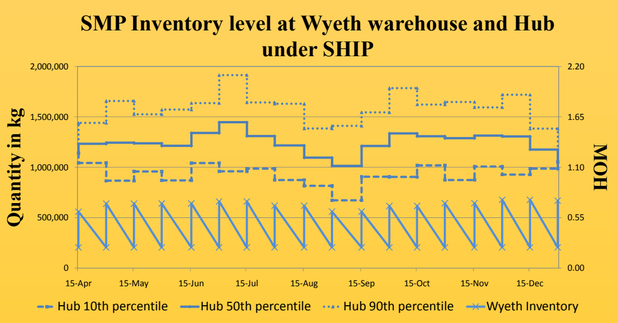
Order practices	CP	EP	EP+
Frequency	Quarterly	Quarterly	Monthly
Quarterly order restriction	Yes	Yes	No
Determination method	Equal month of supplies policy	Equal safety factor policy	
Order quantity determination formula	$Q_n = C * \left\lceil \frac{(MOH) f_{n+1} + f_n - I_{n-1}}{C} \right\rceil$	$Q_n = C * \left\lceil \frac{(k\sigma_{FE} + \bar{x}_{FE}) + f_{n+1} + f_n - I_{n-1}}{C} \right\rceil$	

EVALUATION

SIMULATION RESULTS

Scenarios	Results of simulation (% Change) Ave. 10th percentile	Ave. 50th percentile	Ave. 90th percentile	Evaluation
CP base vs. CP -10% in σ_{FE}	1.20%	0.72%	0.25%	CP insensitive to variations in FE std. dev.
CP base vs. CP -40MT in FE mean		-7.09%		CP responds to changes in the mean of FE
CP -10% in σ_{FE} vs. EP -10% in σ_{FE}	-13.21%	-14.46%	-15.03%	EP performs better than CP
CP base vs. EP base	-9.55%	-10.97%	-11.88%	
EP base vs. EP -10% in σ_{FE}		-3.22%		EP responds appropriately to the changes in FE std. dev. in both directions.
EP base vs. EP +10% in σ_{FE}		4.01%		





PROPOSE RECOMMENDATIONS

RECOMMENDED POLICIES

	Opportunity	Risk
EP/EP+	The prospect to lower inventory levels internally	Requires more frequent inventory monitoring by buyer
SHIP	Reduces bull-whip effect	Greater dependence on supplier

FUTURE STUDY

1. Review existing forecasting procedure to improve forecast accuracy
2. Investigate causes of constant overestimation in production schedules
3. Extend study to all macro raw materials