Mehdi Bennani Smires · Prior work at Palantir

Six months of production. Planned one day at a time.

Across multiple US factories, I built a system connecting demand forecasts to daily plant decisions: **what to make, what to order, and which demand to protect when supply runs short.** Every product and ingredient was tracked daily over six months.

THREE MODELS, ONE CONNECTED PLANNING SYSTEM

01
Forecast demand
High-level demand across the network

→

02
Allocate to factories
Production requirements by manufacturing site

→

03
Optimize each plant
Daily production, ordering and line decisions

Daily / 6 months	1M-10M	<30 seconds	Weekly
Inventory resolution / horizon	Reported variable counts	Model solve times	Plant planning runs

What the plan decides

Produce	How much of each product to make, on which line and day.
Source	Which ingredients to order, in what quantity, and when.
Assign lines	Which products run on each line and day, under switching rules.
Hold & allocate	How inventory covers demand and where shortages remain.

THE OBJECTIVE

Minimize shortages weighted by product/customer priority, alongside disruptions to the existing plan.

When supply falls short

ILLUSTRATIVE EXAMPLE / NOT PROJECT DATA

Demand	Required	Covered	Unmet
Priority A	1,600	1,600	0
Priority B	800	300	500
Total	**2,400**	**1,900**	**500**

Here, priority A is fully covered; priority B absorbs the shortfall. Actual allocations follow the constraints and penalty weights.

RULES THE PLAN RESPECTS

Storage and minimum finished stock
Ingredient availability, sourcing and lead times
Line capacity, eligibility and switching rules

Some models solved in around **10 seconds**, enabling alternative plans to be explored.

Built and deployed end to end.

Business discovery, data wrangling, ERP integration, pipelines, model formulation, solver implementation, and production deployment.

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Client anonymized. Example is illustrative. Timings exclude data refresh. Technical formulation on page 2.

Keep the plan executable.
Make service priorities explicit.

When supply cannot cover every requirement, the model permits shortages and penalizes them according to **company-defined product and customer rankings**. Physical feasibility and service prioritization are separate parts of the formulation.

1M-10M
Decision variables

<30 seconds
Reported model solve times

Optimal solutions
Reported for this project

01 Indices and quantities

f plant · **p** finished product · **r** ingredient · **l** production line · **c** customer priority group · **t** day

$I^F_{f,p,t}$, $I^R_{f,r,t} \geq 0$	**Nonnegative stock**	Daily finished-product and ingredient inventories
$q_{f,p,l,t} \geq 0$	**Production**	Quantity by plant, product, line, and day
$o_{f,r,t}$, $A_{f,r,t} \geq 0$	**Orders / receipts**	Order quantities; receipts reflect sourcing and lead time
$H_{f,p,c,t}$, $S_{p,c,t} \geq 0$	**Fulfillment / shortage**	Delivered quantities and unmet requirements by priority
$y \in \{0, 1\}$	**Discrete assignments**	Product-line assignment; switching rules also apply

02 A priority-weighted objective

SCHEMATIC

$$\min \sum_{p,c,t} \pi_{p,c} \, S_{p,c,t} \; + \; \text{penalty for changes to the existing plan}$$

Positive penalty weights **π** reflect product/customer priority; **S** is the unmet quantity. Higher penalties favor higher-priority demand, subject to resources and the rest of the objective. Exact weights and plan-change terms are implementation-specific.

03 Daily material and service balances

COMPACT CORE EQUATIONS

Finished products	$I^F_{f,p,t} = I^F_{f,p,t-1} + Q_{f,p,t} - \Sigma_c H_{f,p,c,t}$
Ingredients	$I^R_{f,r,t} = I^R_{f,r,t-1} + A_{f,r,t} - \Sigma_p b_{r,p} Q_{f,p,t}$
Demand coverage	$\Sigma_f H_{f,p,c,t} + S_{p,c,t} = D_{p,c,t}$
Line aggregation	$Q_{f,p,t} = \Sigma_l q_{f,p,l,t}$

b is ingredient use per unit; **D** is the requirement presented to the model. Initial stock is an input. Transfer, yield and backlog-policy details are omitted.

04 Linking discrete choices to production

SCHEMATIC RULE

$$q_{f,p,l,t} \leq U_{f,p,l,t} y_{f,p,l,t}$$

If the line is not assigned to the product (y = 0), output must be zero. U is a valid production upper bound, not extra capacity.

Capacity, material, storage and switching constraints apply alongside this link.