DEEPBLUE

HOW DANONE OPTIMISES MILK SOURCING

FROM CHAOS TO CLARITY

Optimizing Milk Supply

Our global business by numbers

No.1 GLOBALLY

- Fresh Dairy Products
- Plant-based Products

TOP 3 COUNTRIES

1. USA
2. Russia
3. France

€13.2bn TOTAL SALES

TOP 3 BRANDS

1. Activia
2. Danone
3. International Delight

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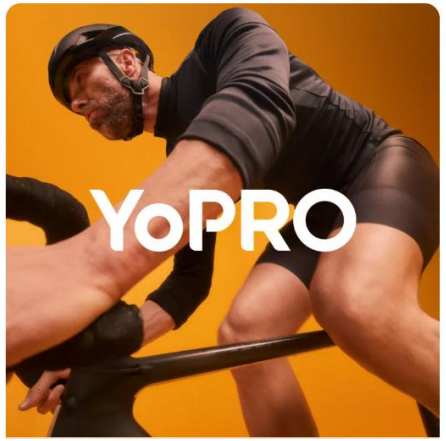
DANONE PORTFOLIO (TOP PRODUCTS)



Why Cows Don’t Care About our Forecast and How GUROBI Powered Deep Blue Does

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WHO AM I ?

AI Strategist at Danone

16+ Years of experience in Data science, ML and now GenAI, helping convert complex decisions into intelligent data driven ones

CPG, Retail, Banking, Consumer Experience

Precision in Complexity
Collaboration is My Superpower

Barcelona

AGENDA

1 INTRODUCTION

2 CONSTRAINED OPTIMISATION

3 KEY CHALLENGES & LEARNINGS

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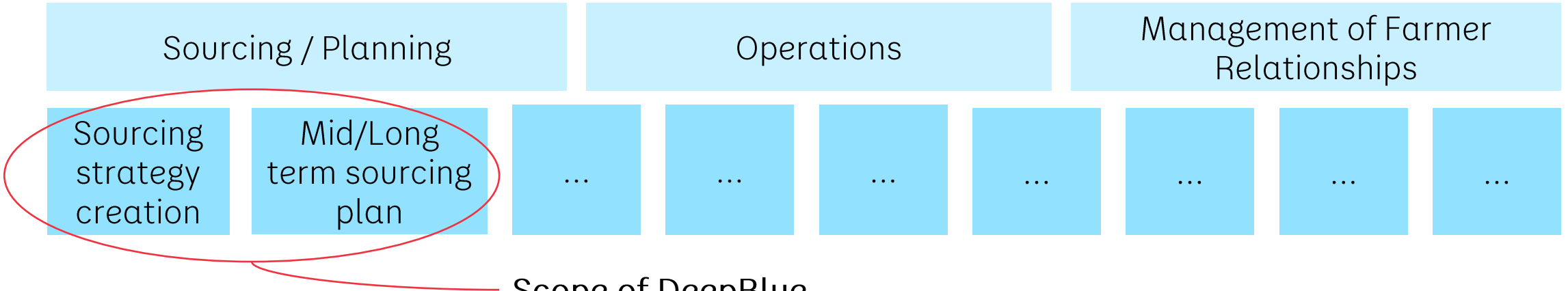
DEEP BLUE: WHERE DEEP BLUE FITS

By using different scenarios , we can test and evaluate diff strategies like vendor/factory combination selection to understand the dynamics and finalize strategy

Milk source to pay process



Zoom

Sourcing strategy creation

- **Objective**: Determine the most effective approach for sourcing milk by generating and evaluating various opportunities.

Mid/Long term sourcing plan

- **Objective**: Accurately estimate the volume of milk that Danone should purchase or sell at a specified price and time.

- **Who contributes:** Milk Commercial & Operations Managers
- **Frequency**: Monthly runs (business cases) + Quarterly Rolling Forecasts

ONE DAY IN THE LIFE OF A MILK PLANNER (1/2)
IMAGINE YOU'RE A MILK PLANNER…

Inputs

What you're looking for…

Material	Demand
Milk powder	500
Skimmed milk	300

What the contracts say

Supplier	Material	Min supply	Max supply	Price
A	Milk powder	100	400	300
A	Skimmed milk	100	400	250
B	Milk powder	50	250	320
B	Skimmed milk	50	250	270

Question

How much and from which supplier should materials be sourced, to **satisfy the demand while minimizing the cost?**

Answer

Supplier	Material	Quantity supplied
A	Milk powder	400
A	Skimmed milk	250
B	Milk powder	100
B	Skimmed milk	50

Decision variables

At stake:
- 1 objective: minimise cost = quantity x price
- 4 decision variables
- 6 constraints:
  - Fit demand
  - Fit contractual quantity (max… and min)

ONE DAY IN THE LIFE OF A MILK PLANNER (2/2)
IMAGINE YOU'RE A MILK PLANNER…

Inputs

Now you're rather looking from the products demand

Product	Demand
SKU 1	500
SKU 2	300

Produced by

SKU	Recipe	Materials	Quantity
SKU 1	A	Milk powder; Skimmed milk	0.3 ; 0.2
SKU 1	B	Milk powder; Skimmed milk	0.25 ; 0.25
SKU 2	A	Milk powder; Skimmed milk	0.2 ; 0.15
SKU 2	B	Milk powder; skimmed milk	0.15 ; 0.2

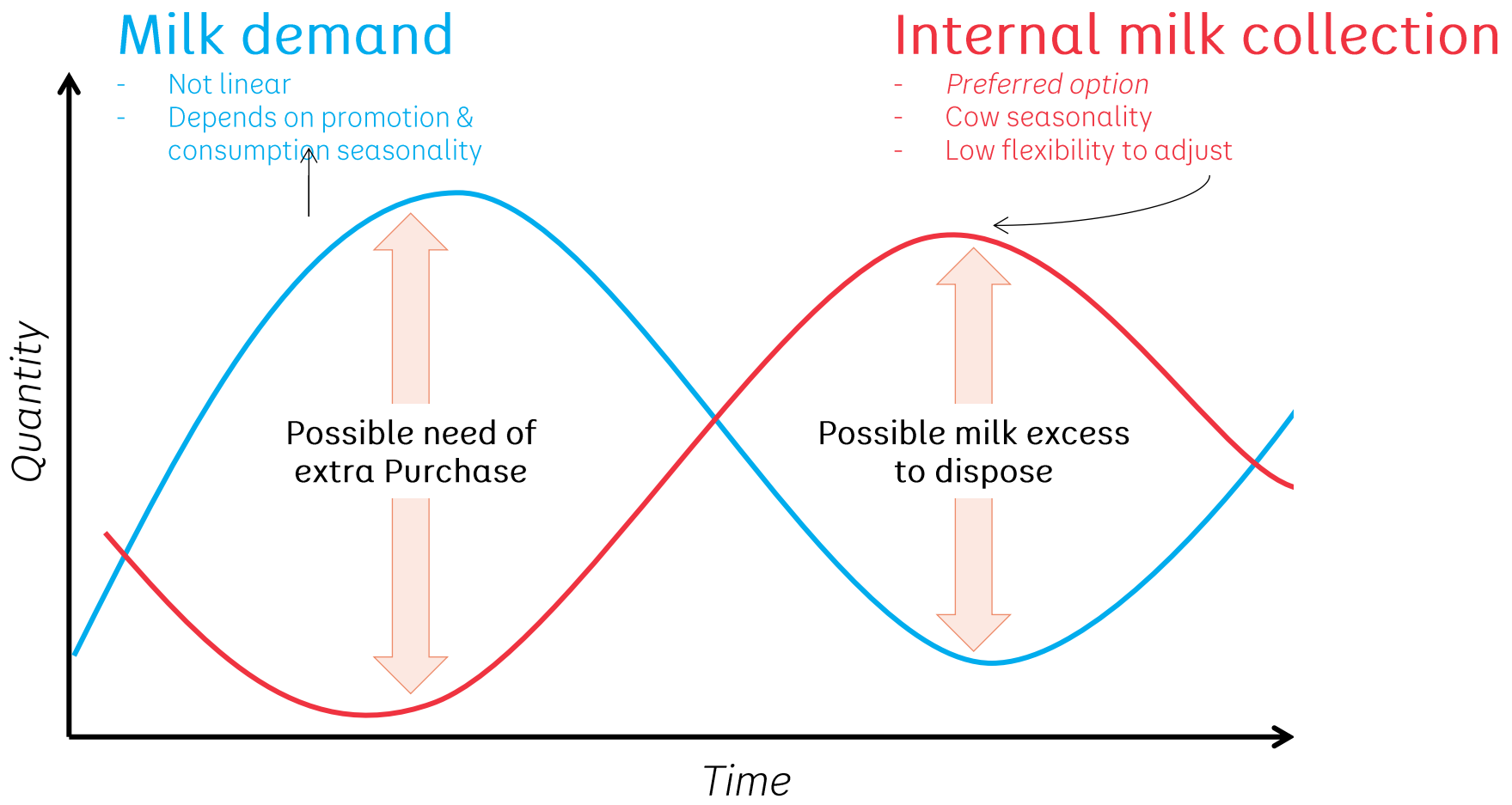
Question

How much and from which supplier should materials be sourced, to **satisfy the demand while minimizing the cost?**

At stake:
- 1 objective: minimise cost = quantity x price
- 8 decision variables
- 8 constraints:
  - Fit demand
  - Fit recipe
  - Fit contractual quantity (max… and min)

Constrained optimisation
The space of solution, although wide, is constrained

THE NEED TO BALANCE MILK



- MILK IS PRODUCED BY COWS, BUT COWS DO NOT PRODUCE ON DEMAND
- MILK DEMAND VARIES

A NON-TRIVIAL COMPLEX EQUATION TO SOLVE

Complex network and constraints

Plant

- Production constraints
- Flexibility in the formula used for production.
- Have transformation capabilities

Collec Site

- Fix milk production capacity
- Protein and fat contents seasonality

Toller

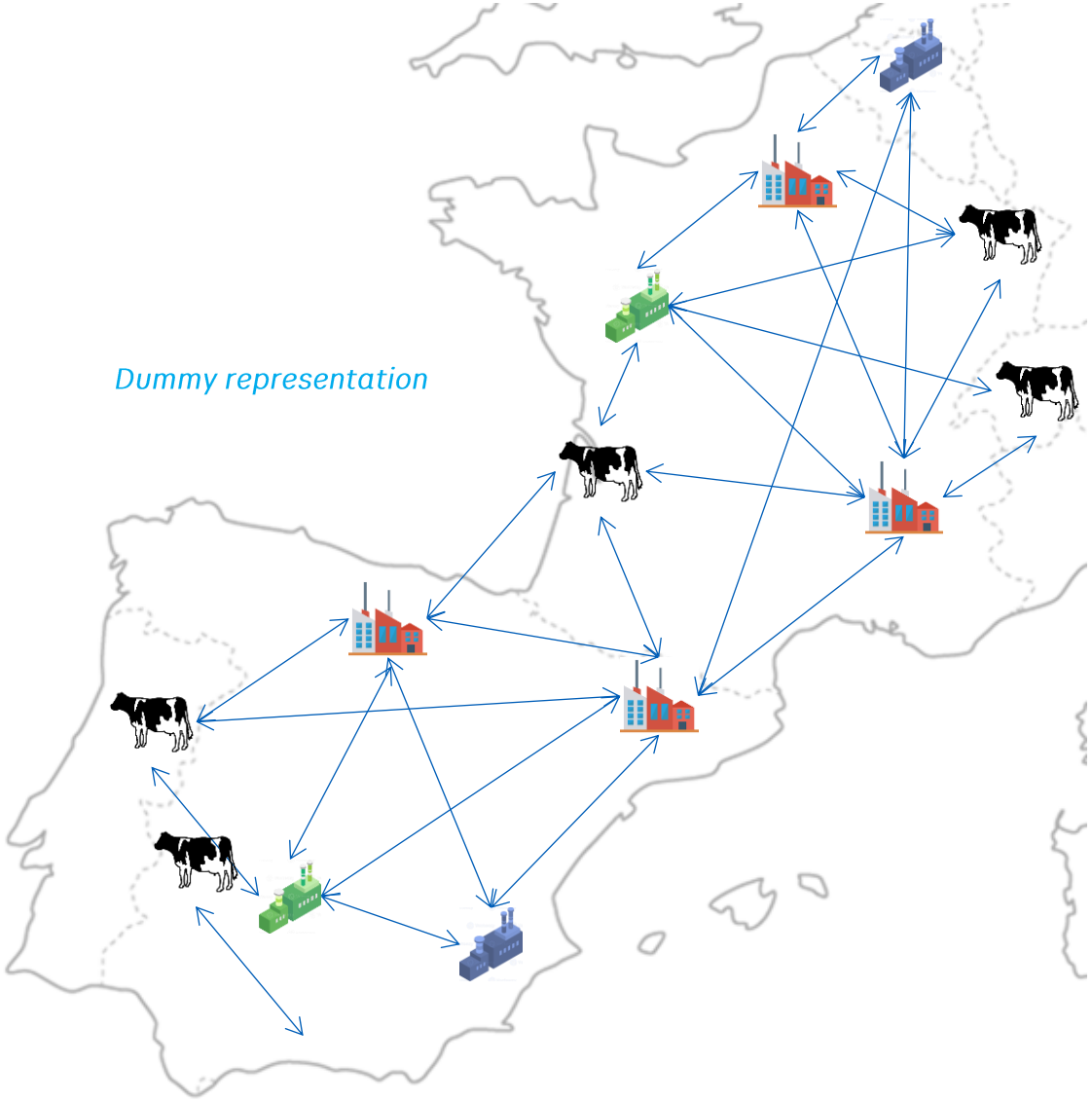
- External partner bringing different transformation capacity

Supplier

- Capacity to purchase or sell dairy ingredient

Orders of magnitude
- # of constraints: 100k
- # of variables: 10k

For a planner: days to weeks to consolidate <u>one</u> scenario, *without guarantee of accuracy / optimality*



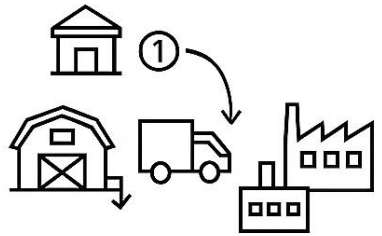
Dummy representation

WHY THE NAME – DEEPBLUE?

A NAME INSPIRED BY INTELLIGENCE, PRECISION, AND OPTIMIZATION.

GOAL

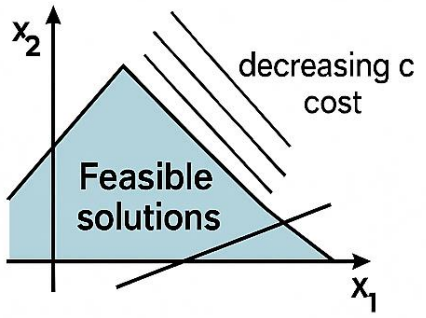
"Minimize sourcing costs while meeting demand for material at each factory



① Source from farmers
② Exchange excess between factories
③ Buy/re-sell in spot market or contracts

METHOD:

Constrained optimization



- First computer to beat a world chess champion (Garry Kasparov)
- Symbol of AI-driven strategy, precision, and computation

- 5 countries, 19 plants
- ~= 100K constraints , ~=10K variables ,Modelling completes under 1 minute

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KEY LEARNINGS

Challenges

- MVP evolved in multiple directions
- Constraints added complexity
- High learning curve for new joiners
- Explainability in case of infeasibility

Learnings

- Start small, redesign to scale
- Remove unnecessary complexities
- Provide detailed documentation
- Structured analysis and diagnostics

BENEFITS AND CHALLENGES OF BUILDING AN IN-HOUSE VS OFF-THE-SHELF MILK OPTIMISER

Benefits

Business

Competitive costs (regularly re-assessed)

Internal knowledge + flexibility:
- Danone network / supply chain modelling / adjustment
- Adapting to evolving business models

Tech

IP owned by Danone (flexibility)

Knowhow to replicate to other domains

Challenges

Business

Process standardization to make the most out of the tool at minimal cost

Tech

Right balance / abstraction between user-friendliness and complexity

Reliability of close-to-transactional data application

CONCLUSION

AI or AGI may never make cows produce milk as per demand, but thanks to Deep Blue powered by Gurobi, at least our planners can sleep at night knowing the solver is working harder to help them!

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QUESTIONS?

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THANK YOU