LISCOS review

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Presentation Outline

- Introduction
- LISCOS case studies & results
  - Case 4
    - Discrete lot sizing
  - Case 1&2
    - Production planning and scheduling for a multi-level production process

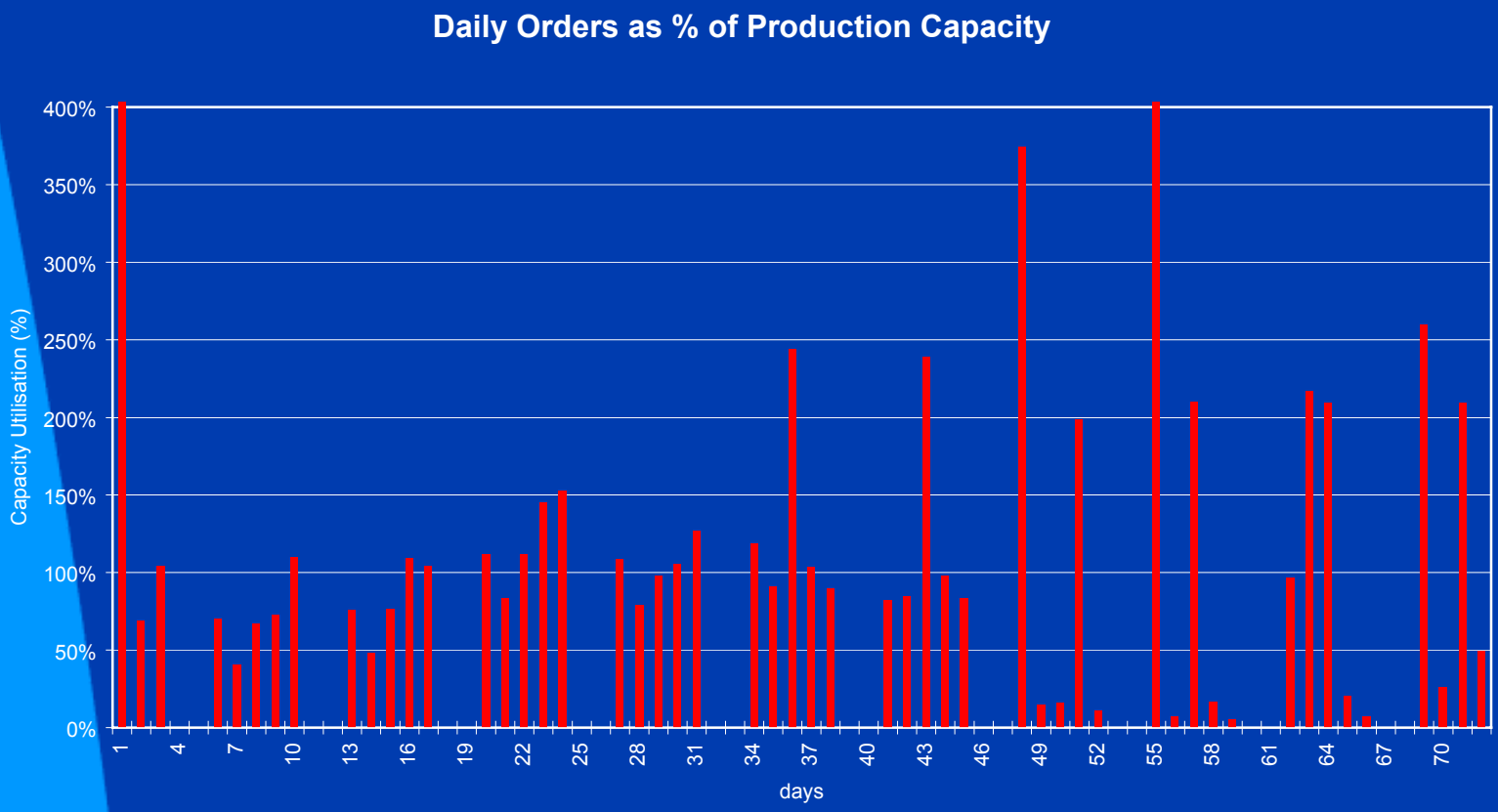
Procter&Gamble

Fast Moving Consumer Goods
Established in 1836
Global Operations
> 40 Billion $ turnover
> 100,000 Employees
R&D investment : $ 1.7 Billion

Liscos case studies : Case 4

- Snacks business
- Multi-period production planning
  - “perfect customer service”
  - “minimal inventory”
- Specific process constraints
  - “keep running”
  - Product change-over restrictions
  - Little spare capacity

Case 4 (continued)



Case 4 (continued)

- Problem dimensions
  - ~ 50 products (SKUs)
  - 90-150 planning periods
  - 1 production unit
- Occurs as sub-problem in many production planning models

Case 4 (continued)

Approach :

- Mixed Integer Programming model
- Reformulate : discrete lot sizing model
- Cutting Planes -> XFormLib

Results :

- Original model : weak LP relaxation ; very long solver times to near-optimality
- Discrete with cuts : true optimality proven in less than 1 minute

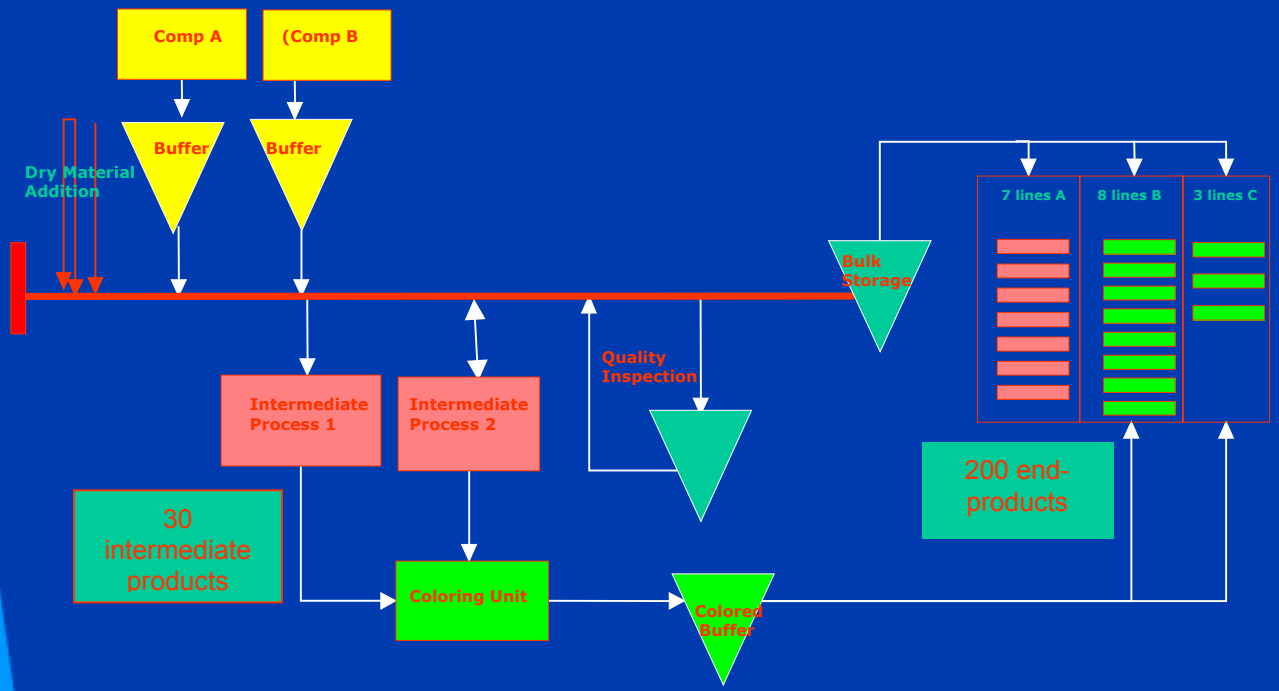
Liscos : Taking it further.

Liscos methods proven on case 4.

Extend the methods to include :

- multi-line production
- multi-level process
  - lot sizing
  - intermediate storage
- shorter planning periods (2 hrs ?)
- variable lower bounds
  - minimum run lengths
  - safety stocks

Liscos case studies 1 & 2



A simplified diagram of the production process

Liscos case studies 1 & 2

- Modeled and run with *bc-gen and XFormLib*

model	LP value	LP time	XLP value	XLP time	MIP sol	MIP time	best bound
PG 1	220	0	707	3	none	7200	
PG 1 + WW-U-B Tk=2	1258	33	1365	119	2688	1500	2009
PG 1 + WW-U-B Tk=8	1616	172	1718	880	none	7200	

Times in seconds on a 350 MHz Pentium II PC.

Conclusions

- MIP research (led by CORE)
  - Classification scheme & naming conventions
  - Cutting planes
  - Extended Reformulations (XFormLib)
- Results
  - Better models
  - Solutions to unsolved problems
  - Better solutions & bounds
  - In less time.
- Applied successfully to other problems.

Thank you.