Quantitative supply chain optimization using big data methodologies in the chemical industry

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Telli van der Lei - Senior Scientist - DSM
Introduction

1. DSM mission, markets and science

2. Model based supply chain optimization

3. Need for continuous improvement: more data & more complexity
1. DSM mission, markets and science
Mission

Our purpose is to create brighter lives for people today and generations to come

We connect our unique competences in Life Sciences and Materials Sciences to create solutions that nourish, protect and improve performance
Building on an impressive history

Hoffman La Roche’s Vitamins (1930s)

Gist-Brocades (1869)

DSM (1902)

Chemical synthesis & biotechnology

Life Sciences

Biotechnology

Materials Sciences

Energy, chemistry & polymer technology

Vitamins
Omega’s
Carotenoids
Premixes for food & feed
Enzymes
Minerals
Cultures & Yeasts
Nutraceuticals
Pharmaceuticals
Cellulosic bioethanol
Biomedical materials
Bio-plastics
High Performance Plastics
Coating Resins
Functional Materials
Solar - advanced surfaces
DSM offers products & solutions to a wide range of markets
Global presence
Continuing Operations as reported ultimo March 2016

- **North America:** 3,151 employees
- **Europe:** 9,298 employees
- **Latin America:** 2,021 employees
- **Asia:** 6,028 employees
- **Africa & Oceania:** 252 employees

*Excluding our non-consolidated Associates & Joint Ventures*
Growth driven by global megatrends

Health & Wellness
- Aging population
- Healthcare issues
- Food composition
- Health

Global Shifts
- Population growth
- Urbanization drive
- Wealth increase
- Nutrition

Climate & Energy
- Sustainability concerns
- Resources constraints
- Energy concerns
- Materials

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Shareholders value & Sustainability go together

DSM outperforming AEX (indexed price* Jan 2000=100)

* Source: Bloomberg
Strategy 2018: driving profitable growth

Through science-based, sustainable solutions.
Key figures

- 22% innovation sales as % of total net sales (2016)
- 5.4% * R&D expenditure (including IP expenditure), continuing operations (2016)
- 300+ patents filed in 2015
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2. Model based supply chain optimization

“Even if a scientific model, like a car, has only a few years to run before it is discarded, it serves its purpose for getting from one place to another”.

— David L. Wingate
In 'Complex Clocks', Digestive Diseases and Sciences (1983), 28, 1139.
DSM Modeling & Data Analysis Competence

Product (& Phenomena) Modeling
- Physical Properties
- Molecular Characterization
- Computational Chemistry

Production Process Modeling
- Process Design & Quantification
- Batch Schedule & Recipe Modeling
- Model Supported Operations

Supply Chain Modeling
- Advanced Forecast & Market Predictions
- Production & Inventory Optimization
- Network & Inventory Optimization

Data Analytics
- Market & Business Data Analytics
- Innovation Data Analytics
- Operations Data Analytics
Why modeling?

- Prevent linear bias
- Understand cause and effect

Marketing & Sales

Supply chain management
Supply chain

- Raw materials
- Suppliers
- Manufacturing
- Warehouses & distribution
- Customers
- Consumers
Modeling Manufacturing & Network

- BOM
- MPL/FLS, Bucket timing
- Resource limitations
- WIP
- GRPT
- OTIF
- AU
- GIT
- GRPT
- AFS
- CSL
- SC Network
- Lanes, TLT, MOQ
- Sales & FC

I

II

III
Supply chain optimization brings strong business results

- 10-20% increase in perfect order rating
- 10-20% reduction in supply chain costs
- 20-50% reduction of inventory
- More efficient, flexible & responsive supply chains
3. Need for continuous improvement: more data & increased complexity
Data challenge is common within industry

Harvard Business Review May 2017:

- Less than half of an organization’s structured data is actively used in making decisions
- Less than 1% of its unstructured data is analyzed or used at all.
- 80% of analysts’ time is spent simply discovering and preparing data.
- Rogue data sets propagate in silos.
- Data technology often isn’t up to the demands put on it.
Need to harness increased complexity

Value

- External data
- Internal data
- Model-generated data
All steps from data to value require attention

Big data & advanced analytics consist of 5 essential steps in order to create value:

1. Collection
2. Storing & Handling Technology
3. Analysis
4. Modeling
5. Value Creation
DSM Big Data Program covers whole value chain

Domains: Business (Sales, marketing, finance), R&D, Operations (Manufacturing, SCM)
Big Data Toolbox used within DSM

Added value from big data & advanced analytics

Big Data Toolbox
To sum up

**Modeling & advanced analytics**
- Proven track record within the organization
- Established competence

**Challenges from a modeling perspective**
- Usability of input and output
- Runtime of existing simulation models
- Incorporating the effects of business choices in models

**Amongst others we are working on:**
- Complex systems models that allow incorporation of market dynamics
- Use of HPC for simulation models

**Focus is to learn case by case and roll-out successful cases to the whole organization**
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