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Development of a decision support tool for supply network planning:

A case study from the chemical industry

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World network of chemicals trade flows





Sources: UNSTAT Comtrade & Cefic-ITC Analysis

berlin

Supply network in the chemical industry

Application background: intra-organizational supply network



- Large number of production sites located in different countries
- Production of a chemical specialty
- Numerous industrial customers across the globe
- Contracted annual quantities, however, highly variable shortterm replenishment quantities
- Introduction of a central supply chain unit for coordinating
- Development of a customized linear optimization model





- DEGUSSA AG, Düsseldorf, Germany
- World largest producer of special chemicals
- Subsidiaries in all continents
- 46.000 employees / 300 plants worldwide
- Turnover in 2005: 11,800 billion €





Supply network in the chemical industry



→ <u>Supply Network Planning</u>

- Mid-term coordination of plant operations
- Integration of production and distribution activities

\rightarrow Lack of coordination results in

- Excessive inventories
- Poor utilization of capacities
- ✤ Violation of delivery dates

Main planning tasks

- Allocation of production volumes to plants
- Determination of the production mode for the main product and the generation of energy



Advanced Planning Systems (APS)



Decisions

Allocation of production quantities between plants

Supply from the plants to DCs and customers



Generic model formulation



Assignment of attributes to pre-defined entities





- Production volume: several 100,000 t per annum
- 100 product specifications
- Continuous production process









 Company negotiates annual volumes with key customers.



 Customers request deliveries upon short notice.









Decisions in supply network planning

Forecasting the period distribution of annual demand

Allocation of customer demands to production sites



 Production volume in the production sites and at each production train

Transportation volumes between production sites and customers

Generation of energy from side-products





Customer Demand

Limited substitutability of products

- Delivery only from sites, which have a customer approval for the product
- A customer demand may only be covered by deliveries from a limited number of sites







Distribution of the delivered volumes at the production trains

 $SV_{s,p,t} \leq MaxSV_{s,p,t}$





- Production
 - Production capacity at equipment level





- Production
 - Production capacity at equipment level





- Production
 - Minimum sales from production sites



Energy

• Transformation capacity of the sites



Energy

 Distribution of the aggregate energy of the various energy types



Energy

• Lower and upper limit on energy sales of the various energy types









- Currently numerous managers are using the tool for operative planning.
- Rolled out in Europe, US and Asia.



- Estimated financial benefit per year from supply network planning exceeded project costs by far.
- Further benefits arise from improved supply network design.
- Scenario mode is used extensively, e.g., for capacity decisions, evaluation of approvals and of the profitability of energy transformation.





























