Operations Research in BASF's Supply Chain Operations

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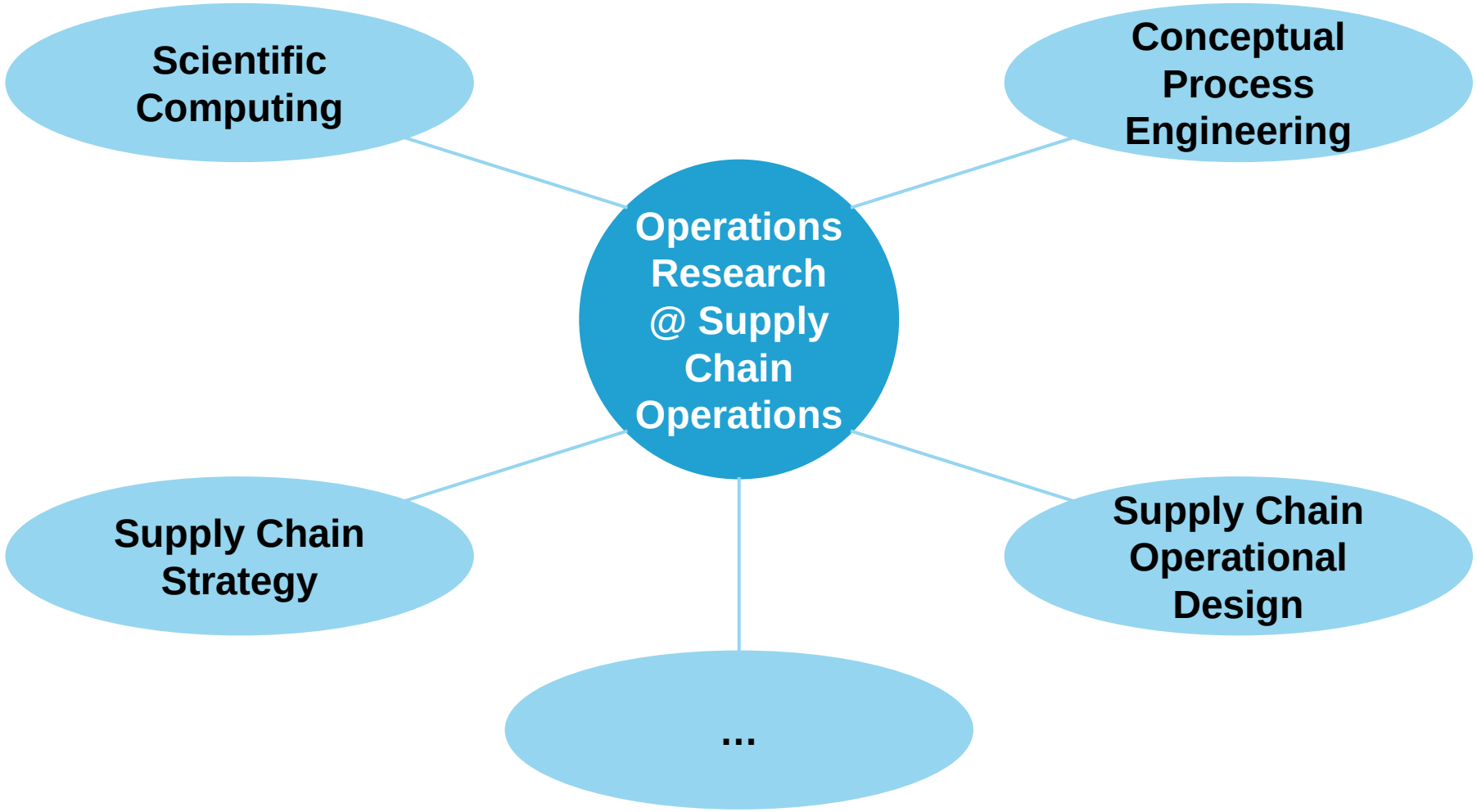
Information Services & Supply Chain Operations is the business solutions provider for BASF Group

- Competence Center Information Services & Supply Chain Operations is one of the largest BASF divisions.
- We have
  - ~13,000 employees (including functional leadership)
  - ~800 factories
  - ~2,400 warehouses
  - ~400,000 articles
- We support BASF's "We create chemistry" strategy with our three areas of core business – Information Services, Supply Chain Operations and Business Process Management.

Operations Research at BASF Supply Chain Operations consists of multiple organizational units



Strategic, tactical and operational perspective of Operations Research

Quantitative decision support …

Time/Planning horizon	Sample applications	Today's samples
■ Long-term / Strategic	• network design (incl. investments, contractual conditions, etc.) • value chain optimization (Verbund) • supply chain risk assessment	**Water Household Optimization in Antwerp**
■ Mid-term / Tactical	• sales & operations planning • inventory optimization • business trend prediction for proactive SCM	**Supply Chain Early Warning System**
■ Short-term / Operational	• detailed planning & scheduling • online optimization	**Detailed Planning & Scheduling at a plant**

The water network of our Antwerp plant as strategic example

Settings:

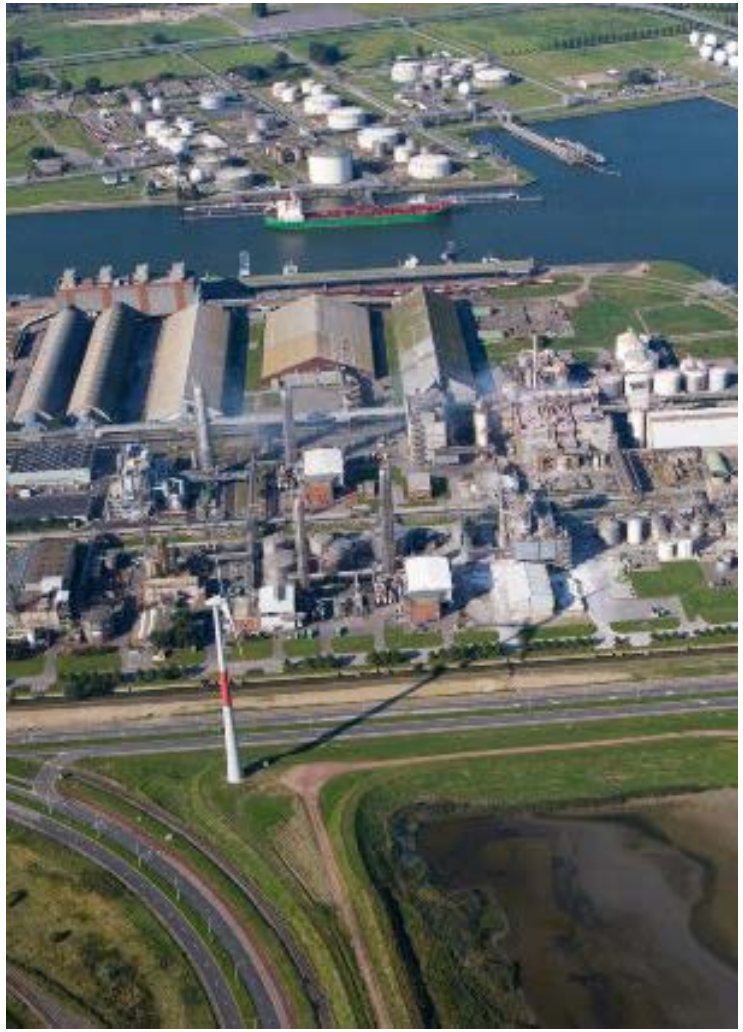
- Water-consuming or -processing units require water which might be waste-water instead of fresh-water
- Treatment and processing units have limited capacities and are partly connected
- Contamination limits for outlet into the Schelde river have to be observed

Task:

- Minimize fresh-water-consumption

Solution:

- Mathematical model including a free network flow topology, pooling (nonlinear), selecting pipes, treatments, and capacities (discrete)
- Mathematical optimization (MINLP) minimizing overall cost



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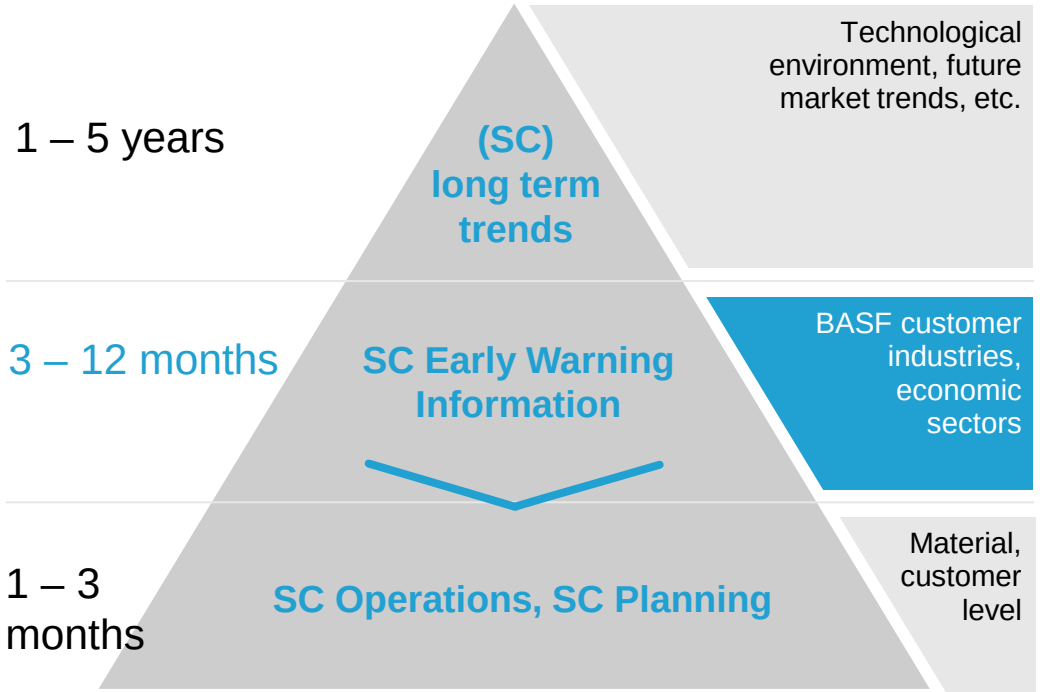
Supply Chain Early Warning system as tactical example of Operations Research (predictive analytics)

Planning perspectives



Current situation

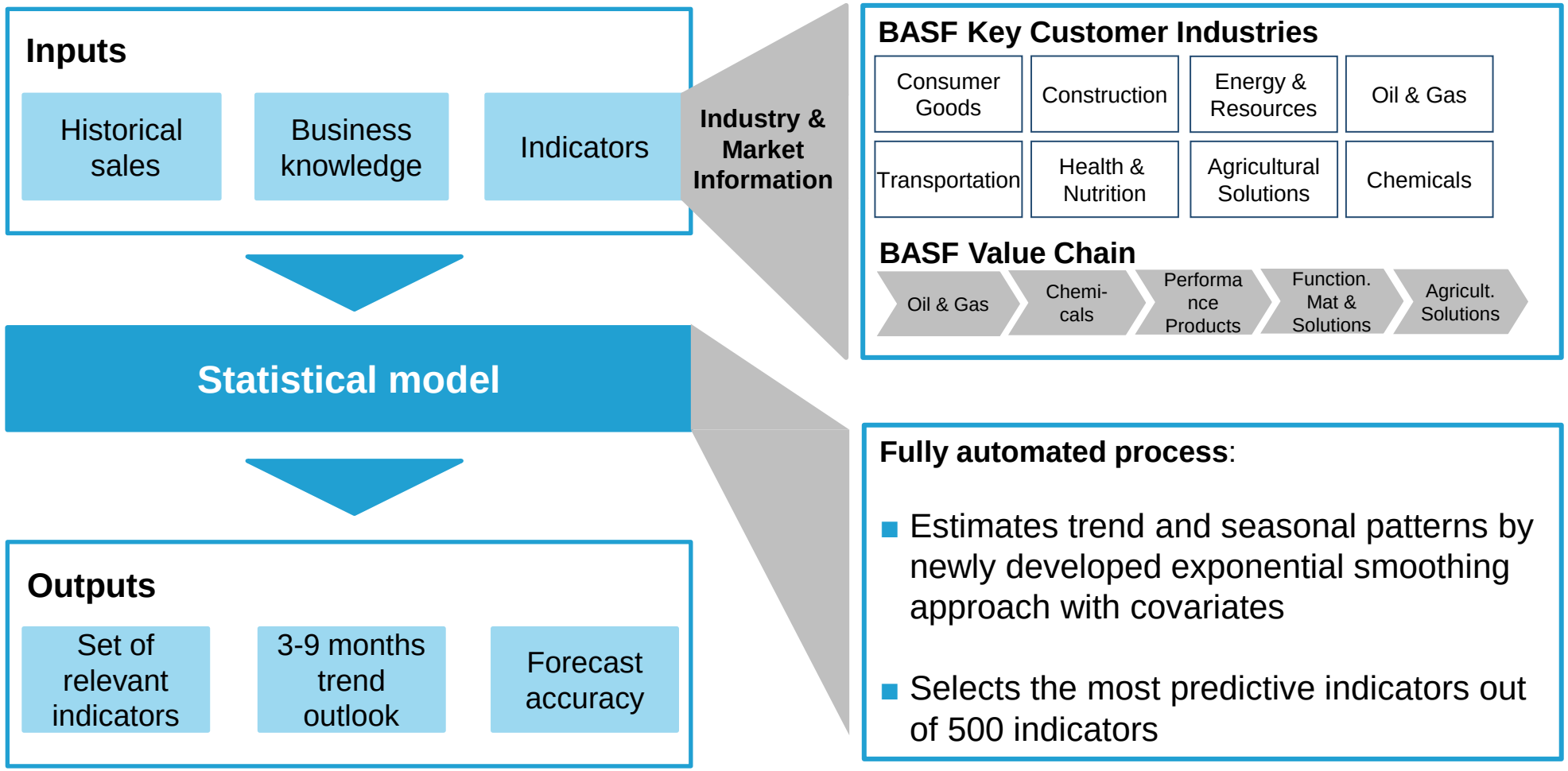
- Performance monitoring is looking backwards by concept
- Macroeconomic environment is not reflected systematically in SC planning
- Performance monitoring follows BASF's organizational charts

Current situation

- Future oriented Inventory structures
- Higher Delivery Capability and flexibility
- Reduced supply chain costs

While classical planning is usually focusing on a detailed level, the early warning approach monitors the economic environment.

A statistical model forms the core of the Supply Chain Early Warning system



Typical detailed planning & scheduling problem as operational example of Operations Research

Typical setting:

- Capacity: 50,000 – 80,000 t/a
- 200 products, > 500 articles
- Multi-stage production (15 reactors, 50 tanks plus special equipment, batch and continuous production)

Task:

- Maximum capacity utilization
- Fast rescheduling in case of changes

Solution:

- Synchronization of production stages
- Optimization integrated into SAP APO

Future topics for Operations Research in BASF's Supply Chain Operations

- Multi-level, multi-product lot-sizing and scheduling with stochastic demand
- Robust supply network design
- Verbund design and collaborative planning between BASF business units
- Sustainable supply chains
- Current Operations Research tools lack flexibility, interfaces for plugging in individual solutions/extensions, etc.

Thank you for your attention

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