

Supply Chain Management 4.0

WORST-CASE “NOT ABLE TO SUPPLY”

How chemical industry decision makers can apply artificial intelligence (AI) and machine learning (ML) to reform their supply chain management and reduce costs

Production downtimes and non-compliance to delivery commitments are the worst-case scenario within globally networked production and collaborative supply chain relations in the chemical industry. There is an overall huge need to balance internal target parameters and KPIs – such as on-time shipment while minimizing inventory levels and optimizing plant utilization – with external industry-specific market trends in order to consistently optimize them with regard to an effective supply chain management (SCM).



How value chain analysis can help to optimize supply chains and improve production planning

There is one thing representatives of all industries can agree on immediately: Continuing high cost pressure due to global competition combined with increasing market transparency in terms of product and pricing due to digitalization turns SCM in a real threat. But what are the specific trends in the chemical industry and how they may effect the supply chains? A few of the most important are listed and explained in more detail:

1. The market is becoming increasingly complex, with a tendency towards commoditization of basic chemicals with low customer loyalty and little scope for price differentiation on the one hand, and growing market fragmentation and specialization with particularly high demands on supply chains on the other
2. Integration into complex just-in-time value-added processes with strictly timed availability expectations whilst shifting (parts of) the value chains globally
3. Customers increasingly demand customized products and value-added services combined with high planning and delivery reliability
4. Trend towards (white label) production of compound systems through vertical cooperation within the supply chain (and provision of raw materials and packaging units in particular)
5. Business unit (BU) structures with operating profit targets within large enterprises dominate the industry
6. High complexity regarding constantly changing laws and regulations
7. Mergers & acquisitions (M&A) complicate standardized company-wide processes

The Corona pandemic and its impact on supply chains related to demand volatilities, global commodity shortages, and disrupted supply networks due to border closures and staff shortages have been and continue to be an additional stress test.

Consequently, the described market and industry specific overall situation result in detailed requirements for SCM in the chemical industry and a particular expectation with regard to production planning optimization processes:

- Stabilization of supply and value chains through digital transparency with the aim of dialog- and service-oriented customer communication
- Application of an agile, data-driven and flexibly adaptable planning tool in SCM
- Consistent customer segmentation with firmly anchored service agreements
- Product- and customer-specific diversification and flexibilization of supplier relations, away from the mantra of “one solution fits everything”



Increase profitability and optimize KPIs with intelligent data management

With the overall aim to increase profitability, chemical industry managers have to take a wide range of price, allocation and portfolio decisions along the value chain. Hence, they are in need of robust information. At best, this information is generated in line with linked records straight from the supply chain itself, such as information on production or storage capacities and the market, as well as customer and supplier specific data. In the planning process, it is therefore important to constantly run scenarios with regard to the following or similar questions:

- Which product-customer ratio is most profitable?
- How do profitability aspects change with volatile input factors (e.g. volatile prices of intermediate products)?

- Which plant or which location should be preferred considering lead times, optimum throughput times and minimum costs?
- What are the cost implications of a “make or buy” decision?
- Is the further processing of preliminary products more profitable than selling them directly on the market?

Since the influence of digitization in chemical SCM processes is still at a comparatively early stage compared to other industries, related decisions are often not taken systematically, but made ad-hoc and based on inconsistently prepared data. Thus, investments into modern digital infrastructure may include the introduction of SCM and Advanced Planning & Scheduling (APS) software tools.



Reasons for the introduction of an intelligent data-driven software architecture in SCM (strategic planning horizon) and APS (operational detailed production planning)

1. Transparent decision-making through simultaneous material and capacity planning

Real-time access to data provides a clear insight into current and expected capacity utilization and statements on the availability for all production factors required in the process. This enables the modelling of capacity utilization and resource requirements to conduct a continuous risk assessment.

2. Cost optimization by means of reducing working capital

System-based simulation of capacity and resource requirements enables streamline warehousing and contributes to optimizing the working capital.

3. Synergies through the centralization of digital SCM in BU-driven organizations

By applying a software-based SCM, synergies between the BUs can be monetized, damaging silo mentalities can be reduced, and the overall responsibility for the supply chain performance can be centralized. Hence, capacity and resource planning can be simulated and modelled across multiple BUs.

4. Consistent adaptation to customer requirements of a strongly horizontally integrated value chain

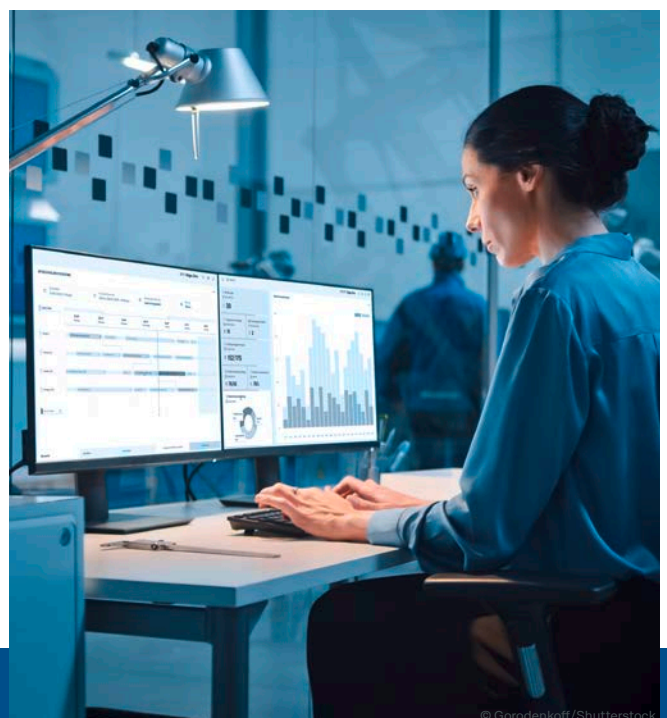
Many of the chemical industry's target sectors rely on well-coordinated supply chains: the pharmaceutical industry due to very long-term, firmly-tacked planning horizons and commitments, other sectors, such as the automotive, food, and packaging industries, mostly due to critical margins. As they are often ahead of the chemical industry in digitizing their supply chains they may expect the same from their suppliers – no matter the motivations are industry-specific or mainly driven by company-specific aspects.

5. "Supply Chain Acts" in a number of countries drive the commitment to sustainability within chemical supply chains

In addition to strategic financial KPIs, sustainability efforts focussing on complying environmental and social criteria of supply chains become important corporate goals. With the help of SCM and APS software solutions, relevant information from sustainability perspective such as inventory management under best-before aspects, wastewater quantities or energy consumption can be accumulated, whereas the processed information –based on simulated and anticipated past and forecasting data – can be easily documented and used for sustainability audits.

6. Considering laboratory capacities as potential bottlenecks along the supply chain

Lab scheduling is a supportive tool for detailed planning processes: limited laboratory capacities can thus be planned in line with standard production resources both for long-term advanced planning with regard to capacity utilization as well as for tactical-operational capacity adjustments.



Using AI-supported data analyses to utilize central transaction data assets for real-time planning

The chemical industry continuously generates large amounts of master and transaction data – such as countless data points on raw material or customer files, sensor data from the process plants or in the form of laboratory information – which is stored in the central ERP or MDX (Machine Data Exchange) and LIMS (Laboratory Information and Management System). A SCM software platform, that is based on a “digital twin” structure utilizing AI/ML technologies to steadily enhance the forecast goodness, can easily analyse this data to optimize target parameters such as lead times, plant throughputs, and/or inventories. As such, digital SCM is an integral part of supply chain planning.

The following parameters should be considered in SCM planning and, if possible, simulated and analysed in real time:

- Delay with suppliers
- Capacity bottlenecks of single-product, multi-product or multi-purpose plants, or multi-site factories
- Capacity bottlenecks of laboratories during at-line quality assurance
- Volatile demand for (planning- and raw material-intensive) products
- Monitoring of best-before-critical raw materials
- Planned and unplanned maintenance and cleaning of production plants
- Availability check and correct allocation of supply and buffer tanks
- Service level-driven fulfilment of customer orders

Due to the variety of applicable parameters in production planning and scheduling as well as in supply chain management in the chemical process industry, digital software solutions are a must-have feature.

Advantages of using a software solution for SCM and APS:

- Improved forecast accuracy
- Improved delivery reliability and service level
- Reduced raw material and packaging inventories by more than 10%
- Reduced finished goods inventories by up to 20%
- Increased throughput due to optimizations by up to 20%
- Reduced expenses of unplanned extra work
- Reduced transport costs



Holistic supply chain planning through the implementation of digital Supply Chain Management and Advanced Planning & Scheduling

The challenges implied by market-related issues – both in the area of procurement and in sales – and in-plant specific requirements of each company reflect a complex overall situation in optimizing supply chains. Indeed, this needs a holistic data management.

ORSOFT Enterprise Workbench is the tactical-strategic tool for supply chain management and supports the forecasting of future sales, whilst simultaneously checking required raw material quantities, safety stocks and plant capacities – also across multi-site factories, or single-product, multi-product or multi-purpose plants. Due to the application of artificial intelligence and machine learning, forecasting and demand planning with volatile demands feature a significantly improved accuracy. Sales & Operations Planning supports simulations on needed personnel and plant capacities in order to align them with the forecasted quantities. In addition, continuous monitoring of necessary raw materials allows to act tactically on critical price developments and enables the opportunity to taking countermeasures. Also inventories can thus be managed.

ORSOFT Manufacturing Workbench follows the principles of Advanced Planning and Scheduling and provides interactive material and resource simultaneous planning. The software enables to create planning scenarios on which the best result – in line with predefined KPIs – can be collaboratively selected. Industry-specific add-ons – such as the ability to plan laboratory capacities and/or maintenance orders as finite resources, production aids as an additional dimension, and storage in tanks/vessels – allow the production process to be mapped digitally in accordance with the Digital Twin principle. Based on SAP ERP or SAP S/4HANA data, the software provides an immediate overview of capacity utilizations, material flows, delay situations and material key figures - even across different sites.

The **ORSOFT Digital Factory Scheduling** offers a cloud- and SaaS-enabled software solution for detailed production planning based on the ORSOFT Manufacturing Workbench. It is specifically designed for use in medium-sized companies or smaller plant sections of large corporate groups in order to replace asynchronous and decentralised stand-alone solutions. The application creates transparency about the current planning situation. Due to the application of artificial intelligence, the software can run through optimization scenarios for material, capacity, time and demand conflicts and thus deliver automatic planning proposals.



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About ORSOFT

As an internationally acting software and consulting company, ORSOFT develops and implements innovative and reliable solutions in the field of Advanced Planning & Scheduling (APS) and Supply Chain Management (SCM) as certified add-ons to SAP ERP and SAP S/4HANA and other Enterprise Resource Planning (ERP) systems. With its affiliate companies, ORSOFT is part of the Germanedge Group which incorporates a focus on digital production 4.0. In the chemical industry, ORSOFT has successfully implemented projects at Allessa GmbH, Hüttenes-Albertus Chemische Werke GmbH and Sanofi-Aventis Group, among others.