Germanedge

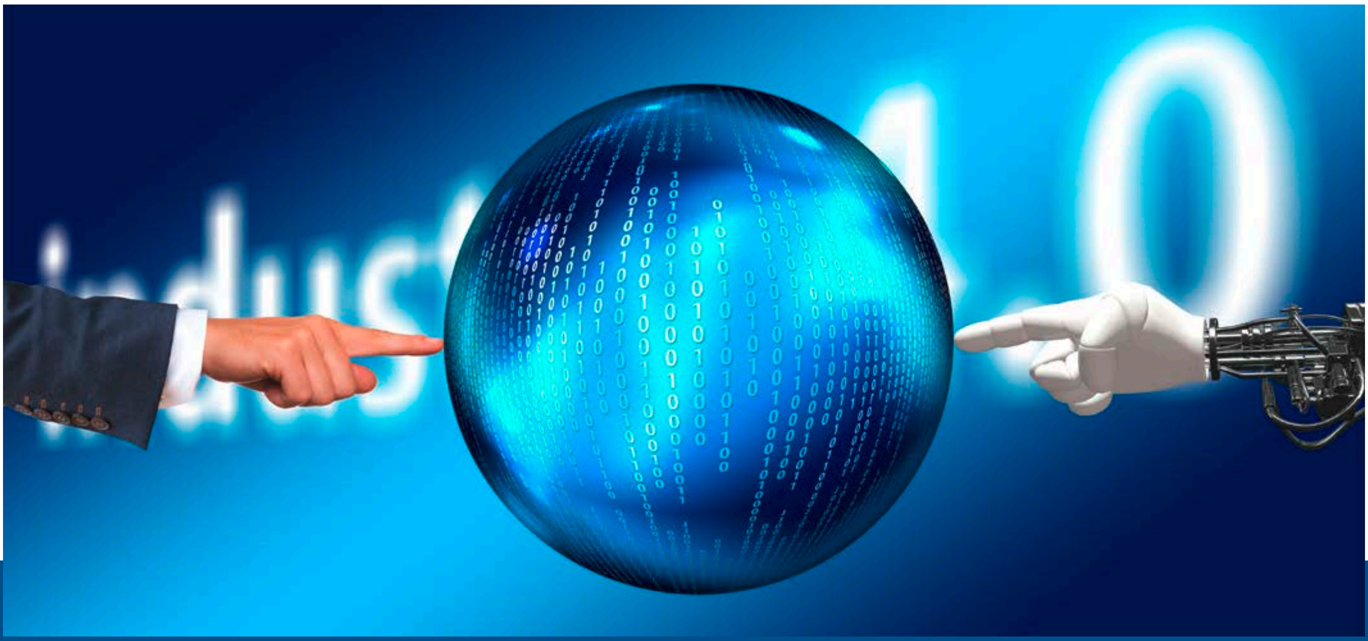
ORSOFT GmbH

Multiple Options Become Available – Already Today and in the Very Near Future

BIG DATA, ARTIFICIAL INTELLIGENCE AND AUTONOMIZATION IN SUPPLY CHAIN MANAGEMENT

Artificial Intelligence (AI) and Machine Learning (ML) play an increasingly important role in shaping the supply chain future. Just to mention some of the well-known ones: They are used in demand planning processes, forecasting, inventory management and in the area of automated scheduling. But that's far from everything. We would like to provide deeper insights and taking you through our development labs. We will outline planning holistically and as a central tool for controlling company processes and thus include autonomous processes on the entire shop floor level. The modelling of a digital twin will form the elementary basis for this.

- What Are Artificial Intelligence (AI), Machine Learning (ML) and Autonomization – Classed Within the Context of Supply Chain Management
- Autonomization of Planning Processes: The Evolution of Enterprise Resource Planning (ERP) And Advanced Planning Systems (APS)
- Modelling Autonomous Planning Through a Digital Twin
- It's All About Advanced Analytics: Using Big Data and Self-Learning AI to Drive Autonomous Conflict Resolution and Decision-Making
- Use Case 1: Autonomization of Advanced Planning & Scheduling (APS) In SAP Environments
- Use Case 2: Holistic Energy Management as an Integral Part of Production Planning
- Enabler of the Digital Factory: We Think Autonomization Beyond Supply Chain Management (SCM)



Germanedge

ORSOFT GmbH

What are Artificial Intelligence, Machine Learning and Autonomization – Classed within the Context of Supply Chain Management

Before delving deeper into the subject, we should clarify some crucial terminologies. For the classification of the term artificial intelligence (AI), we will employ the market research specialist for supply chain management, Gartner. AI applies (thus) advanced analysis and logic-based techniques, including machine learning, to interpret events, support and automate decisions, and take actions.

As a characteristic of AI, the aim of ML is to condition an algorithm through repetitive training in a way that it can perform tasks independently. Unlike conventional algorithms, the detection of (data) structures is not predetermined by an implicit model design, but is left to the "machine" autonomously. With the patterns recognized from the ML, the forecasting quality of time series-based processes may reach a new level of quality.

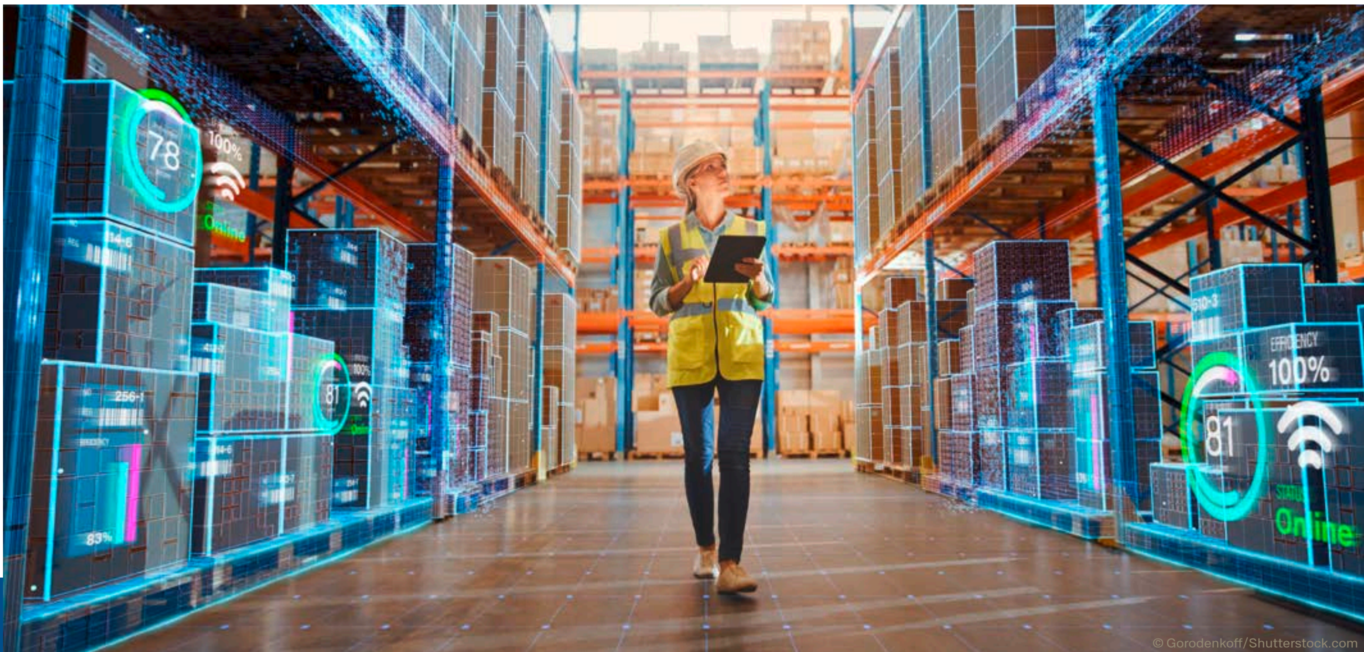
The highest goal of ML is indeed autonomization. In contrast to automation, autonomization does not require an active trigger and the processes do not necessarily run in a closed physical system. In other words, if it is known how a system behaves in a given situation, it is automation. If this is unknown, we speak of autonomization. With autonomy – even if it is sometimes deliberately restricted – we imply an inherently intelligent system.

(Source: https://www.iese.fraunhofer.de/blog/autonom-oder-vielleicht-doch-nur-hochautomatisiert-was-ist-eigentlich-der-unterschied/)

Autonomization of Planning Processes: The Evolution of Enterprise Resource Planning and Advanced Planning Systems

The ERP as the central data logger for master and transaction data at company level includes essential functionalities such as accounting, human resources, sales, quality management and asset management. Since the ERP is not explicitly designed for planning tasks – as such, only rudimentary inventory controls or simple planning processes such as MRP runs can be mapped –, advanced planning systems has been introduced. Advanced planning systems facilitate transactional business processes and provide a forward-looking view on them. They can be used to embed additional functionalities into the planning processes and to optimize and automate key figures for forecast accuracy, stock levels and customer service.

However, many advanced planning systems may not fit reality in total as they often miss advanced end-to-end decision intelligence with their technology. They are neither very agile, do not map entire supply chains nor are they able to process ad hoc plan adjustments close to the batch size of one. With its tools for strategic-tactical and operational planning, ORSOFT software always operates the integrative end-to-end approach to planning. This means, all planning instances are modelled holistically, are intelligently linked and a broad range of simulation and forecasting options are integrated. These characteristics are fundamental to applying autonomous planning instances, the third major disruption in supply chain management after ERP and advanced planning systems.



Modelling Autonomous Planning through a Digital Twin

The term twin probably evokes similar images in all of us. But how do these fit with a factory and its planning processes? Two identical factories maybe? Actually, the conclusion is quite correct! Namely one made of concrete and steel and one made of bits and bytes. But first things first.

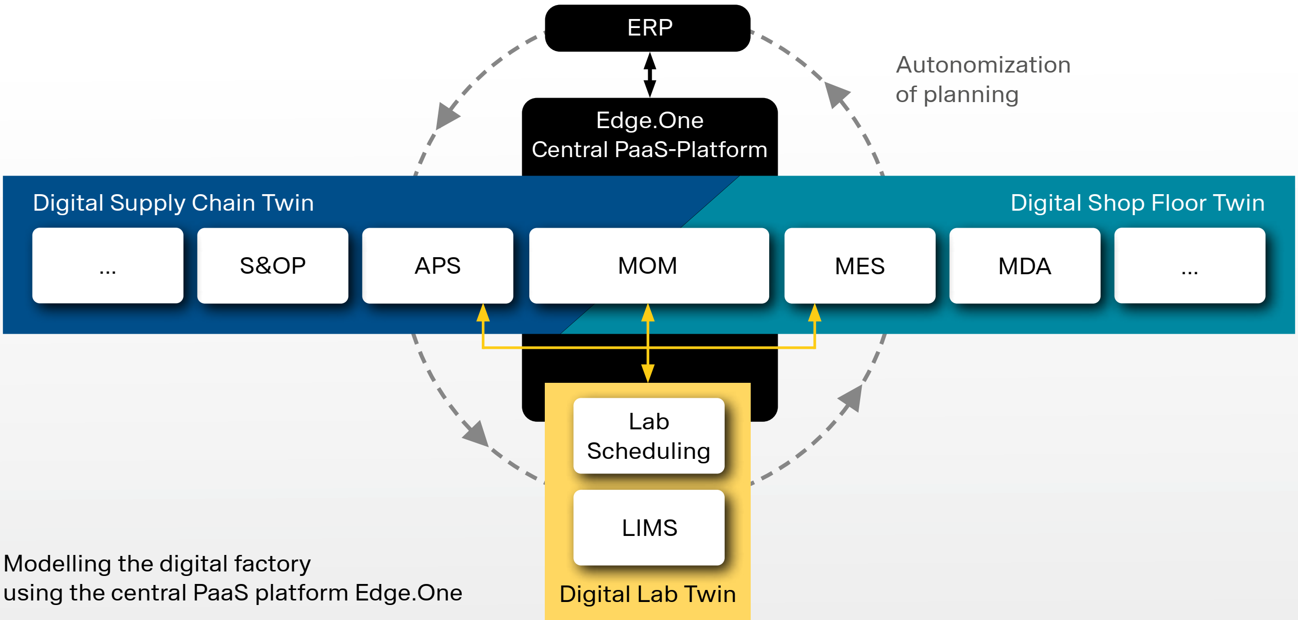
What actually is a digital twin? Analogous to genetics – where identical twins share identical DNA – the digital twin shares specific functional characteristics with its analogue brother. Transferred to industrial reality, this can be, for example, the shop floor and its digital copy of the production or a digital supply chain twin in the area of planning.

The digital supply chain twin forms an essential prerequisite for more autonomization in planning. With it, processes become more efficient, agile and transparent as well as faster and interconnected. The more complex the value chains – a plant with a sales unit very much differs from a comprehensive network of production, purchasing and sales processes – the stronger the need to synchronize the data between the planning instances. Low latency – thus a fast bidirectional real-time data processing – is a critical aspect towards the autonomization of processes. A common data layer should only use relevant planning data with maximum detail, data integrity and responsiveness. Hence, a smart modelling can be based on a modularly expandable and open interface-structured PaaS platform.

Edge.One: Paas-Platform Establishes the Central Hub for the Digital Plant of the Future

Edge.One is an integrated platform based on a micro-service architecture. It offers the possibility to integrate Germanedge solutions as well as third party applications. The domain model is based on ISA95, and is ready for Industry 4.0. Edge.One is delivered in a scalable, customizable structure and is cloud agnostic – based on Docker Swarm and Kubernetes, eventually. We support all operating concepts: whether SaaS, renting from the cloud or operating it yourself, on-premises or as a hybrid concept. You can start using Edge.One as soon as a cloud connection is available.

Modelling shop and top floor activities as digital twins within the central ERP environment and their cross-connection through Edge.One enables a holistic digitization of company processes in line with the Factory 4.0. You can read more about the topic "Enablers of the digital factory" in the last section of this paper.



Modelling the digital factory
using the central PaaS platform Edge.One

Germanedge

ORSOFT GmbH

It’s all about Advanced Analytics: Using Big Data and Self-Learning AI to drive Autonomous Conflict Resolution and Decision-Making

Structuring fully or partially autonomous processes and their implementation is a method of ongoing improvements. Because the circumstances necessary for the use of advanced analytics, but also the goals implied by the application of AI, very much differ from company to company. However, to illustrate the possibilities at this point, we will assume a best-case scenario. This means that usable and analyzable internal data sets are available and that there is a maximum open mindset to use this information – also enriched with external data sources.

Advanced analytics is no longer limited to analyzing historical data through descriptive analytics (the question of “what happened?”), but focuses on predictive (“what will happen?”) and prescriptive analytics (“how can I achieve it?”). By using analytics with regard to the future, planning scenarios can be mapped and – based on predefined and/or prioritized/ranked goals such as maximum customer service level, customer segmentation, margin-optimized production program, etc. – automatically executed. Rules regarding priority may help to resolve conflict situations in the best possible way and automate them through machine learning. Depending on the complexity of the planning optimization process, human decision-making may be partially – or even completely – removed. This is due to the huge number of data being processed, which might be, however, beyond human “processability”.

Since advanced analytics cross-link descriptive, predictive and prescriptive methods, the supply chain management can very much profit from this development. As such, ML-based analyses of time series may provide reliable forecasting information for demand planning. Fluctuations within supply chains can thus be reduced and subsequent processes improved. Their positive effects on inventory management – the reduction of necessary safety stocks to cover fluctuations in demand – is another important aspect. By applying AI methodologies, inventory planning can hence be switched from fixed to dynamic safety stocks.

Reactive scheduling is another huge trend in AI-supported planning where the planning run is described as an agile process that remains open right to the last minute. The goal is to keep being reactive to changing conditions such as ad hoc orders from an A-customer, reorders, delivery bottlenecks, plant breakdowns, staff shortages or similar. Continuous learning from decisions made in the past constantly “feeds” the AI with data. An up-to-date planning engine in the background, fed by the live system, helps to ensure that initially calculated plans only has to be adjusted marginally and continuously.

The advantages of machine learning methods may also affect the field of conflict management, enabling interesting new features. On the basis of one’s own previous decisions and the analysis of the results from them, proposals for solutions are created and, if desired, autonomized. Through the comparison of planned production and real feedback from the shop floor, the quality of the plan can be evaluated and fed back into the planning algorithm. The same procedure may also happen with regard to the implementation of maintenance forecasts. Likewise, alarm functionalities become (partially) automated and self-learning through AI-driven decision processes.

Germanedge

ORSOFT GmbH

Use Case 1

Autonomization of Advanced Planning & Scheduling (APS) in SAP Environments

The customer's task was clearly defined: Touchless autonomization of operational planning. The overall aim was to implement a system that operates autonomously under normal circumstances – so called "happy flow" –, and that can automatically involve planners in certain events. The following additional constraints were agreed upon: Automatic (iterative) interaction with SAP, strong configurability of the data model, automatic reaction to certain, freely configurable events and the execution of functions on a separate application kernel, which enables the software to be operated even without logged-in users.

To live up an autonomization of the operational planning, objectives of the planning run have to be defined through predetermined prioritization rules or as a sequence of priorities. Appropriate rules and constraints can be set in detail. All SAP fields – including those of referenced objects, e.g. the customer for the sales order of a planned order – can be qualified to both, manual and automatic configurations. Hence, all fields can be ranked by maintaining limit and exact condition values. In the particular case, material availability/ lead time, staff presence and qualification were explicitly specified as defined constraints.

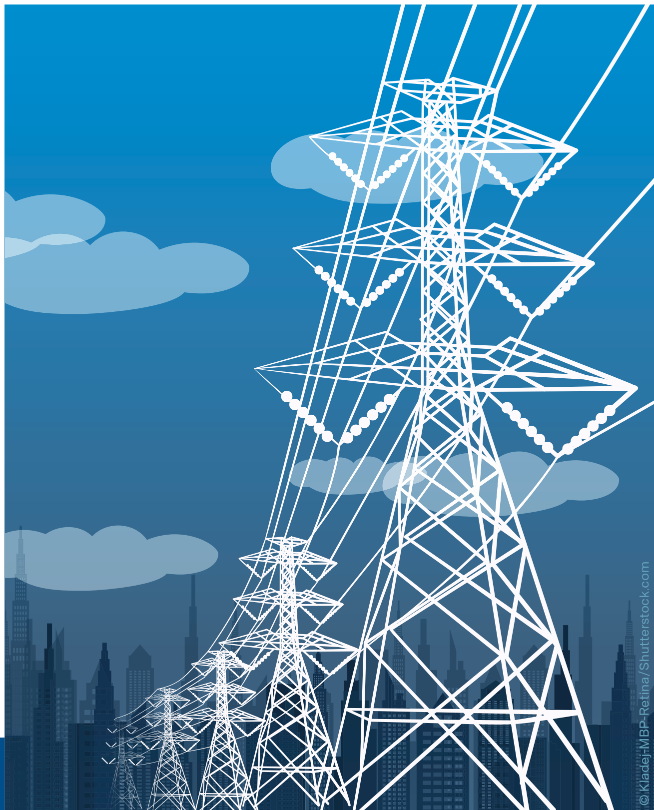
Thanks to the bidirectional real-time synchronization with the master and transaction data in SAP, the plans created always match capacity at plant and material level. ORSOFT applies a complex MRCP (Material Resource Capacity Planning) run with finite capacities – meaning all planning runs are executed with limited available resources and without overloads – which is not available in SAP. In the specific use case, material provisions from customers may also be integrated into the planning run. The initial trigger for planning autonomization is based on the implemented CTP (Capable to Promise)-check – which interacts between the ORSOFT planning tool and the central SAP. Only in the event of trade-offs such as missing resources at material and capacity level, automated alerts are displayed and sent as an e-mail notification.

Use Case 2

Holistic Energy Management as an Integral Part of Production Planning

Energy management is an accessory in many companies and is often limited to the design of the energy master agreement. However, this exactly is the point where potential cost savings may be realized. By using information from energy data management – such as plant-related load profiles, energy consumption due to stand-by times or product-dependent energy consumption – energy management can hence be integrated into planning runs. Production schedules are compiled in such a way that they either comply to an active energy plan – overloads can thus be avoided –, or generate/ supplement such an energy plan. With an energy plan created out of the production planning, peak loads can be reported to the energy supplier and any additional costs incurred may be reduced. To put it the other way around: an energy plan may initiate also internal countermeasures, for example by postponing production steps, changing plants or ramping up energy-intensive plants at times of low base load.

Through the use of AI, energy-optimized production slots can be identified and plans may be scheduled based on key figures with regard to capacity, material availability and energy.



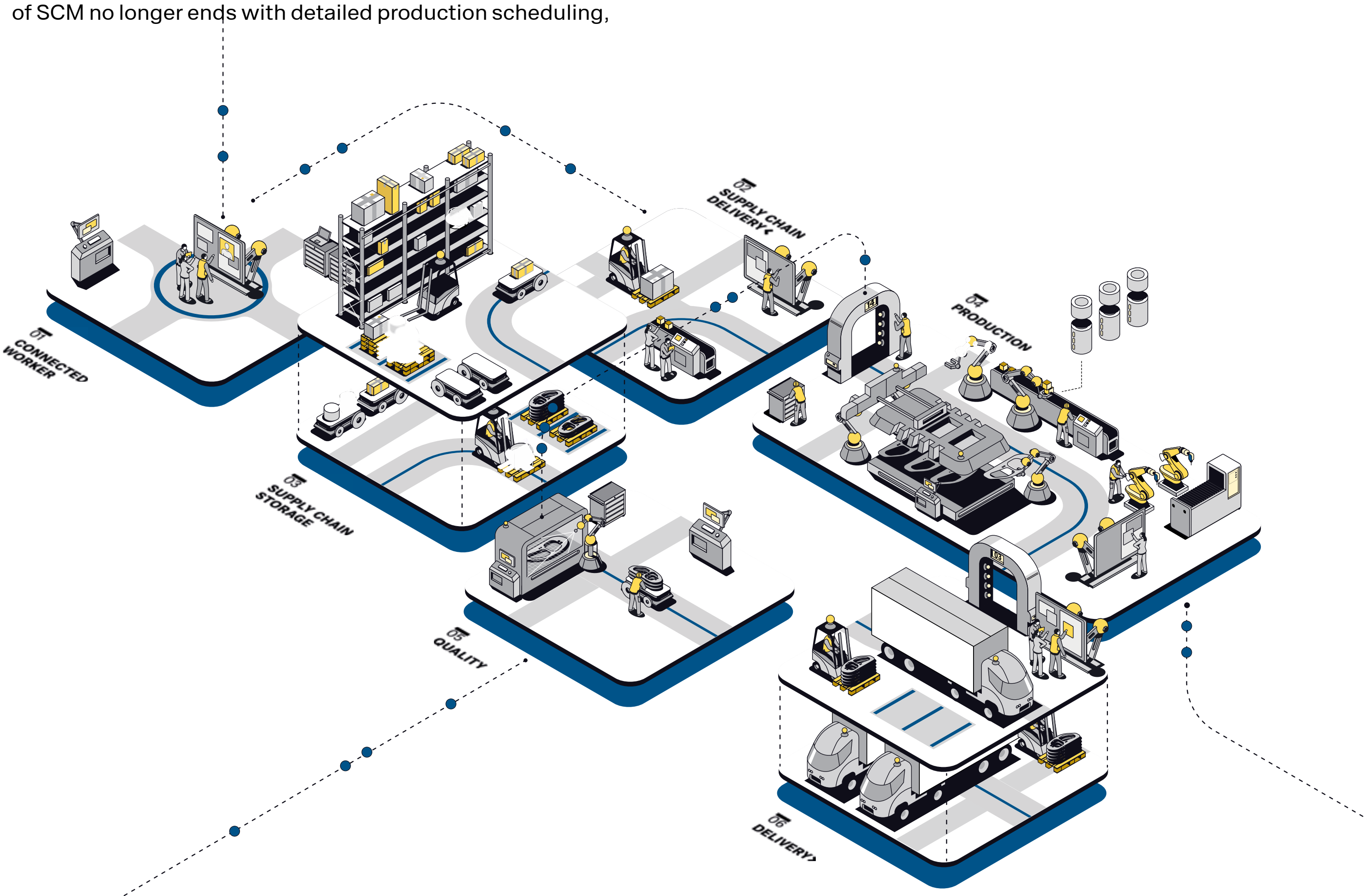
Germanedge

ORSOFT GmbH

Enabler of the Digital Factory: We think Autonomization beyond Supply Chain Management

The process and manufacturing industry 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 through laboratory information – which is stored in the central ERP or MDX (Machine Data Exchange) and LIMS (Laboratory Information and Management System). The central topics of the digital factory – automation and autonomization – are thus coming more and more into reality. This allows taking a holistic view on main objectives of SCM such as delivery reliability, maximization of plant throughput and/or minimization of inventories. The end-to-end approach of SCM no longer ends with detailed production scheduling, but includes countless live data from the shop floor level. Hence, capacity conflicts on the shop floor can be pointed out quickly and efficiently, and automated changes can be imported. Those changes can thus be easily compared with the forecasts from demand planning.

According to the DNA of the digital factory, formerly autarkic isolated solutions and silos in the shop floor (actual state) and supply chain management (planned state) are reversed and merged into a common digital ecosystem. The possibilities here are endless and new use cases are found almost daily.



Get in touch →

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.