

Empower the Intelligent Chemical Enterprise with SAP and its Ecosystem

Operate with visibility, focus and agility to drive game-changing outcomes faster, more effectively, and with less risk



Dear Customers,

The world is facing huge social, economic and environmental challenges, and every person and company has a role in creating a sustainable future for all of us.

Global mega trends are affecting the chemical industry. Resource scarcity, environmental impact, and enhanced expectations in customer and consumer experience call for innovative business models and platforms in support of a “circular economy.” Due to its early position in the value chain, sandwiched between energy & feedstock players and end consumer industries, the chemical industry is predestined to play a pivotal role in this. The need for sustainable, reliable, trusted and innovative products and services requires chemical companies to ensure safety and integrity along the entire value chain and lifecycle of products.



I predict, that in 2025 a large part of chemical companies’ revenue will come from innovative products, services and business models, that are delivered based on real-time data sharing and co-innovation with customers on new platforms and ecosystems. These innovations range from simple aftersales services to complex business outcomes as a service delivering entirely new customer experiences. They also include the monetization of knowledge, intellectual property and data assets, that companies are able to generate based on the business they conduct.

In order to achieve this, companies need to change the way they operate. They must integrate and increase transparency of their own end-to-end processes and operations, combining this with real-world awareness of customers and environment. They must then learn from this information to make decisions and solve problems in novel ways.

By shifting routine tasks from humans to business systems enabled by machine learning and artificial intelligence, chemical companies will free up the capacity needed to define and pursue innovative and transformative business models.

With the Intelligent Enterprise framework, SAP provides the integrated suite of applications, the intelligent technologies and the digital platform that companies need to do this shift. Together with our partners, we have the vision, the solutions, and the commitment to go with you all the way from defining your transformation strategy and delivering the right solutions to running your digital backbone in the cloud.

Sincerely yours,

Thorsten Wenzel (PhD)

Global Vice President · Chemical Industry · SAP SE

Imprint

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Thriving in a Digital World

The need for change

Global mega trends are affecting the chemical industry but also provide new opportunities for growth :

- Resource scarcity, environmental impact and changing consumer expectations call for innovative business models and platforms in support of a „Circular Economy“. Due to its early position in the value chain, sand-

wiched between energy & feedstock players and end consumer industries, the chemical industry is predestined to play a pivotal role in this.

- The need for sustainable, reliable, trusted and innovative products and services requires chemical companies to ensure safety and integrity along the entire value chain and lifecycle of products.



In addition the chemical industry is reshaped by four major trends:

- Ongoing commoditization and margin erosion requires chemical companies to focus on portfolio optimization, co-innovation and selling business value and outcome instead of just products with the ultimate goal to deliver entirely new customer and consumer experiences.
- Digital as the new norm with technologies like IoT, AI/ML, Blockchain, Cloud and analytics available provides new opportunities for chemical producers to cut costs via automating the back office and running „low touch“ operations.
- As the playing field is changing with disruptors coming in from various angles, chemical companies start looking beyond traditional value chains and start competing in complex ecosystems.
- In a more and more dynamic world with mergers, acquisitions and divestitures as key vehicles for portfolio optimization and sustainable growth, strategic market-driven agility has become an imperative to survive or even thrive.

Ability to address the global trends will determine who will be among the winners in mid- and long-term future. Tomorrow's leading companies are already moving beyond providing products and services. They are applying technology to create deeper and more meaningful relationships with people. They are creating new affiliations with businesses across industries who share their vision and mission. They are using these new partnerships to invent new products and services that meet the goals of their customers and employees and, in doing so, are achieving new levels of growth and differentiation. They are also helping their communities create new eco-

nomic opportunities and develop new ways of serving and protecting citizens, benefiting society as a whole.

Intelligent Technologies as Key Enabler

The current pace of technological advancements has the most profound impact on enabling how chemical manufacturers transform themselves to respond to market trends and to deliver entirely new customer experience.

Intelligent technologies promise to bring great benefits such as productivity and efficiency gains, enabling innovative new business models and new revenue streams. The following intelligent technologies are instrumental in helping chemical companies respond to the market trends.

Artificial Intelligence (AI) and Machine Learning (ML)

Machine Learning enables algorithms to “learn” from existing data and achieve the best possible outcomes without being explicitly programmed. Once the algorithm is trained, it can then predict future outcomes based on new data. Businesses can leverage these capabilities e.g. in Cash Management to boost automatic matching rates and free up finance professionals to focus on strategy and service quality or in HR to automate the talent screening process and identify the candidates with the best skills and education match for a specific job description.

The Internet of Things (IoT)

Advances in ubiquitous connectivity and edge computing are driving a step change in business productivity. This connectivity, coupled with artificial intelligence and

machine learning, can analyze petabytes of data and affect real business outcomes. Although manufacturers have been using IOT for some time, now the entire value chain can be connected: from development to production to supply chain. Data-driven insights can drive customer-centric innovation, lower material costs, and reduce risk. Remote condition monitoring of assets, provides real-time data of machines to predict maintenance needs, and identify potential quality problems in manufacturing processes before they occur. Assets can be jointly managed as digital twins by manufacturers, customers and partners improving asset data and modelling.

Advanced Analytics

The integration of advanced analytics capabilities, including situational awareness, into applications enables business users to analyze data on the fly and drives better decision making from shop floor to top floor. Empowered users, benefiting from embedded analytics in business processes, can get real-time visibility into their changing environment, simulate the impact of business decisions, mitigate risk and achieve better customer outcomes.

Blockchain

A relatively recent breakthrough technology, blockchain is revolutionizing the movement and storage of value by creating a chain of unaltered transactional data. The blockchain model of trust, through massively distributed digital consensus, could reshape supply chains and commerce across the entire digital economy for example by digitizing the Bill of Lading (B/L) document as part of the international ocean shipping process.

Augmented Reality

Virtual reality (VR), the use of digital technology to create immersive simulations, was once the stuff of science fiction. So was augmented reality (AR), which lets users interact with digital content that's overlaid on the real world. Already in use to help workers with difficult or infrequent maintenance activities, this will become even more critical to attract and retain millennials.

Conversational AI

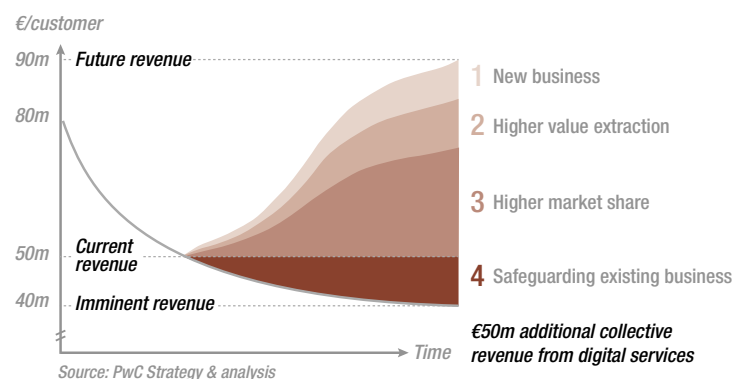
Advances in machine learning are enabling algorithms to become highly accurate in natural language understanding and in image and speech recognition, especially useful in after service and call center activities. Voice interface will be the go-to for the next generation of applications, allowing for greater simplicity, mobility and efficiency while increasing worker productivity and reducing the need for training.

Industry Vision 2025

By 2025, chemical company revenue will depend on innovative products and services that derive from new business models. These new models range from relatively simple aftersales service offerings to complex outcome-as-a-service models, and include programs to monetize corporate knowledge, intellectual property and data assets. Increasingly, these new ways of doing business will rely on real-time data sharing and collaboration with customers on new platforms, supported by extended partner ecosystems.

Customer-centric R&D will anticipate customer and consumer demand, collaborate with extended ecosystems, simulate product and formulation performance,

Business impact of introducing digital services in a chemicals company



Source: PwC, Chemical Trends 2018-2019, A Tipping Point in Profitability

and design products that minimize environmental impact.

Applying **digital technologies in operations** will help analyzing production process variables in real time and simulating their impact on product quality, costs, and yield. This predictive analysis will further enable chemical companies to anticipate downstream supply chain disruptions and take corrective actions in real time.

Enabling **digital twins and IoT connectivity of assets** will allow chemical companies to continuously monitor asset health, process quality, throughput, waste, and emissions. By combining asset information with predictive analytics, companies can predict the likelihood of asset failures, plan maintenance and adjust production plans accordingly.

Digital technologies like blockchain, the IoT, 3D printing, and machine learning provide opportunities to **optimize,**

extend, and even disrupt supply chain processes and models. Digitalization benefits supply chain processes from authentication of raw materials and fair labor practices to automated tank replenishment and fleet management. It helps optimize trading and shipping, additive manufacturing, and product integrity management while minimizing supply chain risk.

Strategic Industry Priorities

Leading chemical companies plan to capture new business opportunities by driving customer experience, focusing on step changes in productivity and empowering an innovation culture. They will constantly innovate across the value chain to drive profitable growth and adapt to how customers want to acquire, use, and pay for their products and services.

Successfully embracing the following four strategic priorities and addressing the opportunities from new technologies will help chemical companies to stay ahead of the innovation curve and evolve towards the 2025 vision.

Sell business outcomes instead of products

The chemical industry has its roots in selling products made from crude oil and inorganics into a variety of downstream industries such as consumer products or life sciences, pharmaceuticals, automotive and hitech, just to name a few. Finding new molecular structures, scaling them up and selling them in a B2B fashion, either as standalone products or as part of proprietary formulations into downstream industries, was and still is today's standard business model. Now, this business model is challenged by mass commoditization of products and formulations, global competition, higher demand from end consumers in terms of sustainable products and operations and exponentially increasing regulatory requirements.

The vision:

Coming from a pure B2B-based push model in the past, by 2025 most chemical companies will apply B2B2C-based business models and concepts, including the „segment of one“ concept, leveraging digital technology to deliver sustainable, co-developed applications, services and business outcomes instead of simply pushing products into the market. They will develop and maintain customer relationships, based on trust, joint development, shared values, risks and innovative customer experience as the new paradigm.

The journey:

Chemical companies will start towards this goal with personalization of customer experience by marrying customer sentiment analysis with analysis of buying behavior across channels to understand individual customer needs and generate tailored customer interactions. They will establish searchable IP databases to rapidly access relevant scientific information.

Once having this foundation they will extend into predicting properties and performance of new formulations to significantly shorten development process and time to market while monitoring product/formulation compliance along the entire lifecycle. Furthermore they will extend into their customers' value chain, monitor process parameters and allow in situ quality control in real time through sensors at customer operations. In terms of logistics they will track and trace material flow and product integrity along the entire value chain.

Finally they will collaborate in open innovation platforms, turn data into value based services and establish transformative business outcome driven and customer centric revenue models to improve quality and reduce costs and risks for customers.

Simplify to shrink cycle times

Safe, compliant and sustainable operations are at the top of the CEO agenda and thus have a high priority in any transformational efforts. Even though a high level of safety and automation, in particular through DCS systems at the shop floor, has already been achieved over the last decades, many chemical companies still suffer from siloed data and lack of in-

tegration in manufacturing and supply chain which prevents them from further automating end to end processes in those key business functions.

The vision:

By 2025 chemical companies will be able to automate major parts of their back-end systems leveraging machine learning technology and predictive models to enable scenarios like „lights out manufacturing“ or „touchless order fulfillment“ bringing them close to the overall vision of the autonomous enterprise.

The journey:

In a first step companies will look at their plants and further reduce processing time, increasing first pass yields, and improving OEE by fully integrating IoT, Machine Learning and digital twins throughout operations. Next, companies will extend into connecting and collaborating with customers, suppliers and service partners upstream and downstream, e.g. via the Asset Intelligence Network, using predictive models to better forecast demand and balance it with supply in real-time. Furthermore they will be able to anticipate possible disruptions, ad-hoc simulate and implement contingency plans to mitigate risks along the entire supply chain.

Finally, they will get close to the vision of the autonomous enterprise via fully automating standard operations with Machine Learning.

Compete as an ecosystem

Today most chemical companies operate within their traditional boundaries. Innovation is primarily driven by an “inside out” view, primarily capitalizing on ex-

isting products, internal know how and established relationships with suppliers, partners and customers. However, with growing competition, ongoing globalization and the advent of mega trends like Precision Farming or the Circular Economy industry boundaries are more and more blurring and established business models and practices, based upon linear value chains are no longer sustainable.

The vision:

By 2025 many chemical companies will have gone beyond the boundaries of their current product-based value chain. Together with a network of partners (for example, service providers, universities, research institutes, toll-manufacturers, technology providers, etc.), chemical producers will be able to work on customer-specific solutions and applications in the End Consumer Industries (e.g. Automotive, Hitech, Aerospace & Defense, Consumer Products, etc.) in a „segment of one“ relationship, delivering outcome-oriented applications and services. They will adopt the capability to flexibly redesign their network and relationships in line with market dynamics and ongoing portfolio optimization.

The journey:

In a first step chemical companies will capitalize on structured and unstructured data from an open network or ecosystem to understand market needs.

Subsequently they will connect with and orchestrate an extended network of external stakeholders to rapidly respond to market needs and establish a common platform for collaboration.

Ultimately, based on data and intelligent insights from ecosystem they will develop

differentiating, innovative services (like benchmarking, proprietary recipes etc.) or business models which support a higher purpose (e.g. Precision Farming, Circular Economy, Open Innovation).

Adopt strategic agility in response to market dynamics

In today’s highly dynamic world growing organically is no longer the only, or even the primary, recipe for success. To survive and thrive in such an environment more and more companies turn towards mergers, acquisitions and divestitures to expedite portfolio adjustments and diversify into promising new markets or segments. However, many of such initiatives fail as it takes way too long to realize the expected synergies and embed the acquired entities into existing portfolios.

The vision:

By 2025 chemical companies overall performance, profitability, growth and competitive position will be based upon enhanced speed and agility to adjust strategy and product & service portfolio, to grow into new markets or segments, and to re-

alize synergies of mergers, acquisitions, and spin-offs. This goes far beyond the product and manufacturing expertise the chemical industry has shown in the past. It requires the flexibility to apply B2C sales & product management capabilities and the ability to manage diversified product and application portfolios frequently in a „segment of one“ relationship.

The journey:

First and foremost chemical companies will reduce cycle times for dynamically analyzing their product and service portfolios, based on better availability and visibility into internal and external data.

In a next step they will start embedding external market and company data into ad-hoc simulations on strategic scenarios (like Mergers, Acquisitions and Divestitures) and will be able to assess the overall impact on corporate KPIs and company performance.

In the final transformative stage companies will co-innovate with customers and embed business and technology innovations into their application & service portfolio for diversification, differentiation and profitable growth.

The Intelligent Enterprise for Chemicals

To continue the digital transformation journey, you now need intelligent, integrated business processes.

In a connected world where every company is becoming a technology company, smarter products and services will further focus on outcomes for your customers and change industry boundaries. In order to remain successful chemical companies should bring intelligence to their products, services, and models for work and business.

SAP point of view: winning with the Intelligent Enterprise

Digital disruption has transformed how companies and customers interact and disruption is continuing as the transformational power of digital fuels the Fourth Industrial Revolution, changing how people live, work and relate to one another. Unlike its predecessors, the current industrial revolution is affecting every sec-

tor of the economy with chemical companies right at the center.

The new intelligent technologies are changing the way companies operate and how they deliver and monetize their products, solutions and services. Intelligent technologies are enabling the disruption of the industry. Embracing these technologies is critical for chemical companies to thrive and become Intelligent Enterprises.

Intelligent enterprises empower employees through process automation. In the coming years AI will evolve to automate ever more complicated tasks, to free up employee time and empower them to do more meaningful and rewarding work. Companies have the opportunity to transform the workplace with automation augmenting their expert resources. Instead of fearing automation, many employees can look forward to jobs that challenge and interest them, providing opportunities

Fig.: 1

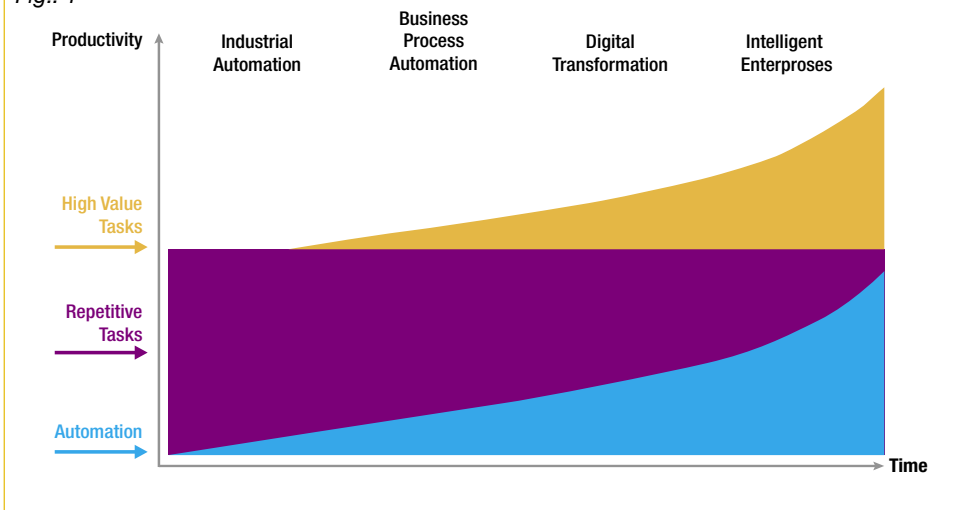
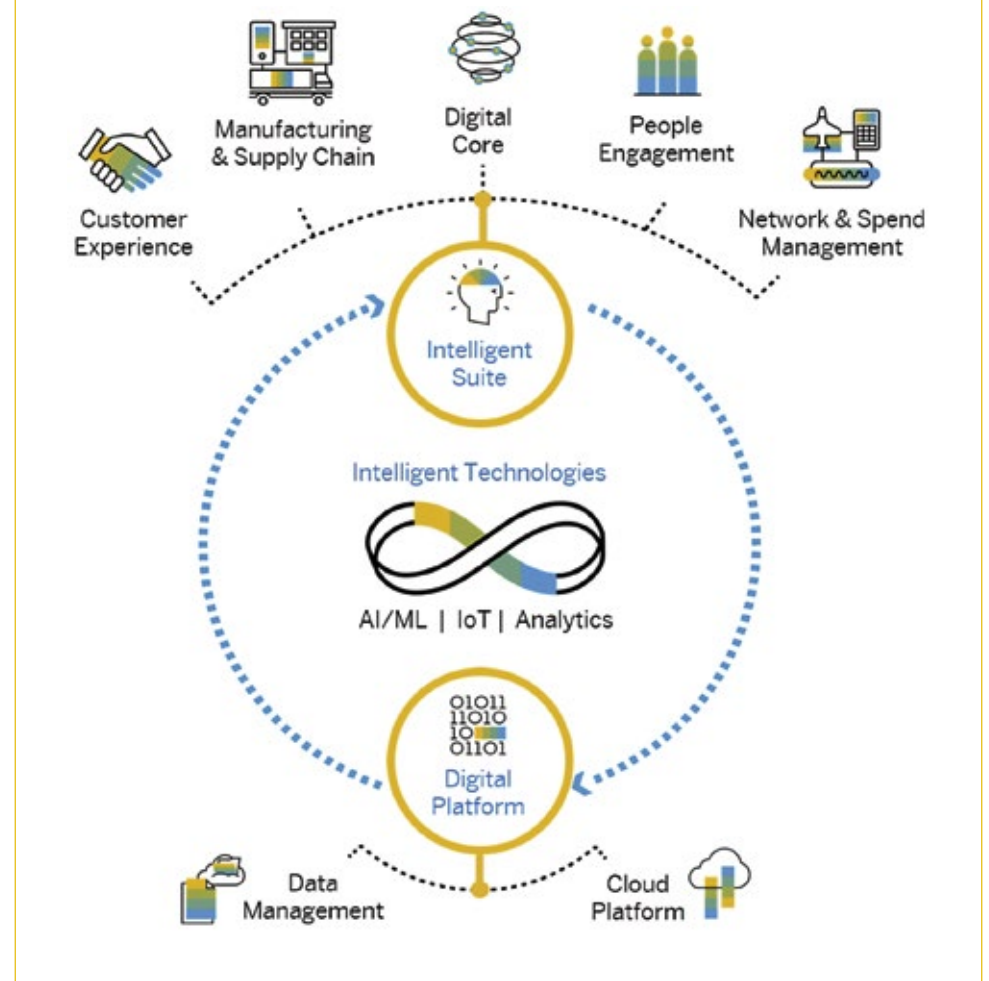


Fig.: 2



Intelligent Suite
Our intelligent, integration-ready applications can help you manage customers, supply chains, networks, employees, and core processes. They are easily extensible – and offer a consistent and intuitive user experience.

Intelligent Technologies
Drive rapid and continuous innovation with SAP Leonardo – a guided approach to digital transformation that combines intelligent technologies and services.

Digital Platform
Manage data from any source, in any format and rapidly develop, integrate, and extend business applications – with an open digital platform.

to add more value instead of performing mundane, repetitive tasks.

This empowered workforce will be able to focus on high-value activities like customer success, strategic planning, and innovation. Automation can now also be implemented far more cost-effectively,

because it is embedded more and more within business processes.

Advances in ubiquitous connectivity coupled with artificial intelligence and machine learning, can be used to create new business models that generate new revenue streams. Monetizing data-driv-

en capabilities and applying core business competencies in innovative ways that would never have been possible with traditional face to face engagement models.

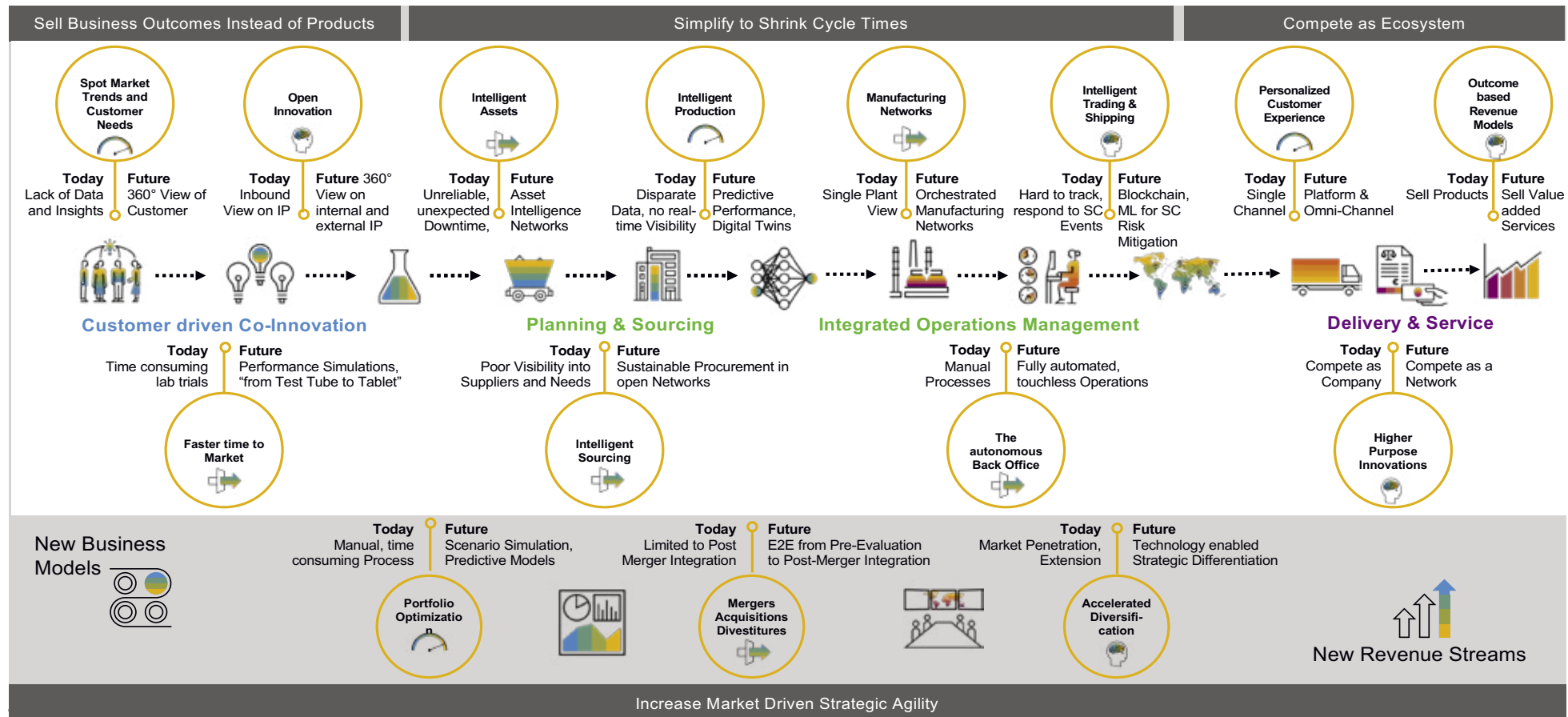
When interaction shifts to the digital, it becomes far easier for customers to

switch to other providers, especially with new disruptive market entrants. New approaches and business models are required attract and retain customers and companies will need to anticipate and proactively respond to customer needs, creating personalized and unique cus-

Fig.: 3

The Intelligent Enterprise for Chemicals

End-to-End Industry Value Chain with Intelligent Industry Scenarios Embedded



customer experiences using AI, chatbots, and voice technologies to deliver best in class customer service.

The imperative for change is clear and the difference between winners and losers will be to their ability to digitally transform, embracing intelligent technologies and the major trends shaping the future of the industry.

SAP enables chemical companies to become intelligent Enterprises

The Intelligent Enterprise Suite for Chemical Companies is a set of Integrated Business Applications that use Intelligent Technologies and can be extended on SAP's Digital Platform. This enables next generation business processes to deliver break-

through business value on our customers journey to become Intelligent Enterprises.

The Intelligent Chemical Enterprise

In order to execute on their strategic digital priorities and achieve the 2025 vision, companies need to change the way they operate. By shifting routine tasks from humans

to business systems enabled by machine learning, and redesigning processes, they will free up the capacity needed to define and pursue innovative and transformative business models. The Intelligent Enterprise is the fabric that weaves together all these siloed processes, intelligent technologies and real-world data threads from customers and the environment into flexible end to

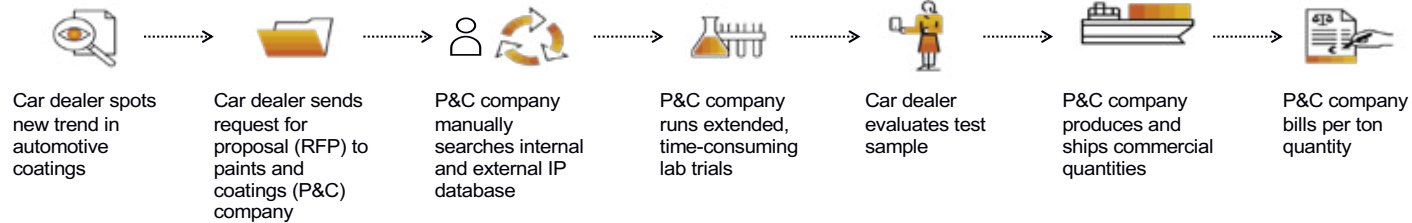
Fig.: 4

Next Practices Example: Outcome Based Co-Innovation in Chemicals

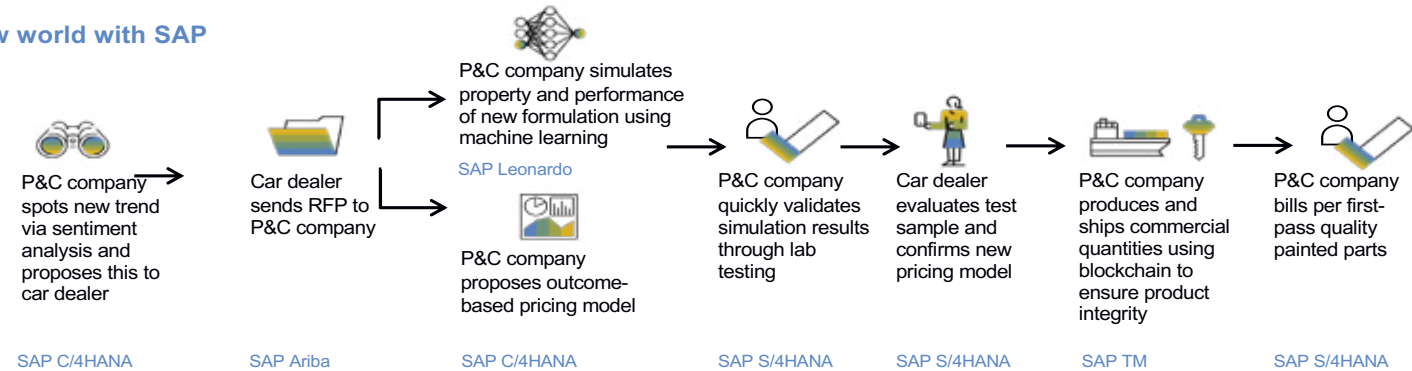
 Sell business outcomes instead of products
SAP Products as Enablers

Traditional scenario

Cumbersome, multistep development process and traditional, product-quantity-based revenue model, delay time to market and time to value.



A new world with SAP



Top value drivers **Faster time to market** **Increased quality and customer satisfaction** **Reduced costs and waste** **Increased brand recognition**

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Experience Matters

end value chains that provide a transformative customer experience and support next generation business models.

The Intelligent Enterprise for chemical companies offers unlimited innovation op-

portunities across the enterprise, and opens up the path towards new frontiers beyond the traditional enterprise boundaries. It offers intelligence that is embedded into processes within the enterprise, as well as

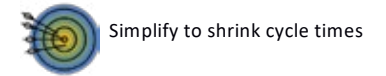
transforming the enterprise by supporting new business models and revenue streams.

The strategic priorities, that address the major themes shaping the industry, impact the entire end to end value chain.

Application of intelligent technologies will help chemical companies address their digital priorities, implement next generation business processes and become intelligent enterprise. (see Fig. 3)

Fig.: 5

Next Practices Example: Integrated Operations Management

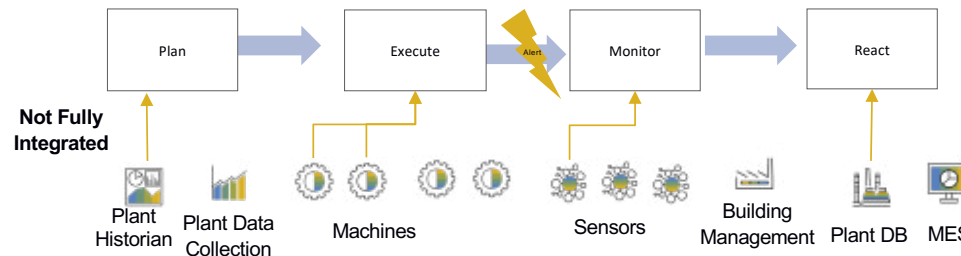


Top value drivers:

- Act on essential data
- Faster reaction time
- Support new business processes

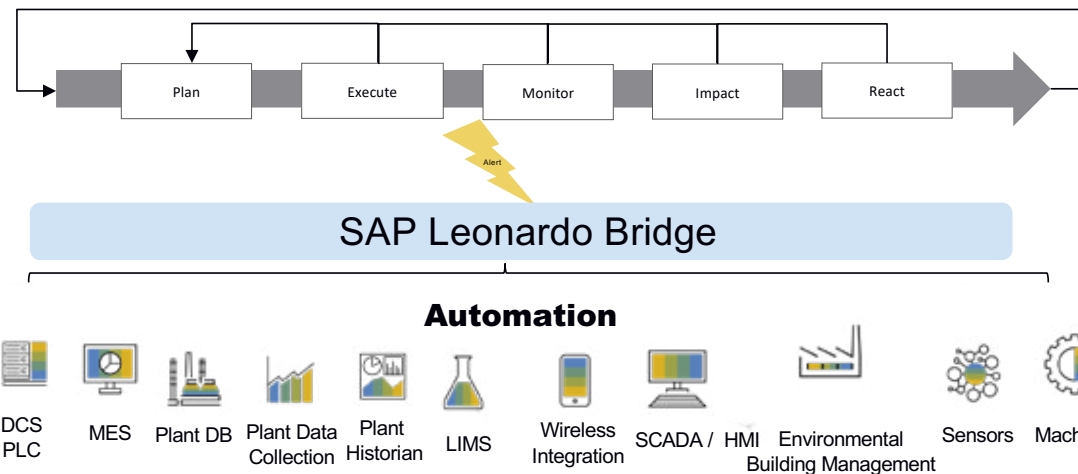
Traditional scenario

- Not possible to understanding the potential impact of an event on one or multiple downstream processes
- Unable choose the best solution to a problem due to the lack of capability to completely model multiple solutions.
- Minimal integration between operation and management systems



A New World with SAP

- A digital representation of the operational world that deals with the interrelated data from facilities, operations, human resources, logistics and the environment, shop floor integration fully supported by SAP Leonardo and the SAP Leonardo IoT bridge.
- As events occur, only those events that are of interest are presented, analyzed for impact, considered for remediation, and then a new plan or reaction is executed.
- Being able to learn what data needs to be acted upon is essential to modern operations.

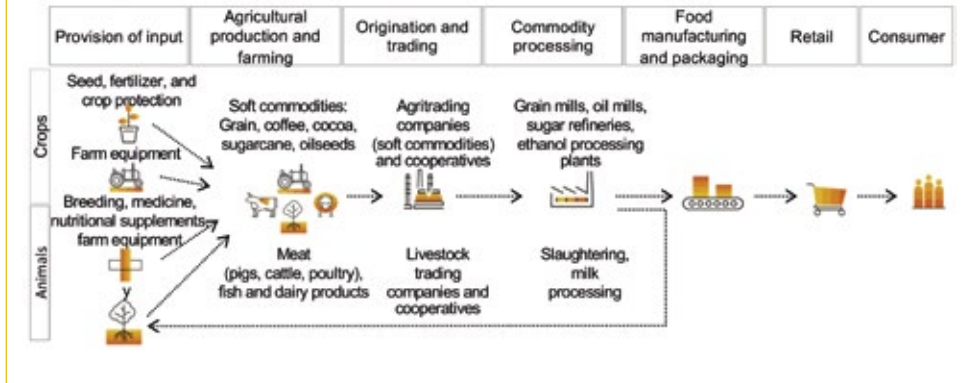


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Experience Matters

Fig.: 6a

Traditional Scenario



Outcome Based Co-Innovation in Chemicals

Traditionally chemical companies develop products in response to market needs driven by downstream industries like consumer products, pharmaceuticals, engineering & construction.

In the future, chemical companies will strive for unprecedented levels of customer experience, anticipating market trends and needs, rapidly developing and manufacturing corresponding formulations, and selling those based on “business outcome” (e.g. first pass quality semi-finished parts or goods) instead of selling by quantity. Such innovative process are enabled by innovative technologies like Machine Learning, IoT and Blockchain. (see Fig. 4)

Integrated Operations Management in Chemicals

Being able to operate safely and effectively is essential to chemical industry. Companies for years have been trying to reduce

cycle times and improve first pass yields to operate more effectively with special emphasis on individual inefficiencies (e.g. movement of material, efficiency of equipment, etc.) for years. Modern chemical companies in their search to reduce cycle times are looking at the fully integrated operations for the company. Realizing that changes in one area can impact further downstream operations they are looking at the total process, end to end, to reduce the cycle time. By providing this integrated operational view SAP S/4HANA, SAP Leonardo, and the Digital Twin allows companies to operate more reliably and efficiently while providing valuable insights into operations to improve problem resolution and business outcomes. (see Fig. 5)

Digital Farming - from traditional value chain to business network collaboration

Increasingly, agrichemical companies struggle to differentiate themselves in a marketplace plagued by low commodity

Fig.: 6b

A New World with SAP



prices and highly price sensitive customers. Yesterday’s hot GMO seed and its companion crop protection chemical has to compete today with similar offerings from global competitors. In this environment, companies are moving towards direct sales to farmers, with product sales supported by companion product and service offerings provided by business partners. The winners in this market are those with wide partner ecosystems who bundle agricultural products with things like customized crop insurance, financing, weather services, agronomic advice, equipment maintenance services, even planting and application services – all of which may come from partner companies. Competing as an ecosystem requires a new mindset and close collaboration between business partners

facilitated by supply chain collaboration, business networks, and close customer engagement. (see Fig. 6)

Adopt strategic agility in response to market dynamics

Increasingly, chemical companies' overall performance, profitability, growth and

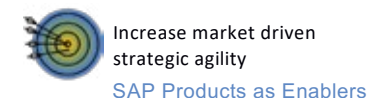
competitive position will be based upon enhanced speed and agility to adjust strategy and product & service portfolio, to grow into new markets or segments, and to realize synergies of mergers, acquisi-

tions, and spin-offs. This goes far beyond the product and manufacturing expertise the chemical industry has shown in the past. It requires the flexibility to apply B2C sales & product management capa-

bilities to the B2B world, and the ability to manage diversified product and application portfolios frequently in a „segment of one“ relationship. (see Fig. 7)

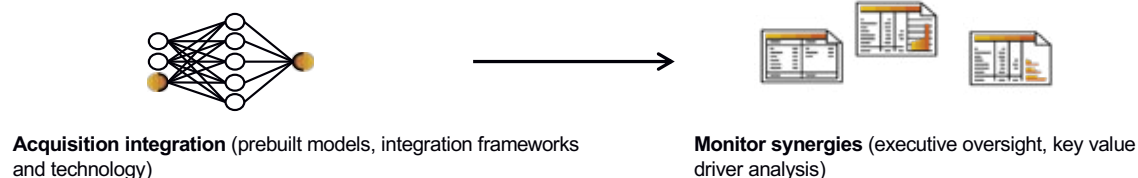
Fig.: 7

Next Practices Example: End-to-End Mergers & Acquisitions



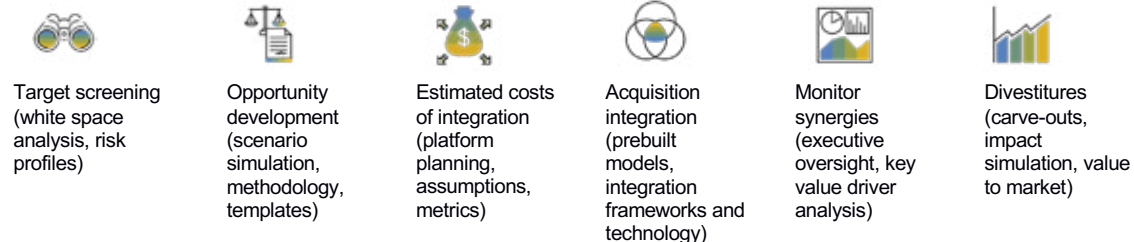
Traditional scenario

Traditional core functionality of SAP® software limited to postmerger integration



A new world with SAP

Closed-loop, E2E process to cover mergers, acquisitions, and divestitures in their full scope, from pre-deal evaluation to postmerger integration and divestitures



SAP Analytics Cloud (Digital Boardroom)

Top value drivers

Increase market share

Realize synergies

Increase revenue growth

How to get there

The journey to becoming an intelligent chemical company begins with digital and leverages a transformation road map.

How to plan your path to the Intelligent Enterprise

In the digital economy, intelligent technologies and integrated business processes are now driving digital transformation. To do this effectively requires an end-to-end plan for becoming an intelligent enterprise. This includes creating an intelligent enterprise roadmap and implementation plan with proven best practices and deployment options that optimize for continuous innovation with a focus on intelligent outcomes. (see Fig. 8)

To move forward with speed and agility, it helps to focus on live digital data, combine solution know-how and industry-specific process expertise with data analytics so that the right digital reference architecture is defined and delivered. In that context, a

model-company approach (see Fig. 9) is aimed at simplifying and increasing the speed of digital transformation journey. Model companies represent the ideal form of standardization for a specific line of business or industry. They are built on pre-configured SAP solutions based SAP best practices along with the business content that encompasses our experience and expertise relevant for the industry. They provide a comprehensive baseline and come with the accelerators to jump start the digital transformation projects.

How to ensure a successful transformation to your Intelligent Enterprise

SAP Digital Business Services has a broad range of services to cover the end-to-end digital transformation journey, ranging from consulting on a digital innovation road map and implementation plan with proven best practices to the ability to run all deployment options and ultimately optimize for continuous innovation (see Fig. 10). We provide both choice and value within our service

Fig.: 8

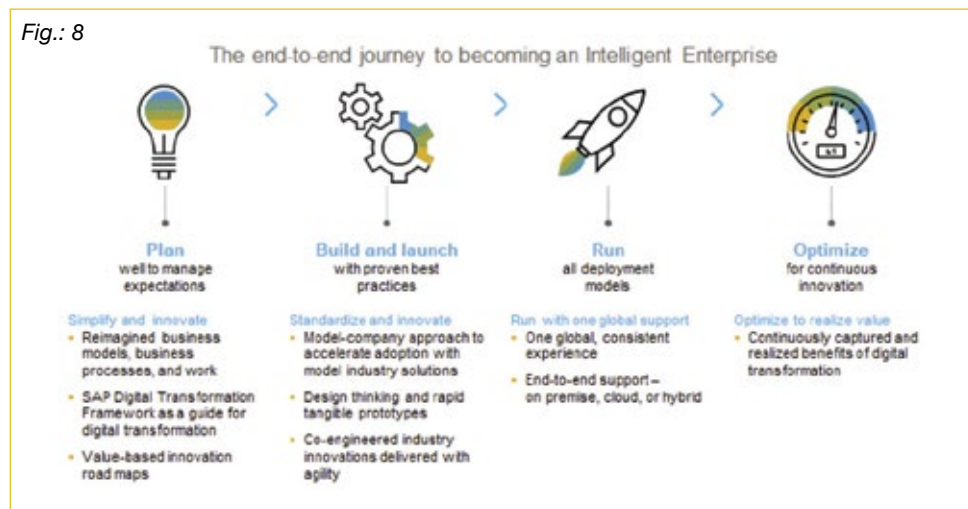
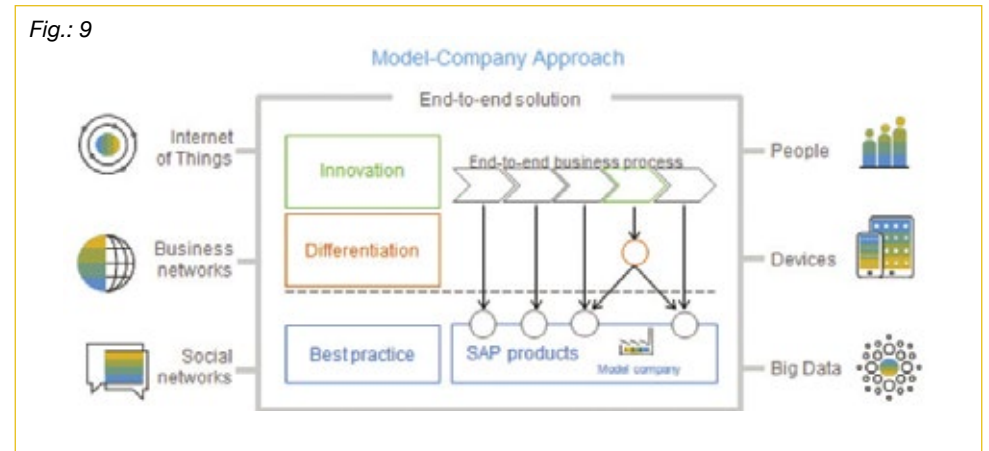


Fig.: 9



offerings, allowing you to tailor the proper approach based on your specific company expectations and industry requirements.

- 25,000 professionals in 70 countries
- Customers in 130 countries
- Outcomes delivered as one team in one contract
- Projects connected in real time to a global network of support functions through SAP Mission Control Center
- SAP MaxAttention™ and SAP ActiveEmbedded services to safeguard investment
- Consistent experience – on premise, in the cloud, or a hybrid
- Standardized adoption of processes and tools
- Streamlined onboarding and ramp-up of stakeholders

From proposing a comprehensive digitalization proposal to realizing and running it, SAP delivers on the digital transformation promise to its customers on time, within budget, and on value.

Value delivery from SAP is possible due to our many unique, differentiating assets:

SAP Digital Business Services deliver digital innovation with simplification and accelerated implementation, which is key to adoption and value realization. Continuous improvement is supported through the ongoing assessment of real-life data insights and joint governance with customers (see Fig. 11).

Value delivery from SAP focuses on the following deliverables:

Fig.: 10

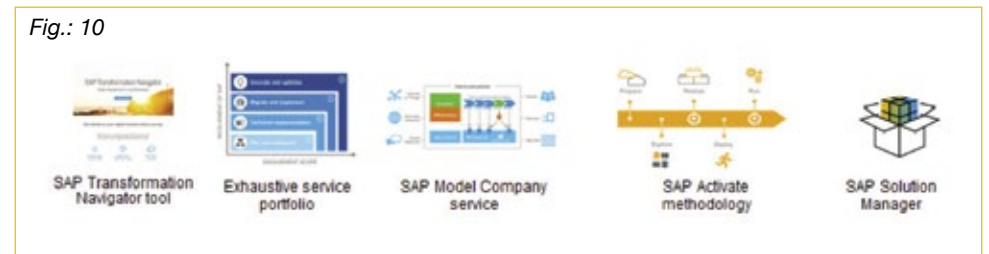
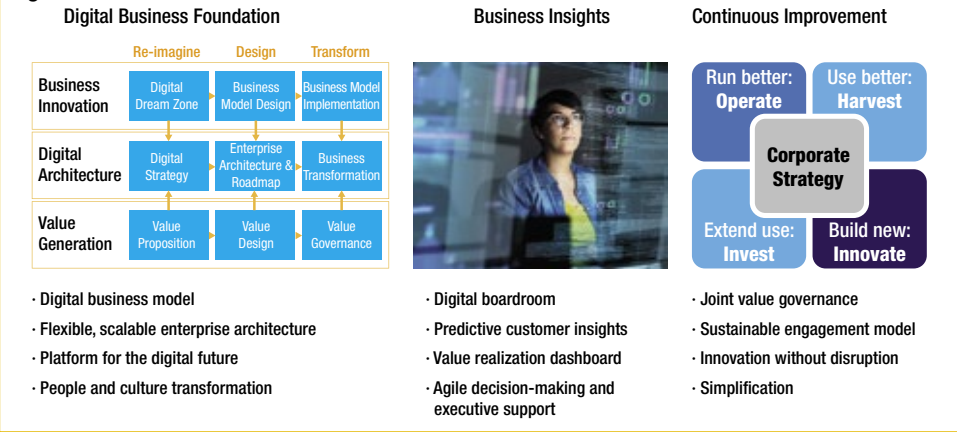


Fig.: 11



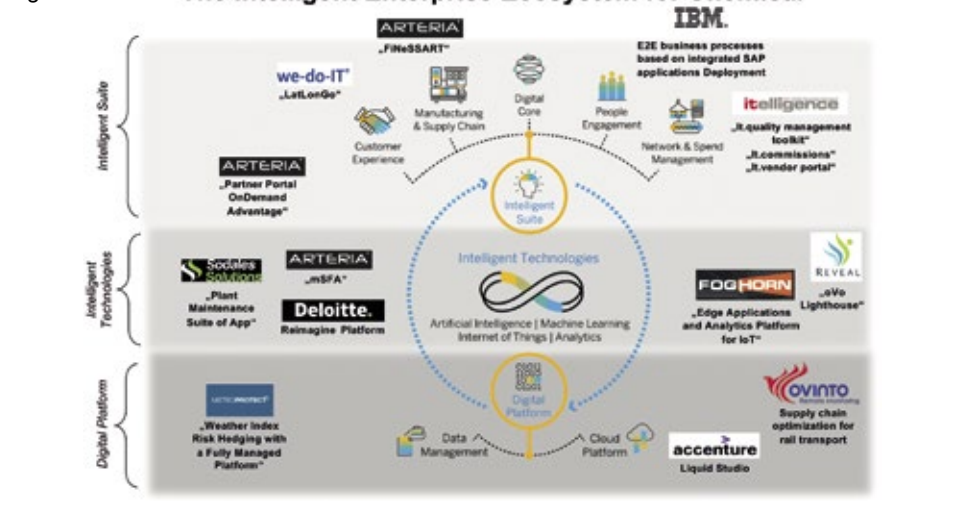
Comprehensive SAP Ecosystem - Orchestrating the world to deliver faster value

Our comprehensive chemical ecosystem (see Fig. 12) offers integration into:

- A wide range of business services (merchandising, POS, supply chain, analytics, omnichannel, and so on)

- Open architecture: choice of hardware and software
 - Complementary and innovative third-party solutions
 - Reach – partners to serve your business of any size anywhere in the world
 - Forum for influence and knowledge
 - Large skill sets
- Our partner ecosystem includes, among others:

Fig.: 12



SAP Is Committed to Innovation

Ten-year innovation vision

Deliver fully intelligent business solutions and networks that span across company boundaries and promote purpose-driven businesses. These solutions will be the most empathic symbiosis between machine intelligence and human ingenuity.

- Self-running enterprise systems
- Self-organizing business ecosystems
- New markets and business models

Comprehensive industry coverage

SAP enables the comprehensive coverage of the complete chemical value chain across the enterprise. With its clear industry road map, SAP is the partner of choice for the chemical industry.

- More than 7.000 chemical manufacturers in 97 countries innovating with SAP solutions
- 95% of the chemical companies in the Forbes Global 2000 are SAP customers
- All lines of business supported on a single platform

Proven services offering

By bringing together world-class innovators, industry and emerging technology expertise, proven use cases, and design thinking methods, we help chemical companies develop innovations that deliver impact at scale.



Learn more

- [SAP for Chemicals](#)
- [SAP Leonardo](#)
- [SAP Digital Business Services](#)
- [Design Thinking Workshops from SAP](#)

- Use proven methodologies to drive innovation, from reimagining customer experiences to enhancing operations
- Fuel your innovation through a managed innovation ecosystem from SAP
- Build your own innovation capability and culture

Only SAP delivers support for the intelligent enterprise for chemical companies – providing integrated business applications that use intelligent technologies and can be extended on SAP Cloud Platform to deliver breakthrough business value.

Please read also:



„An Industry Point of View: The Digital Chemical Industry – Unlocking new Business Value with Intelligent Technologies“



“Industry White Paper: The Intelligent Enterprise for the Chemicals Industry”



“Infographic: 9 Investments Chemical Companies are making to become Intelligent Enterprises”

Emerging Business Models in the Chemical Industry

IIoT, Artificial Intelligence and Blockchain are the Game Changers

With the rapid growth of the Industrial Internet of Things (IIoT) and recent advances in Industry 4.0 technologies like cloud computing, machine learning and remote sensing, there's been a lot of debate about the impact that digitalization will have on the process industries over the next few years. Volker Oestreich sat down with Stefan Guertzgen, senior director — Global Industry Marketing Chemicals at SAP in Walldorf, Germany, to discuss relevant trends.

CHEManager: Mr. Guertzgen, what are today's major trends for the Chemical Industry?

Stefan Guertzgen: First of all, I see an accelerated globalization. Supply centers are shifting due to the advent of shale gas in the US or coal to olefins in China. Also, demand centers are shifting thanks to a rapidly growing middle class in the emerging countries. In addition, new market entrants challenge incumbents with innovative products and services, hence contributing to shortened lifecycles and rapid commoditization of products.

Next comes the circular economy. Key raw materials are getting scarce. Regulatory requirements exponentially increase as the environmental impact of emissions and waste becomes more and more evident. Chemical companies are seen to be



in the driver's seat to respond to this, and some are already extending their ecosystems with the purpose to establish end-to-end recycling concepts.

Which changes are caused by the rapid developments in IIoT, cloud computing, machine learning and other digital technologies?

S. Guertzgen: Digitalization will drive a tremendous wave of innovation. Recent advancements in digital technology offer unprecedented levels of connectivity, granularity, and speed in accessing, processing, and analyzing huge amounts of data. Besides mobility, cloud and in-memory computing, the Industrial Internet of Things, machine learning and blockchain will start acting as game-changers in the chemical industry.

All three trends are coming together to challenge existing strategies and create a perfect storm for the chemical industry. Customer and feedstock proximity, intellectual property, and technology know-how may no longer secure a sustainable competitive advantage. Early adopters of innovative business models have the unique opportunity to act as digital disruptors.

Which innovative business models and processes are emerging for companies in the chemical industry?

S. Guertzgen: I see four major developments. First, companies will start to adopt strategic agility. The need to rapidly transform product and service portfolios in response to dynamically changing market and stakeholder needs will continue unabated. Preparing for ongoing mergers, acquisitions, and divestitures will be a critical success factor.

Second, we'll see more companies going beyond their traditional value chains and start competing as entire ecosystems. Such ecosystems are presently built around hot topics like for example precision farming or the circular economy.

Third, we'll see companies become more customer-centric and focus on selling business outcomes instead of products. In that context, think about delivering first-pass quality products or semi-finished goods instead of paints, coatings, or reactive resin components.

Fourth, companies will get another push towards operational excellence and business process automation. With digital technologies becoming scalable and commercially feasible, companies can now realize concepts like "lights-out manufacturing" and "touchless order fulfillment."

You mentioned blockchain as a game changer. How will this impact today's businesses?

S. Guertzgen: Let's first look into some general benefits blockchain brings to the table. First of all, it raises the level of trust and security among collaborating stakeholders in a network. Second, it allows to disintermediate non-value adding parties in a value chain, like brokers, authorities etc. Third, it creates a fully auditable trail of product, document or financial flows through capturing all transactions, changes in ownership etc. as immutable records along the entire value chain. This provides big opportunities for simplification and innovation in a global and more and more complex world.

How does this affect the chemical industry?

S. Guertzgen: Blockchain could have an impact on almost any line of business in a chemical company. Just think about collaborating in an open or closed community in R&D (permissioned private or public blockchain), tracking and tracing engineering changes and maintenance activities on a manufacturing asset (safe operations, book value accuracy, insurance claims etc.), ensuring full integrity of a multi-modal product shipment to a customer, or trading derivatives of a physical product and set the foundation for clear ownership, once the critical mass for building a physical plant has been reached.

Are there other new avenues for manufacturing — and are there also new risks?

S. Guertzgen: 3D printing, also called distributed manufacturing, is proving to be a revolutionary technology that is moving manufacturing closer to mass customization. In particular, the chemical industry can benefit from developing tailor-made proprietary formulations and systems.

However, a much-discussed but unresolved issue is intellectual property protection. Similar to the way digital music is shared, 3D printable digital blueprints could be shared illegally and, for example, print molds from a scanned object which is protected by copyright, trademark, and patent laws can be replicated in large volumes. With blockchain, data and rights holders could store metadata about any substance, from human cells to powdered aluminum, on the blockchain, in turn opening up the limits of corporate manufacturing while also protecting intellectual property. New markets could enable buyers and sellers to contract more easily in an open market.

How can chemical companies best capitalize on all technologies you mentioned before?

S. Guertzgen: To leverage and scale aforementioned technologies across all of their business functions, chemical companies need to turn into “intelligent enterprises.” Intelligent enterprises operate with visibility, focus, and agility to achieve game-changing outcomes. They do more with less and empower employees through process automation. They deliver a best-in-class customer experience by proactively responding to customer expectations. They invent new business models and revenue streams.

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A Connected Supply Chain

The Connected Supply Chain Cockpit tackles the challenges of increasing complexity in the supplier, production and customer network of chemicals and life sciences companies. Built on top of the existing IT landscape, it links structured as well as unstructured data intelligently, and like being in a cockpit, a user takes control of the supply chain, a chain that runs from the raw materials to customers.

Data is king in our digital world, and the Connected Supply Chain Cockpit harnesses your data so that you can predict the future with greater certainty: what customers will order and when; how much inventory is needed and where; as well as the timing of maintenance and replacement parts. It also means more transparency and massive savings by reducing the time spent on retrieving information. Through technology and data, you finally

have more control over your supply chain from beginning to end.

Supply Chains in Real Time Save Time and Money

A tarpaulin truck is carrying humidity-sensitive goods to your production site. Schedule and quantity deviations are identified and revealed at an early stage based on real-time data transmitted by Bluetooth Low Energy devices that accompany the goods. The devices are paired with the relevant delivery data so that further analyses can be executed, and these devices also transmit conditions such as humidity, temperature and light to an onboarding unit. The onboarding unit – found in newly produced trucks and easily installed on older ones – transfers this information to the cloud where the data is interlinked with

other data and becomes part of the analysis for estimating arrival time (ETA) based on traffic and weather conditions. It can recalculate stock coverage and initiate counter measures if the stock coverage drops under a certain defined threshold. Also, as the devices record conditions, it would identify humidity in the tarpaulin truck as it drove through rain. As the tarpaulin truck is carrying humidity-sensitive goods, the freight may be affected and not useable, which would have negative consequences for the planned production. Reordering would take several days. The Connected Supply Chain Cockpit identifies the possible reduction in the quality of the goods that will arrive and initiates a new purchase order as soon as the threshold for humidity is exceeded. The early reorder through the connected supply chain drastically reduces the time for the provision of goods in the needed quality.

Furthermore, based on GPS information that is also transmitted when the devices are paired with the delivery, the localization of the goods can be identified. As an example, with the definition of geo fences around a plant, subsequent tasks can be initiated: when the truck is 80 kilometers from its destination, all registration documents can be generated and electronically transmitted to the driver. Considering truck drivers often do not speak the local language, the registration and instruction documents can be provided in the driver's language, reducing waiting time for the driver.

Advantages of a connected supply chain:

- Fast and easy identification of supply chain incidents
- Intuitive user experience within one central view

- Increased data and information availability for all supply chain partners
- Enhanced automation level decreases lead and order processing times

A Digital Twin of Your Supply Chain

Big Data, cloud-based platforms and in-memory processing allow data handling and modelling for a one-to-one copy of an entire supply chain: the digital twin is born. The digital twin is based on operational data and reflects all the specifics of a supply chain. As the system is fed by ERP data, it is always up to date and simulations can be run without simplifications. Comparisons and benchmarks between actual and what-if scenarios are possible on the fly. You benefit from several features:

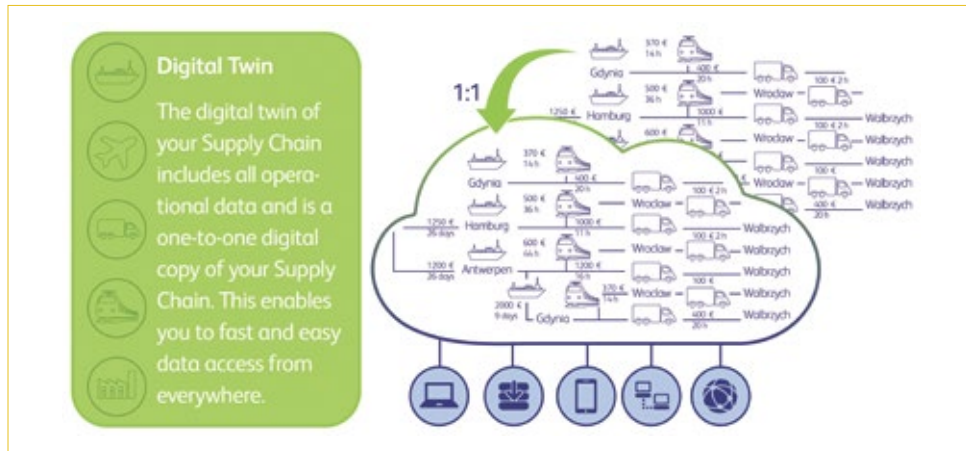
- End-to-end transparency: all steps and legs of your supply chain are reflected. Gain full transparency as network data/business rules are merged with daily transaction data
- Multi-dimensional: the trade-off between costs, lead times, inventories and ecological goals become visible
- Supply chain analytics: fact-based decision-making support down to the product/customer level
- Optimization/simulation: run what-if-scenarios with real data – no simplification is needed, so results are three to four times more accurate

A Use Case From Chemicals – Cost Cutting in Supply Chains

A major chemical manufacturer was questioning its national distribution strategy. Two business units were operating separate distribution networks in one country. Products and clients were different. How to as-



Advantages of a Connected Supply Chain



Digital Twin of the Supply Chain

sess the benefit of merging? The digital twin brought both business units together in one virtual supply chain. Data of daily transport and handling operations were simulated and optimized and as a result, capacity was found sufficient even in a merged and downsized distribution network. The simulation pointed out a two-digit percentage savings potential. Implementation realized the feasibility and savings.

A Use Case From Chemicals – Cost to Serve

A global chemical manufacturer was keen to understand the correlation between order pattern, supply frequencies and supply costs per customer/product. With the help of a digital twin, these multiple dimensions were brought into one model. Simulations showed the cause for cost peaks driven by order pattern. As correlation was obvious and the impact on costs and carbon footprint was transparent, the chemical manufacturer was able to convince his customer to change his order behavior. It was a win-win at its best.

A Use Case From Life Sciences – Carbon Accounting

A large multinational life sciences company used the digital twin approach to reflect the carbon emissions for its fully outsourced transport operations. Interfaces provided ERP data at the transaction level. The ERP data was validated and gaps were closed automatically by applying business rules so that an end-to-end transparency was achieved. Carbon data is now updated and available daily – carbon accounting at its best.

BearingPoint®

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Next Level Supply Chain Management

Why 'Demand-Driven' is key for the chemical industry

Demand-Driven Supply Chain Management (DDSCM) is the future approach to control variability across value chains – to maximize contribution margin by increasing service levels and decreasing inventory. In several industries, the Demand-Driven Adaptive Enterprise (DDAE) model already has been successfully employed to master complex and volatile environments. The chemical industry faces strong challenges in efficiently meeting global customer demand – demands that DDSCM has been proven to meet in a range of manufacturing enterprises. As a pioneer in the successful implementation of DDSCM, we explain why that is and show industry specific use cases.

Intelligent Enterprises operate 'Demand-Driven'

The Intelligent Enterprise is an umbrella concept defined by SAP to leverage automation and data insights, not only to boost efficiencies and achieve better results but also to support enterprises in reinventing business operating models. We believe the DDAE concept is the cornerstone for any company to become an Intelligent Enterprise. Camelot is a pioneer in this area, providing deep conceptual expertise, software and industry insights to make this a reality for next generation enterprises.

Camelot has a unique relationship with SAP that spans more than 20 years. It's best described as a 360° partnership: co-innovation partner, global implementation partner and customer of SAP. We

are currently working with SAP as a strategic development partner to bring our Demand-Driven Material Requirements Planning (DDMRP) expertise into the core SAP Integrated Business Planning (IBP). Camelot will also be a global implementation partner for this new solution.

Significantly increased performance

Fulfilling the demands of end customers has always been at the heart of supply chain management. So, what is new? Traditional supply chain planning approaches use forecasts of future customer demand to specify what is to be delivered, produced and moved, when and how – both for suppliers and factories. A forecast-based system only works well if the demand forecasts very accurately meet actual customer requirements. However, given the complexity and volatility of today's markets, a steadily increasing number of products for sale and ever shorter product lifecycles, it is simply no longer possible to come up with accurate demand forecasts.

Demand-Driven Supply Chain Management (DDSCM) is a new approach that focuses on the variability in today's supply chains rather than forecasting. The culmination of all these components of DDSCM is the Demand-Driven Adaptive Enterprise (DDAE). It is the way intelligent enterprises will operate in the 21st century. The disruptive character of the Demand-Driven Supply Chain Management approach requires companies to radically redefine

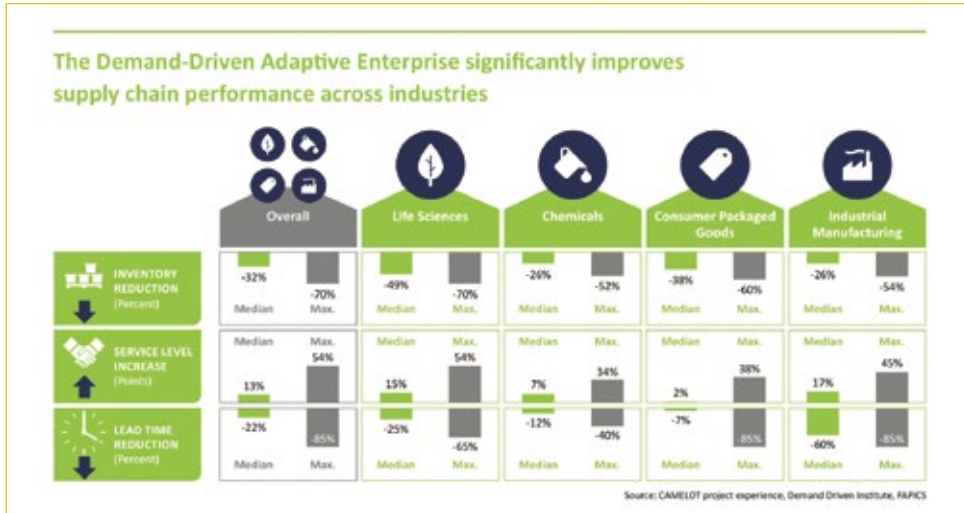


Figure 1: Benefits from Demand-Driven Supply Chain Management

their planning and execution processes. Companies will greatly benefit from that concept by significantly improving key performance indicators (see Figure 1).

Implementing DDMRP into SAP IBP is a milestone for Demand-Driven Supply Chain Management because the Demand-Driven approach can now be realized for many parts of the value chain, including the following:

- 1. Demand-Driven MRP:** As a key pillar of future operating models, the concept reduces the variability of supply and demand by using the inventory in the value chain as a buffer. These buffers are replenished based on actual consumption rather than forecasted demand.
- 2. Demand-Driven Rhythm Wheel Planning:** Companies need to schedule orders based on this demand in the production system. Demand-Driven Rhythm Wheel Planning follows the repetitive cyclical production approach to level production over time, to reduce demand fluctuations on the upstream stage and

to increase the visibility and reliability of relevant signals in the supply chain.

- 3. Integration:** Integration of both Demand-Driven MRP and Rhythm Wheel Planning can further amplify benefits from these two concepts.
- 4. Demand-Driven S&OP:** Ensure continuous review and updating of the parameters of the value chain and adaptive S&OP (sales & operations planning) to reconcile and align the corporate strategy and business plans down to the operational horizon and execution.

What the chemical industry can learn from other industries

Almost all ERP or SCM/APS systems in the chemical industry today are still working with the material requirements planning (MRP) processing logic from the 1960s. But that only works with very accurate demand forecasts – an impossibility in today’s lightning-fast global economy. Demand-Driven Supply Chain Manage-

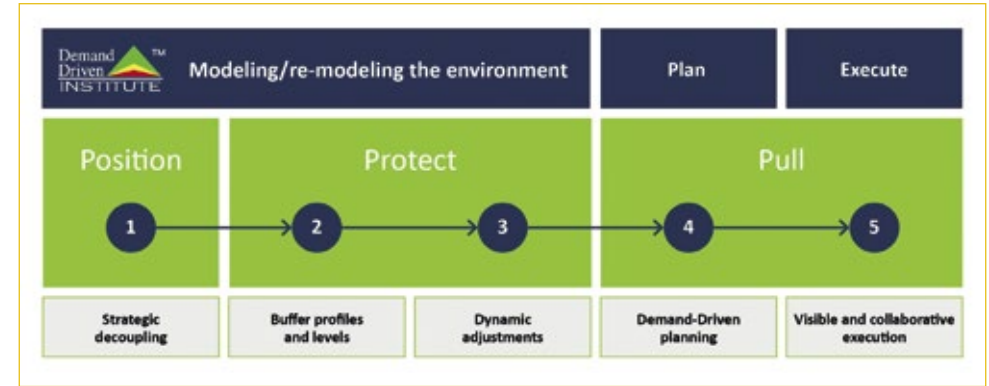


Figure 2: The five steps of the DDMRP concept

ment (DDSCM) with DDMRP at its core is a new approach to mastering the extensive variability in today’s digital supply chains. Already, pharmaceutical and consumer packaged goods industries that use DDSCM have seen inventory reductions of up to 30 percent on average, along with 20 percent shorter delivery times and significant service level improvements.

An effective implementation of Demand-Driven Supply Chain Management – with DDMRP at its core – is only possible if it’s based on the latest technological support. Camelot ITLab, as the strategic development partner of SAP in this area, is jointly developing Demand-Driven Material Requirements Planning (DDMRP) in SAP IBP, supporting DDMRP end-to-end, including steps one to five as illustrated in Figure 2. We also provide additional microservices based on SAP Cloud Platform, extending SAP IBP standard capabilities and meeting specific customer requirements.

The five steps of DDMRP

The first step of the DDMRP concept is about the strategic positioning of decou-

pling points. De-coupling the supply chain creates independence between processes or entities and is the only way to stop the bullwhip effect, mitigate variability and compress lead times.

Steps two and three concern the buffer profiles and levels as well as dynamically adjusting the buffer levels. Buffer sizing is the shock absorber to ease both supply and demand variability and reduce or eliminate the bullwhip effect.

Within step four order recommendations are generated by evaluating actual inventory, stock that has been ordered but not received, and qualified sales order demand.

Finally, in the execution part – step five – users have visibility into inventory through alerts that track usage, so ordering lead times and material delivery can be synchronized.

Use cases in the chemical industry

There are many potential use cases and references. We present a few to highlight the benefits of DDMRP in the chemical industry:

Use case 1 – Just in time packing of pigment SKUs: To successfully handle fluctuations in demand, it is best to delay the final packaging of the finished goods into SKUs with delivery driven by customer demand. DDSCM solves the mismatch of SKU stocks, thus safety stocks are significantly lowered. Based on customer demand, these SKU stocks can be replenished, while the need for unplanned repacking from one SKU into another is avoided.

Use case 2 – Reducing planning complexity in specialty chemical intermediates: Applying Demand-Driven planning cuts the complexity of uneven planning scenarios by decoupling inventory and allowing an independent scheduling of stock replenishment. The amount of the buffer stock can be adjusted to mid-term demand trends and planned shutdowns, based on demand, sales and operational planning.

Use case 3 – Sequencing in plastics production: Change-over effort and off-spec volumes in plastics production are dependent on the sequence of the products. Demand-Driven Rhythm Wheel Planning incorporates an optimized, predefined sequence as the basis for production scheduling in connection with capacity planning. This leads to a significant reduction in change-over material and an increase in capacity.

Driving success as Demand-Driven Adaptive Enterprise

One of Camelot's customers has made it its mission to be the world's best-performing supplier to the printing and packaging industry through high value creation, con-

sistent quality and continuous innovation. However, an increasingly complex and uncertain market environment made it difficult to accurately predict customer demand. The company experienced higher than expected inventory levels in its quest to ensure customer demand could be met. With the introduction of the Demand-Driven Rhythm Wheel approach and support from Camelot ITLab, the company is now able to react to demand fluctuations in a flexible and agile way and to be a reliable partner for its customers in the future.

Becoming a Demand-Driven Adaptive Enterprise (DDAE) starts with applying the Demand-Driven principles to the supply chain. Companies that have realized the Demand-Driven principles experience a significant increase in performance. The potential for the chemical industry is likewise enormous and can be leveraged today.



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A different kind of catalyst

Reimagining digital transformation in chemicals

Despite the current challenges of an increasingly VUCA environment, the global chemical industry has experienced strong performance over the last two years, enjoying healthy cash reserves, strong aggregate margins, and noteworthy revenue growth. These favorable tailwinds are providing opportunities for companies to make strategic investments, enhance their portfolios, and explore options for further growth and productivity improvements. Leaders in the industry are taking advantage of the current environment and exploiting strategic opportunities to sustain and enhance this positive momentum. Deloitte and SAP are working together to help companies reimagine their digital futures.

One of the main long-term developments identified in the recent Deloitte Insights chemical multiverse study is digital transformation, which has the potential to be a different kind of catalyst that will alter many key aspects of the global chemical enterprise. The study indicates that while many organizations are beginning to use more advanced digital technologies to enhance their performance, others are lagging behind because of a lack of understanding, overenthusiastic marketing, inertia of current processes, misaligned talent, inadequate returns on early digital investments, or just simply not knowing where to start.

Add to that the fact that many chemical companies have significant technical debt



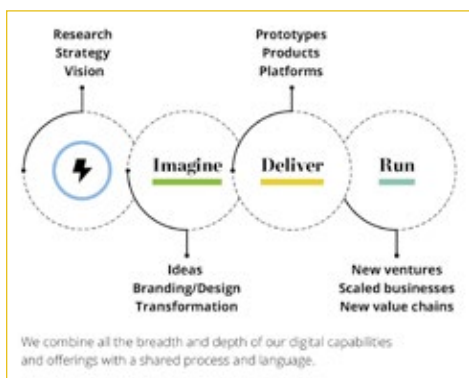
weighing down their ability to modernize and innovate core IT platforms and it leaves the industry in a challenging position to plan and execute the digital transformation needed to reimagine their business and unlock exponential value. This technical debt comes in the form of aging and highly customized ERP platforms, disjointed or poor-quality data across and within IT systems, out-of-date infrastructure, and talent focused on the current platforms instead of new and innovative possibilities.

However, the ability to build alignment and support for investments in the digital core and for innovative digital capabilities around that core is not out of reach for chemical enterprises. CIOs and other business leaders must think differently about

these digital opportunities and make specific plans for smart investments.

Leaders in this industry have long memories, and many have first-hand experience with the mega-ERP projects of the past. On the other hand, those same leaders hear every day about the need to “go digital” and feel some sense of urgency to “do something”. Prudence and a well-thought-out strategy are needed on both ends of that spectrum. Leaders should certainly use what they have learned from those experiences, but also learn about new strategies for modernizing the digital core and for innovating around that core and envision novel uses of digital. For instance, chemical companies are

migrating to SAP S/4HANA to refresh the digital core, adopting simple, standard processes to support global transactions and reporting. Using a “clean core” strategy, Deloitte is helping these companies to adopt and implement data models and process flows with little or no customization while developing innovations around the outside of that core for more strategic or unique capabilities. These innovations come in the form of off-the-shelf cloud applications and from specialized applications



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such as the Deloitte Reimagine Platform powered by SAP Leonardo to drive improvements in planning, transportation, procurement, global trade, shared services transaction processing, customer collaboration, analytics, plant maintenance, and manufacturing.

This strategy eliminates the technical debt living in legacy systems, provides a simplified transactional core, enables innovation around that core, and adds important business value where it counts. Integrated platforms that enable real-time visibility, higher computing power, cloud-based architectures, and advanced analytics capabilities are the goal.

Examples of these digital innovations are predictive and self-adapting planning processes, predictive sourcing, and proactive supplier risk management. In the production arena, real-time profit per hour optimization is achieved by algorithms that provide optimal setpoints for controls at the level of unit operations,

production lines, and plants, and even at the overall site level. In distribution, we see touchless processes and connected supply chain cockpits that allow supply chains to remain robust in the light of external influences. On the customer side, chemical producers and distributors are increasingly using AI to segment the customer base, developing price guidance applications for sales people in the field and using recommendation engines for cross- and upselling purposes.

One important aspect of digital transformation is that it definitely is a transformation, with a strong element of organizational development, including structures, processes, culture, and rewards, as well as incentives and leadership approaches. Without this transformation, there is no business case. This also means that we need to tread carefully with all the technologies and digitalization capabilities we have today. We should not simply digitalize the solutions we once invented in a distant past. It is good practice to understand which user stories are behind a legacy solution and reevaluate what this solution will look like for its specific audience in the light of current and future available technologies. At Deloitte we do this with Deloitte Digital, which provides us with the creative ‘agency’ and design thinking approaches needed to accomplish this. For instance, in building a digital twin for the manufacturing environment, it means we look at technical documentation at the plant such as P&IDs and engineering specifications, and transform these into solutions for the future, applying worker augmentation technologies.

Another important element in successful digital transformation is talent. As in other manufacturing sectors, the chemical

industry can benefit from new skills and perspectives where the technologies and new concepts such as agile development may seem untenable or impractical to many leaders. Organizations should intentionally recruit and develop digital talent in IT as well as in manufacturing, engineering, commercial, and other supporting functions to seed innovative thinking and advance digital capabilities. Chemical companies seeking to attract these talents and become an irresistible organization need to provide a seamlessly intuitive, real-time, and personalized experience not only to their customers, but also to their employees and business partners.

Deloitte’s research into the future of work indicates that a higher level of technology fluency will be required of leaders. Executives may welcome ideas on how to improve back office productivity, enhance customer engagement, or increase working capital efficiency, but have a time-stamped view of what digital technology can achieve. Likewise, within IT the talent may have proven domain expertise in the organization’s existing platforms and applications but little experience working with an agile development environment or with potentially disruptive, leading-edge digital innovations.

Beyond specific talent and skills, creating a “digitally mature” culture with active senior leadership support is also needed. Digitally maturing organizations have cultures that actively encourage employees to take calculated risks, be agile, and collaborate more effectively. Senior leadership in chemicals organizations can proactively espouse such a culture. Evidence also points to the fact that future digital initiatives will be increasingly driven by the C-suite instead of by IT or

a separate digital function. For example, to kick-start digital thinking, the CEO of one global chemical company gave his team the task of preparing proposals on how to apply digital solutions to a list of business challenges and opportunities facing the company. The team studied the opportunities and developed ideas on how to apply digital solutions to them to deliver quick improvements. The CEO met with the team and reviewed one-page outlines that described six- to eight-week digital sprints to make quick advances in the specific business opportunities. The CEO and leadership team selected and funded one of the digital sprints and it began immediately. Learning from that first sprint, the organization has expanded the use of the digital tools employed in that sprint and is continuing to experiment with new digital ideas, investing in and expanding the ones that advance its strategy.

This is what we at Deloitte mean with our overarching Imagine – Deliver – Run approach to digital transformation. In the imagine and deliver phases a great deal should be possible as long as we make improvements, learn fast, and are willing to fail. As soon as we wish to scale a pilot beyond our digital accelerator, however, we need a business case and full ownership by a business unit that is going to embed it within its operations.

Digital will be a disrupter not only in internal processes and capabilities but also with customers and their end markets. Certain chemical industry segments that are closer to consumers might find themselves more exposed to digital disruptions and should take a more proactive approach to digital transformation – with the added benefit of meeting or exceeding

their customers' expectations. Innovations downstream in the value chain through digital collaboration and planning can increase the pace and quality of decisions for chemical companies.

What is important now is for industry leaders to be catalysts for the digital journey and intentionally reimagine the future of their enterprises – a future that is not fully in focus but one that offers exciting opportunities to accelerate the innovation cycle while strengthening the core.

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“ConnectedLab” – Our answer to the necessity for a complex IoT infrastructure

In the future, companies will realise significant competitive advantages from the use of Internet of Things (IoT) solutions. enowa AGs and iCD. Vertriebs GmbH's IoT prototype “ConnectedLab” offers the complete networking of data from production and laboratory, vertical integration and new analysis and control capabilities. With it, chemical and pharmaceutical companies can lay the cornerstone for a digital supply chain.

The IoT is already an entirely available and affordable technology. It can be used to tap into a wide range of potential improvements along the length of the supply chain. In the vast field of digitalisation, IoT offers the requisite requirements for taking further steps in digitalisation. It's only when all information along the supply chain exists in digital form that further possibilities of digitalisation open up.

In comparison to other industry sectors, the chemical and pharma industries have something special: the manufactured product itself cannot be digitalised. All the more reason why the supply chain forms the core for all strides in digitalisation. The supply chain is key to process optimisation and achieving competitive advantage.

At enowa AG, we provide our customers with the experience of digitalisation for the chemical and pharmaceutical industries, in that we offer concrete IoT solutions for these industries. The ConnectedLab solution is the result of our partnership with iCD. Our application can be integrated with existing customer solu-

tions with a minimum of effort, conforms to specific landscapes and is completely scalable to a cloud solution. It offers our customers the possibility, on the basis of standard application, to further their development of vertical integration, realise process improvements and to lay the cornerstone of an open and expandable IoT infrastructure.

Complex networking – ConnectedLab

In many cases, laboratories, and lab equipment in particular, are not yet connected with the business applications of the companies' ERP systems. Data exchange is often done manually, or not at all. This presents great potential for optimisation and process controlling.

The ConnectedLab, based on the Middleware LABS/QM® of the LABS Suite of iCD. and the SAP IoT platform “Leonardo,” closes this loophole and creates additional possibilities for vertical integration and analysis of lab and production data.

With our IoT prototype, we show how smoothly the direct connection of measurement devices and systems can be achieved and how by using the resultant GxP/FDA-compliant workflow, the automation level of the laboratory will be enhanced.

We succeed in making the lab data available in a structured and analyzable format on the level of a batch or batches. We readily talk about digital twin technology in the chemical-pharmaceutical industry. With the integration data from production

(ConnectedProduction) we can establish correlations, and increase value propositions and control capabilities once more.

Quality control and process reliability from the connection of measurement devices with paperless lab

Measurement devices are attached using differing interface technologies. This determines which data can be exchanged. With simple lab devices, all essential information is transferred automatically, as determined by the device software. With complex measurement systems, additional spectra and chromatograms can be directly transferred and archived via the device interface. This makes centralised quality control possible.

The use of mobile devices for data capture reduces the amount of manual

records and calculations of intermediate results. They support the scanning of barcodes and QR codes. Measurement devices, chemicals, measuring equipment and the like can provide information from barcodes, thus avoiding mistakes and at the same time, documenting all essential process data. Comments and tips guide the user. The online display of the standard operating procedures on the tablet also increases quality control.

Freely scalable and expandable IoT solution

We use the SAP Cloud Platform (SCP), which is available as an open platform. In contrast to the frequently fixed structures of an ERP system, the structures of the SCP can be customised to meet the requirements necessary for the meas-

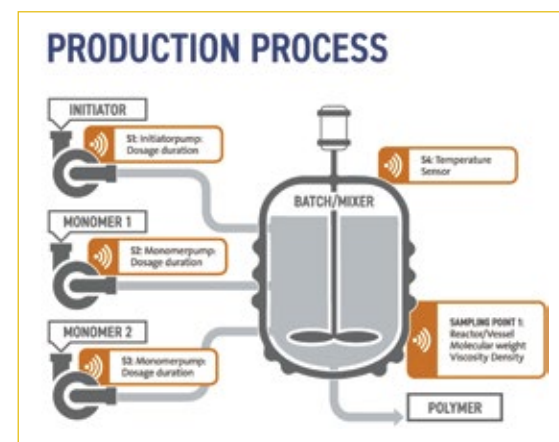
urement results of a laboratory. This flexible platform also allows the lab data to be brought in connection with data from other areas. The integration of lab and production data is still not standard, although this is exactly where diverse optimisation potential lies. It brings to light problematic constellations downstream, which can then be avoided in the future. The direct transmission of information from production affords the management of the testing of the laboratory, so that additional tests can be planned or obsolete tests can be cancelled directly.

Our ConnectedLab is a freely scalable solution that is expandable to use with other data sources.

In addition to vertical integration with laboratory data, merging with production data and all associated analytics, ConnectedLab also includes:

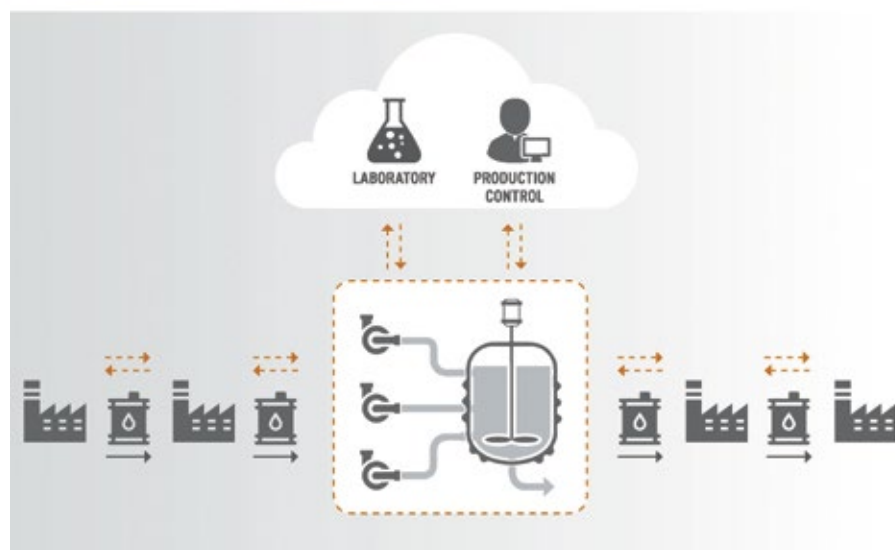
- Automatic recognition of product and quality variations on the basis of raw and measured values, and knowledge management in SAP Analytics
- Real-time alerts and direct real-time notifications to appropriate employees via SAP
- Digital risk management: complete evaluation of all production, quality and R&D data; recognition of correlations and causes of failure
- Community: integration of R&D/Technical Centre for potential improvements in the production process
- Proactive: prevention of larger problems (recalls, incidents, loss of production)

Digitalisation in the chemical industry is based for the most part on the IoT. Our



ConnectedLab makes optimal use of the latest technology available and is our answer for the complete digitalisation of the entire supply chain.

INTEGRATION SCENARIOS



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Unlock the power of data

New technologies put to new uses in chemicals

Summary

The digital revolution will move the chemicals industry toward new business and operating models, driven by the disintegration of classical industries and the formation of digital ecosystems that combine products and services enabled by technologies such as SAP's solutions.

Optimizing intelligent enterprise

What do you need to be a pioneer in the chemicals sector? The answer lies in today's intelligent technology. "Intelligent enterprise" is an approach that applies technology and new service paradigms to improving business performance. This has become more important across both discrete and process manufacturing businesses.

To remain viable in the future, it is crucial for chemical companies to be able to take data and translate it into an information set to use in making business decisions. The tools are there, but it is a significant leap from just having the tools and having data analyzed. Automating business processes allows companies to gain deeper insights and make quicker decisions while employees are freed to focus on more important critical-thinking tasks. By leveraging SAP S/4HANA and other SAP solutions, businesses can achieve these capabilities, accelerating growth and transforming into intelligent enterprises.

An established, end-to-end relationship

The EY organization's strategic partnership with SAP is an important asset for clients, as it has created strong relationships that will allow for powerful teaming around implementation. We engage key facets of SAP, including its active global support, development, services, education and executive leadership. As a global SAP partner, we co-create innovative answers. Together, we guide companies on a journey to innovate and transform, while still running their business every day.

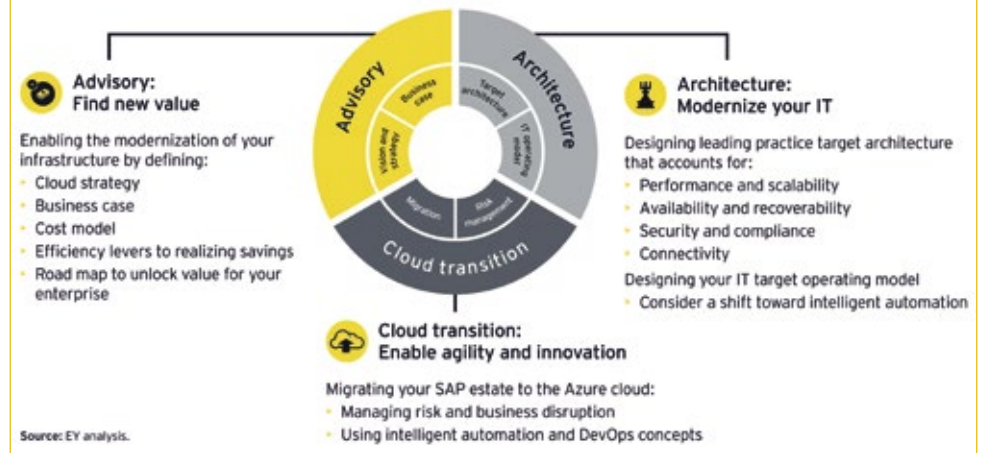
As both a customer and alliance partner of SAP, we have extensive experience in the following areas:

- Deploying SAP for chemicals and other process industry clients from R/3 through S/4
- Developing a broader SAP S/4 footprint globally across industries that are migrating faster than the chemicals industry
- Leading finance transformation and its enablement in SAP S/4 Central Finance
- Working with a thorough understanding of SAP BP4CHEM (chemicals template)

An intelligent, automation-focused approach to migration

Our EY Intelligent Move Solution for use with SAP S/4HANA®, a new generation of SAP Business, allows businesses that use SAP solutions to migrate to SAP S/4HANA

EY services framework to help clients adopt innovation at the speed of business



in less time and use fewer resources, minimizing business interruptions.

We are among the first SAP alliances to incorporate robotic process automation (RPA) tools to help accelerate and streamline the move to SAP S/4HANA. Artificial intelligence (AI) is used throughout, including in the time- and labor-intensive data migration work stream. The EY Intelligent Move Solution was developed to streamline the process of data migration. AI capabilities help optimize the identification of data objects and help reduce dependencies from SAP solutions to lower data load cycle times. Further, the testing cycles are executed using robots instead of people, which frees up employees to focus on key projects and business resources. Automated testing has the additional benefit of identifying and mapping RPA opportunities for other processes.

Throughout the migration process, our proprietary migration tools identify custom code and remediate potential problems, enabling faster completion

times and reducing costs and disruption for businesses that need to migrate their data.

This solution:

- Automates migration to a cloud environment with greatly enhanced capabilities
- Drives value in process and organization transformation
- Focuses energy on the design and deployment of transformed processes, controls and organizations

By helping organizations manage their data, we know that the functions involved in a big enterprise resource planning (ERP) move — such as configuring the new system — can be automated. This can dramatically increase ROI and build a business case for digital transformation, rather than just migration.

Recently, the EY organization was ranked #1 in RPA services by HFS Research and named a leader in innovation consulting services by Forrester Research.

S/4 HANA capabilities: Solution offerings built on S/4 with integrated auxiliary components

Category	EY offering	Description
SAP Cloud Solutions	SAP S/4 on Microsoft on Azure	EY teams bring advisory, architecture and integration capabilities to deploy S/4 on Azure, bringing intelligent automation elasticity.
SAP Blockchain Solutions	EY Ops Chain	EY Ops Chain is one of the first blockchain-based solutions designed for SAP® Leonardo. It supports end-to-end supply chain processing on enterprises' existing infrastructure.
SAP S/4 Industry Templates	Industry-specific solutions developed with clients, built on S/4	EY professionals have built S/4 templates for the consumer goods and products (Asahi), life sciences (Mallinckrodt, Avanos) and health (UnitedHealth Group) industries based on actual client engagements.
Co-Innovation Program	Business Integrity Platform powered by SAP	By leveraging the HANA cloud platform, GRC, and the managed-cloud-as-a-service delivery model from SAP, we intend to bring EY Fraud and Risk Management offerings to the market via a subscription-based model.
OEM Solutions	EYSight	EYSight is a solution that identifies bottlenecks and offers benchmarking and compliance analytics in S/4. This includes process diagnostics, compliance and control, supply chain benchmarking, and pre-assessment for automation.
S/4 Readiness Solutions	EY ReSQ	EY ReSQ is the asset for charting the renewal path to S/4, security assessment and code quality. ReSQ is designed to achieve the following: Renewal path for the code base to drive compliance with SAP S/4 and assessment of risk on the code base in order to avoid cyber-attacks, fraud and compliance issues.



Our internal and go-to-market approach with RPA applies technology to an end-to-end process transformation, with a strong focus on rationalizing and refining upstream and downstream functions impacted by change. This includes strategy, processes, controls, change management, talent and governance elements. This real-world use of RPA informs the development of IP and tools and accelerators.

Integrated business planning (IBP) made easy through EY SAP IBP Center of Excellence (CoE)

Through our joint IBP CoE, we have over 50 consultants trained in SAP IBP/sales and operations planning (S&OP) across the globe, with an average of more than 10 years of experience. Our rapid proof-of-concept (POC) approach provides a cli-

ent with a specific working S&OP model, where we develop an end-state solution architecture and implementation road map; deliver rapid value with a phased SAP S&OP implementation and process transformation; and integrate with on-premise systems. Because planning is critical in the chemicals sector, Central Finance must be at the core of all S/4 deployments.

We offer a leading-class intercompany profit elimination and reporting solution that calculates, manages and reports intercompany profit as a consolidated cost at the SKU level. This data is used to book all elimination entries in Central Finance, creating a single source of truth for both internal management reporting and external financial reporting.

Depth of chemical experience utilizing SAP software solutions

EY teams completed a number of pilots across all four major work streams as part of the assessment/design phase, including the S/4HANA POC. The following is a brief description of a subset of the POC and the associated business challenge.

The POC utilized S/4HANA Central Finance to collect all transactions related to elimination of intercompany profit. The POC also leveraged SAP Product Costing to develop a global consolidated cost or group valuation to facilitate elimination of unrealized profit in inventory. The S/4HANA POC consisted of real examples of 10 end-to-end trade flows or production streams around the globe and started with an as-is assessment identifying key data elements required from each legacy SAP and non-SAP system.

We developed the S/4HANA Central Finance component for both general ledger

and product costing; loaded real production costing data into S/4HANA to develop the global consolidated cost using a global bill of materials across the entire supply chain; simulated the entry of transactions for two financial periods; and demonstrated the accounting and elimination of profit in inventory. The POC included five different SAP source systems and five non-SAP legacy systems across 15 countries (in North America, South America, Europe and Asia). We also employed cross-industry leading practices to address complex auto industry supply chain issues that affect planning, accounting for and reporting financial results. To implement these leading practices in a practical way, we relied on our real-world experience on other client engagements; a commitment to train and educate client staff; and the use of POC projects, pilots and agile implementation techniques.



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Chemical production meets IBM Watson AI

AI improves product quality and replenishment accuracy

The collaboration between a chemical engineer or production expert and a data scientist can push established processes into a new quality of insights. IBM helps many chemical companies using state-of-the-art AI tools like machine learning and modern assistants' systems to increase the insight from production and SCM data in order to make better decisions. The usage of AI can improve a replenishment process or, as shown below, predict product quality.

The Cognitive Enterprise – Production Engineers and Data Scientists become friends

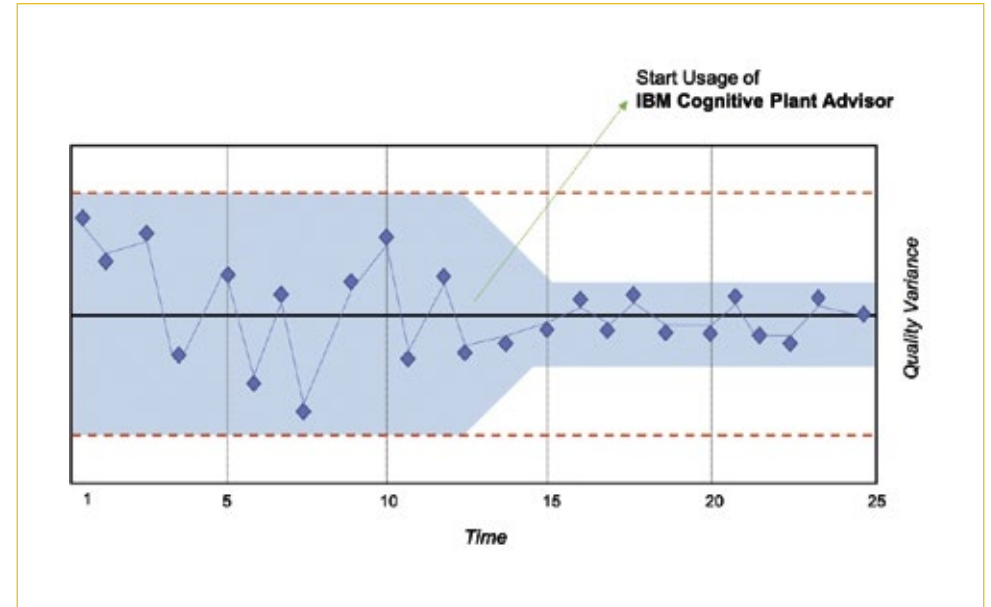
Process Industry Plants have been heavily automated and optimized. Nevertheless, most operators run the production line within standard parameters. Due to this automation, a data history collected over years is available and can be used to improve settings and with that - quality, output and safety. In several projects, we brought together client engineers with our data scientist. After overcoming the first shock that this well-educated but young consultant should help to solve problems which sometimes exist for longer time, the engineers and data scientist find a base using data visualization to find root causes of a problem. With the help of today's analytics tools, structured as well as unstructured data can be used. Connecting data from SAP systems, MES or historians is not an issue anymore and can be realized in efficient manner.

IBM is in of the largest SAP Services Provider

IBM has a long-lasting relationship with SAP and was recently awarded with the **EMEA/MEE Service Partner Excellence Award 2018 for SAP S/4HANA**. With our consulting approach we drive enterprises to the next level of insight by combining the knowledge of existing data in the SAP system with the goal to support faster and better decisions based on this data and IBM's AI capabilities. In conjunction with SAP and the data stored in the system, we see a lot of opportunities to support a better decision-making process and as well as to preserve the best knowledge in an AI system. A key benefit of this preserved (and digitized) knowledge is that a lot of information, which is collected over time, is normally never used again for new challenges. For example, a problem which was solved in the past in South America will be re-solved with the same effort in Europe again, because nobody was knowing the existing solution. An AI system can easily overcome this problem as shown in example 1.

Use Cases - Product Quality is Key

Every client invests intensely into improving, stabilizing and understanding influencing factors regarding their product quality. Of course, chemical and process engineers are required first to achieve this goal. But over time, an additional component can be used to get deeper insight into the chemical / physical process during production- data. Batch and recipe data, incoming product quality checks,



Quality range before and after usage of AI tools

LIMS data, weather data and a lot more are gathered and cumulated over time. Combining this data with chemical and physical knowledge can lead to new insights for companies regarding the improvement of their product quality.

Example 1: Influence of ingredients for coatings formulations

Analyzing SAP Recipe Data and Recipe Test Data

Coatings for cars, furniture or for covering pure plastics are a mixture of many different ingredients out of many available chemicals. Nevertheless, a common structure with binders, pigments and solvent is needed to have a usable (and saleable) formulation. Let's take so called soft touch coatings.

To formulate soft-touch coatings that meet expectations for both, haptic and

mechanical performance properties, remains a challenge. Softer coatings tend to have a reduced chemical and abrasion resistance. Finding the right combination of resins that impart a desired rubbery or velvety feel while exhibiting long-term scratch and stain resistance typically involves trial and error and can be a lengthy process.

Chemical companies are testing many of these formulations to measure the influence of the different ingredients on expected product properties. These tests are complex and producing endless rows of numbers describing the level of the expected result. By using advanced data analytics, a data scientist is able to correlate ingredients and behavior. On the way to the final formulations many tests lead to results which are normally never used again. IBM helps clients to re-use this knowledge in a very efficient way and

can lead a scientist easy to an unexpected side effect, which was not relevant in the past but has maybe a huge impact for new products with other properties.

With this knowledge and a large amount of test data, new and adapted formulations can be developed in a shorter time.

Example 2: Predictive product quality for chemical compounds

Realtime operator advice based on machine learning system

An industrial products client of IBM raised the question, if the product quality variance, which was already in the committed range, can be minimized. The chemical production step is in this case the first of several steps to produce sealings. Here, the goal was to reduce the variance and the risk that later steps are impacted from a quality which is more on the edge of the committed quality band.

First, data from the last two years was used to correlate different factors influencing the quality. The data came from SAP modules as well as from the inbound quality checks (also stored in SAP) and from real time sensors, measuring the flow behavior of the chemical compound.

The production process itself cannot be put into a fixed algorithm, a machine learning approach was used to cover all aspects of the production process. As a key element of the initiative, the service shall complement existing process control systems by providing expert advisory to process operators. Recommendations are supposed to look beyond the time horizon typically covered by process control and take into account the specific conditions and overall behavior of the mixing process. The result was a Cognitive Plant Advisor (CPA).

With the knowledge about the influencing factors, the CPA provides a dashboard to calculate and advice production operators. The depicted information will help to maximize product quality, keeping variances in quality to an absolute minimum.



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Become a digitiser-of-efficiency!

IRES – Optimal resource efficiency in the chemicals industry

In times of industry 4.0 and digital transformation, companies have to answer one question in an increasingly differentiated and target-oriented manner: How can optimal output be generated with minimal use of energy and resources?

IRES, the Intelligent Resource Efficiency Solution, developed by INTENSE AG in cooperation with SAP and DELL EMC, creates the optimal prerequisites for this with its SAP integration and use of modern IoT Frameworks in the SAP-Cloud.

IRES permits precise tracking of energy and resource use in respect of the production rates of specific plants in various locations, e.g. in process industry. The effects of relevant influencing factors, such as temperature, humidity, substance parameters, etc. are also considered in normalisation, analysis and forecasts. These, and many other details that can be selected as desired, can be used to derive further specific optimisation potentials in turn.

Is there a „Golden Use Case“ for energy and resource efficiency?

Not only in the chemicals industry does future-proofing require improved efficiency in the use of energy and resources, as well as in production. Digital tool support is a good choice here. Therefore,

There cannot be any single use case that meets all of these requirements, due to the diverse scenarios. IRES is therefore

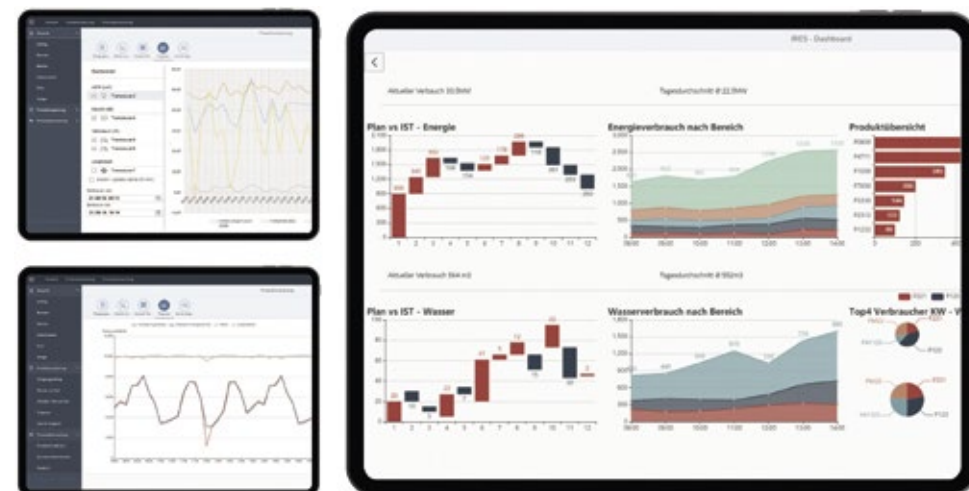


Figure 1: INTENSE IRES – Intelligent Resource Efficiency Solution

not primarily targeted at individual fields of optimisation but pursues an integrated and holistic approach – fully in alignment with the SAP philosophy of „smart companies“. The driving forces essentially are:

- energy cost reduction & purchasing optimisation
- standard conformity & positioning in the supply chain
- identification of dependencies & productivity increases
- resource conservation & protection of the environment
- implementation of IoT and industry 4.0 scenarios

Typical use cases of IRES customers are, e.g., the reduction of power consumption or optimisation of the use of resources, securing of peak loads, demand forecasts and purchasing optimisation, certification and positioning in the supply chain as well as productivity increase/usage optimisation.

IRES makes it possible to combine these use cases in order to clearly increase the added value for the company.

Of course, the costs are always at the focus!

IRES comprehensively supports efficiency and optimisation programs. Optimisation of the use of power and resources will reduce consumption, and thus the costs. Transparency, comparability and the ability to forecast in detail improve the portfolio in energy procurement, as well as possible own generation scenarios. In the context of flexible power tariffs and new load management programs, load peaks are minimised and low-load times are optimally used. Implementa-

tion of the requirements of the EED (Energy Efficiency Directive) and the EDL-G (Energiedienstleistungsgesetz; energy service act) as well as ISO 50001 / 50006 conformity, builds the basis for auditing the energy or environmental management systems and consequently ensures peak compensation and avoids contractual penalties.

How to create a „Closed Loop“ in production and resource efficiency?

IRES is completely integrated into the SAP logistics and production modules. Hence, product-specific resource/energy profiles are available as part of the planning. Individual as well as accumulated energy and resource demands are available in real time according to the production plans and current production/manufacturing figures. The connected costs may be used as a further influence factor to the classical product optimisation algorithms.



Figure 2: Closed loop of production and resource efficiency

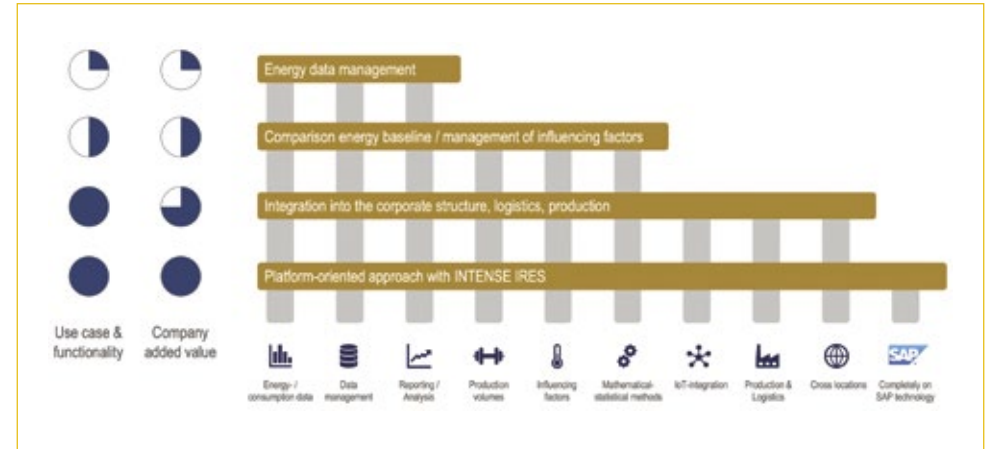


Figure 3: Use-case-oriented integration into process management and technological platform

Do energy and resource efficiency increase productivity?

As part of a smart factory approach, additional IoT data are considered as influencing factors in addition to consumption data; specific consumption values are standardised and may be used as a basis for comparison. EnPIs (Energy Performance Indicators) are used to compare similar machines, sites, manufacturers, etc. and to identify anomalies and trends (e.g. quality of machinery, rejects, wrong machine configuration, etc.). The permanent real-time comparison of actual data to expected consumption data can secure and increase production efficiency by optimisation of the production chain & manufacturing parameters. Use of IRES increases productivity in specific areas by 2 to 5%.

How does IRES differ from other software products?

IRES has been consistently developed in a use-case-oriented manner to create an op-

timal corporate value with a solution-oriented approach. Based on a highly flexible data model and data management, IRES may consider any influencing factors and work fully integrated into the company's structure, logistics and production planning functions – while staying 100% compliant with your SAP platform strategy.

IRES is delivered as a core software solution in the SAP Cloud Platform (SCP), which is then customised and integrated. This tool box alignment permits industry-comprehensive use. At the same time, any user will profit from innovations and digital solution scenarios of other users and industries.

SCP features such as data management, data privacy & security, analytics, integration & orchestration, Leonardo, pattern recognition, machine learning & KI and mobility are consistently integrated into the IRES functional spectrum. As a result, IRES is the new standard for resource efficiency optimisation in the SAP Cloud.

Are you looking for a contemporary type of energy and resource efficiency for your

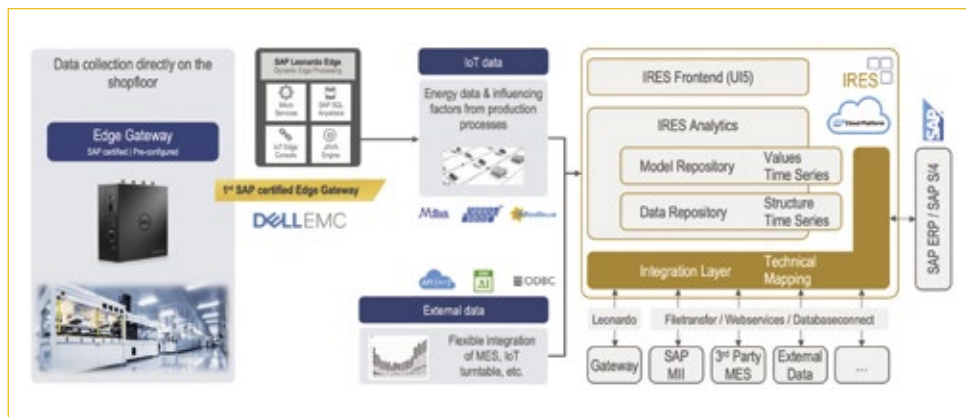


Figure 4: INTENSE, together with its partners SAP and Dell EMC, offers a solution portfolio edge to core

company? Do you want to use non-redundant SAP-based data maintenance as a basis for your analyses? Then IRES, the IoT-based, ISO 5000ff-compliant energy and resource management software, is the optimal tool for you.

Leonardo conformity with full HANA & PAL (Predictive Analytics) performance from the SCP and integration into your SAP-ERP & S/4 functions (Cloud/OnPremise) create further synergies as well as reduce your integration effort – and thus your costs.

INTENSE AG – We digitise customer business models

Energy and resource efficiency is not only part of sustainable economic action, but also a central challenge of the future.

INTENSE AG is a leading provider of SAP efficiency solutions – with more than 20 years of experience in energy management, development of innovative organisations, processes and solutions, and

more than 15 SAP-based software solutions for efficiency increase.

INTENSE, SAP and Dell EMC – a strong partnership to secure resource and production efficiency in the chemical industry.



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Supply Chain Integrity and Security

How Track & Trace Turns Compliance into Supply Chain Values



Chemical companies carry a tremendous responsibility as their products directly affect both humans and the environment. At the same time, chemical research is making rapid progress, further adding to the increasingly complex and demanding regulatory requirements such companies face. Therefore, compliance as well as global anti-counterfeiting protection are key issues in the chemical industry. The chemical sector is, however, not only challenged to meet regulatory requirements, but also to increase quality and efficiency, while further minimizing operating costs and product prices. These diverse challenges and key issues can be tackled with SAP Track & Trace solutions. In the case of a leading chemical pesticides company, the implementation of Track & Trace even turned compliance into a supply chain value proposition through the introduction of a supply chain loyalty program.

Explaining Track & Trace

Track & Trace is the process of identifying past and current incidences of a

uniquely identified item, including its forms, transformations, positions and characteristics. This means that events related to the unique item are meticulously recorded throughout the entire supply chain, so that companies are always able to answer questions such as what, where, why, when, and sometimes even how something has happened to their items.

In order to reach full traceability three different aspects of Track & Trace need to be taken into consideration:

- With exact documentation tracking chemical companies are able to better predict and react to potential disruptions in their supply chains.
- Ensuring well-recorded product genealogy enables businesses to improve product quality and security and allows extremely precise actions to be performed, e.g. in case of a product recall process.
- And finally, clear event and unit tracking helps identify product properties and statuses of uniquely marked products at any given time.

A Case Study: How Track & Trace Turns Compliance into Supply Chain Value Propositions

Our customer in the chemical pesticides industry also had to deal with increasing compliance requirements as well as supply chain protection against counterfeiting, and fierce competition. The company decided, however, to use Track & Trace not only to tackle these issues, but also to utilize other emerging benefits of end-to-end supply chain processes. Particular focus was given to the company's supply chain relationship with distributors and wholesalers. With the help of item level tracking a supply chain loyalty and reward program was implemented. By capturing and analyzing traceability information, including supply chain partners' events, the company was able to improve the precise planning of activities and time to market, as well as to reduce stock outages, while rewarding the loyalty of its supply chain partners.

The 18-month-long project was based on thorough process analysis, in-depth screening of downstream supply chain partners, and detailed fit-gap analysis. SAP Track & Trace technology proved to be the right choice, as it combines documentation tracking and the tracking of material, and logistic events. The corresponding full traceability and increased transparency not only led to increased loyalty of supply chain partners, but also to improved sales and better consumer confidence. The company is now able to confirm the authenticity of products, resulting in higher brand reliability. In a next step, the leader in the chemical pesticides industry aims to provide individualized information for its customers and, in doing so, improve consumer loyalty and end user experience.

Potential business benefits of Track & Trace at a glance:

- Downstream supply chain efficiency
- Ingredients quality
- Overall product quality
- Product stability
- Warehouse operations transparency and management
- Stock transparency throughout the whole supply chain
- Stock optimization
- Faster supply chain process execution
- Sales forecasting
- Customer insights (expectations, direct contact, etc)
- Supply chain loyalty
- Cross border and illicit trade suppression
- Monitoring fulfilment status of business processes
- Monitoring process milestones
- Events and exceptions monitoring
- Visibility into the location and condition of goods and assets along the entire supply chain
- Anticounterfeit and increased brand reliability

Founded in 2006, Movilitas is a niche and premium SAP partner, as well as an expert in the domains of Serialization/Track & Trace, Warehouse Management, Manufacturing, and Mobile Solutions. All these domains combined make Movilitas a key player in achieving Supply Chain integrity. Movilitas helps companies solve problems along the entire supply chain and turn compliance into supply chain value propositions. Movilitas empowers

organizations to accelerate their digital transformation journey with IoT and move from a reactive to a proactive state by transforming data into real-time insights. With regards to Track & Trace, Movilitas has been implementing SAP based T&T solutions in 65+ successful projects for over 10 years across multiple industries including Pharma, FMCG, Food, Chemicals, Explosives.

Want to know more?

Scan the QR-Code to discover more benefits of Track & Trace and deep dive into the Movilitas story.

<https://www.movilitas.com/track-trace-chemanager>



Have a nice day!



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At OSIsoft, we believe data is your most valuable asset.

For nearly 40 years, OSIsoft has been providing known and trusted operational data infrastructure to companies across a dozen different industries who are looking to maximize the value of their operational data. OSIsoft is the creator of one of the most widely deployed Internet of Things (IoT) analytics and information management platform, the PI System. The PI System captures, cleanses and contextualizes operational data so that users can understand their operations and improve them in real time, and over time. The PI System pulls in information from a range of different, sometimes incompatible sources, creating a single source of truth for operations managers, engineers, supply chain partners and others that enables them to improve quality, increase yield, reduce costs and create new products.

Digital transformation in the chemicals industry

Data and technology are transforming the chemicals industry, and fast. But digitally transforming a business is no small feat. Many existing tools were not designed with enhanced data analytics or machine learning capabilities, and become easily overwhelmed by large data sets. Excel spreadsheets and traditional historians can only do so much. When devices and sensors start collecting terabytes worth of data, customers need trusted and market-proven tools like the PI System that can provide operational intelligence quickly and intuitively.

The PI System helps companies to survive and thrive in this rapidly changing world of data and analytics by offering a foundation for operational data that is robust, flexible, secure and accessible by a wide spectrum of employees. The PI System's flexibility allows it to easily adapt to the specific needs of chemical logistics. It can help companies efficiently manage complexity when handling dangerous goods and supports the integration of all entities involved in the chemical supply chain. Many users also discover hidden or added benefits beyond what they could have imagined. For example, after using the PI system to lower costs on a production line, new insights from the platform can also help improve worker safety, or provide insights to help meet changing regulatory requirements. Such insights allow customers to become empowered rather than overwhelmed by their data.

Today, nine out of the top 10 chemical companies rely on the PI System to deliver critical operations data integration, applications and analytical infrastructure, allowing managers and engineers to monitor processes and assets in real time. For example:

Covestro: OSIsoft's PI System helped the specialty polymers producer Covestro reduce energy consumption by 20% and CO₂ emissions by 39% per ton of product.

Sartomer: A subsidiary of the global chemical company Arkema, Sartomer uses 200 different recipes each with its own process parameters to produce acrylic and methacrylic monomers. They

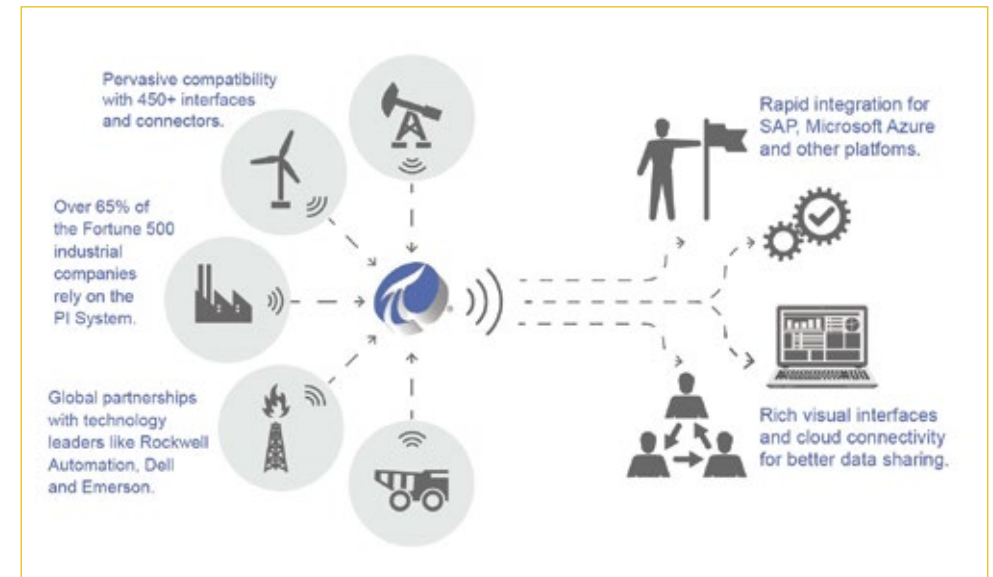
use the PI System to detect and rescue off-track batches and minor deviations in real-time, leading to substantial savings by minimizing loss of product.

Air Liquide: The industrial gas conglomerate Air Liquide uses performance data captured and synthesized by the PI System to help it determine the optimal parameters for individual plants or process

and improve quality. This is part of BASF DriveE Operational Excellence which contributes to €1 billion in yearly earnings.

The PI System and SAP

Merging multiple systems into one comprehensive database can often take a tremendous amount of time and resources. But with the SAP HANA IoT Integrator



lines. In the first three months of operations, Air Liquide recovered its initial investment in and achieved a 10x return on investment within the first year. Some individual plants have saved over \$5 million since 2017.

BASF: Building a Reliability Center connecting a majority of all machines from 17 plants allowing BASF to increase operations by reducing downtime, detect problems before they generate failures, build condition and predictive maintenance

tool by OSIsoft, any enterprise can have its information technology and critical operational technology systems talking in no time, leading to faster, more actionable insights. The SAP HANA IoT Integrator joins the power and advanced analytics of the SAP HANA platform with the OSIsoft PI System to create an enterprise infrastructure for connecting sensor-based data, operations and people to enable real-time intelligence.

Since 1995, customers from chemicals, oil and gas, manufacturing, utilities, life

sciences, metals and mining, pulp and paper, and many other industries have relied on OSIsoft's partnership with SAP to connect data from existing automation and control systems with data from transactional and business process systems. These connections can increase situational awareness, add transparency into industrial operations and business processes, and help you preempt problems and identify opportunities for improvement.

The SAP HANA IoT Integrator by OSIsoft helps to address OT-IT challenges by providing the ability to cleanse, augment, shape and transmit (CAST) operational data sets that include preprocessed transformations such as efficiencies, run times and period totalization to the SAP HANA platform in real time so that SAP applications such as the SAP Analytics Cloud and the Digital Boardroom can consume the data in the appropriate format.

Many customers have already realized the many benefits of connecting the robust technologies from SAP and OSIsoft.

One example is Marathon Oil, a fortune 500 company, who took control and optimized its assets in the face of falling commodities prices by connecting the OSIsoft PI System with SAP HANA through the SAP HANA IoT Integrator by OSIsoft. Connecting the two systems, Marathon oil used its real-time, cleansed, normalized and contextualized OT data from the PI System to create a digital oil field production and surveillance system on the SAP HANA platform. Together, the PI System and SAP HANA provided engineers with a single source of truth for IT/OT data and made insights available in near real-time. The platform also helped

engineers apply analytics and visualization to all their IT and OT data. With a comprehensive view of all its assets and performance data, Marathon can now make necessary changes quickly and easily to optimize production. The result is a visual system and a trustworthy process that has increased productivity and decreased downtime, reducing their analytic cycle from three months down to two weeks.

Interested in learning more why our joint customers are saying "OSIsoft and SAP – Better together"? Please visit us at <https://www.osisoft.com/solutions/advanced-integrations/sap-hana/> to learn more.

**9 of the top 10
chemical companies rely
on the PI System.**



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Making Rail Cargo sexy

An intelligent enterprise is, as we know, data and process driven. The data feeds intelligence which in turn feeds process automation and innovation.

This implies that the available data at least has to be connected. A statement that seems very logical but sadly not always is the case.

The chemical industry is known for its professionalism and innovation. Chemical industries are used to spending large amounts of money on R&D year by year, but sometimes certain aspects of business doing tend to be forgotten when it comes to innovation.

One of those aspects is rail freight transport. Rail cargo is still being handled and executed like 100 years ago, heavily depending on manual, human interventions.

Where all other transport modes are connected and being automated, rail freight mostly is not, often remaining a blind spot to the chemical companies.

In a way this is very strange as rail freight stands for 'bulk in & out' meaning that most of all invoiced goods will travel via rail implying that however efficient the production may become, the real capacity will be dictated by the bottleneck called 'rail'. So why hasn't there been a much stronger focus on the rail transport efficiency until now?

Just imagine that rail freight transport tomorrow would suddenly become 30 % 'easier'...the effort to ramp up production and sell more product would be marginal making that the improvement in rail or in other words the innovation in rail transport could be real driver for sales and revenue improvement.

Large industrial players invest very heavily in back office software platforms, connect trucks, planes and ships but often forget to connect and automate rail freight.

From this came the idea and mission for Ovinto to develop a platform, dedicated to



help the existing software infrastructure in these industries when it comes to rail freight.

The goal and purpose of this platform is to connect all relevant internal and external data sources, digitize all data, automate repetitive manual actions, enrich and preprocess the gathered data to feed the results into the relevant existing software modules that were before constantly waiting for manual input.

By doing so we drastically reduce repetitive manual labor and by doing so we also drastically reduce errors.

The existing software infrastructure is able to speed up and become even more efficient as it doesn't have to wait for input all the time.

Summarized this means that Ovinto has developed a platform dedicated to feed and be of service to existing SAP modules to enable them to speed up with less input errors when it comes to rail and intermodal freight of course.

Some examples and use cases:

Condition based maintenance

Imagine an industrial player operating 6000 rail cars...imagine the manhours necessary just to keep track of something so simple...the mileage.

At Ovinto we have developed a digital 'rail & intermodal' map, including not only all public rail tracks but also all the private rail tracks in the world.

By connecting the planning data with the bill of lading we can immediately exactly calculate the correct amount of kilometers per trajectory, without deviation, without risk of errors and without manual time loss.

These calculated kilometers can immediately be pushed and integrated in the asset maintenance module to allow a better, smoother and more efficient maintenance planning.

This example is only a very first and simple step.

As from the moment we are able to 'unleash' critical parameters on driven trajectories we can start to take into account aspects such as: topography, amount of kilometers in fully charged situation, amount of kilometers empty, amount of curves taken, how many to the left, to the right, how much time in the neighborhood of salt water, etc....

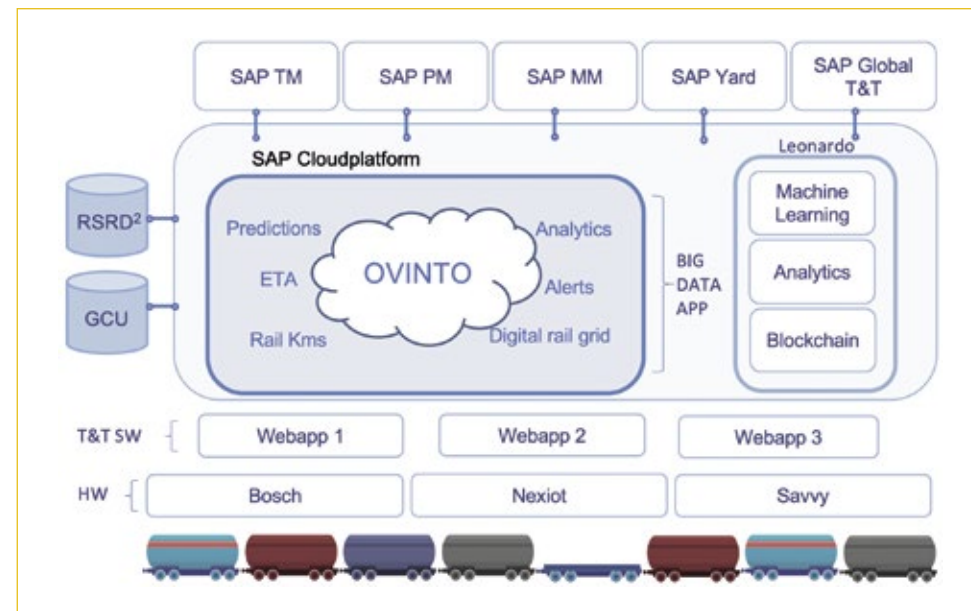
And suddenly a real 'driving analysis' per rail freight car becomes possible enabling an easy shift from 'reactive and time based maintenance' towards 'condition based and predictive maintenance'.

A recent study from Mc Kinsey learned that only the shift from reactive towards condition based maintenance will already result in a 15% maintenance cost reduction which is a very substantial amount knowing that maintenance covers approx. 50% of the total operational cost of the rail car!

Predictive ETA services

As from the moment we start to analyze rail freight trajectories, the generated data can also be used to create intelligence that is being fed back to the planning system.

By analyzing all historical transports/trajectories of a fleet of rail cars it becomes possible to calculate the exact average speed per specific segment of rail track in the grid. Next to the speed, also the percentage of risk of having a delay can be calculated leading to the possibility



ty of comparing actual data to calculated and analyzed historical data to find out how the current trajectory is related to the planning and the created intelligence out of the history.

By doing this, predictive services can be created to warn shipper, operator but also the customer about possible delays and anomalies during transports. Because of the repetitiveness of the transports, predictions only become better in time offering a better and better accuracy to all stakeholders taking the biggest pain away in the rail freight sector = the blind spot.

Integrating ETA analysis back into the planning software module will allow a higher rotation because of a much faster adaptation to new situations as the transport planning module will be informed sooner and better.

So not only maintenance can be improved but also transport rotation aka real business can be improved.

Safety stock and production planning

As from the moment anomalies can be predicted and planning is improved this can be connected to the production planning of the company.

Until today, industrial production facilities often encounter near shutdowns or even shutdowns because of hitches in the supply of raw materials.

Trains come in late, don't come in at all or don't carry all planned rail cars.

To cope with these irregularities, companies tend to increase their safety stock but even that is not always sufficient.

Predictive services allow production facilities to anticipate quicker enabling them to prevent costly shutdowns.

Because of the already mentioned improving character of predictive services, the 'peak' anomalies constantly become smaller leading to the situation where

companies can start to lower their safety stocks as the irregularities become smaller.

A reduced safety stock will have an immense impact on the business as next to the financial impact there will often also be a 'safety related impact' when considering dangerous goods.

We could continue to list use cases, but the above-mentioned examples should already give an impression of the phenomenal impact on business we can generate when making rail cargo sexy again!

SAP Cloud Platform

As we want to connect as much data sources and feed existing SAP software modules we deliberately chose to build our platform in the SAP Cloud Platform using the power of the in memory database HANA.

The cloud platform is the ideal development environment enabling us to start very small and simple but always keeping the possibility of scaling up and connecting more and more components.

Summarized

At Ovinto we are dedicated to supply complementary services to existing SAP modules when it comes to rail & intermodal freight. Our goal is to connect data sources, enrich the data, analyze and preprocess it to feed the results to the relevant SAP modules that are waiting for input.

In this way we enable the customer to benefit even more from the SAP technology he already deployed and we will motivate him along the process to activate more SAP components if necessary to in-

crease overall performance and optimize the efficiency of his rail & intermodal freight supply chain.

Broader benefit

Making rail & intermodal freight transparent and more efficient is not only helping the supply chain of the stakeholders involved.

Did you know that studies of the European Union showed that if we were able to put 4% more freight in rail transport, this would immediately result in more than 9% less road transport!

So, making rail freight more efficient will drastically help us in reducing our emissions and improve our congestion and mobility problems.

All of the above are the reasons why we at Ovinto are dedicated to making rail freight sexy again!



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