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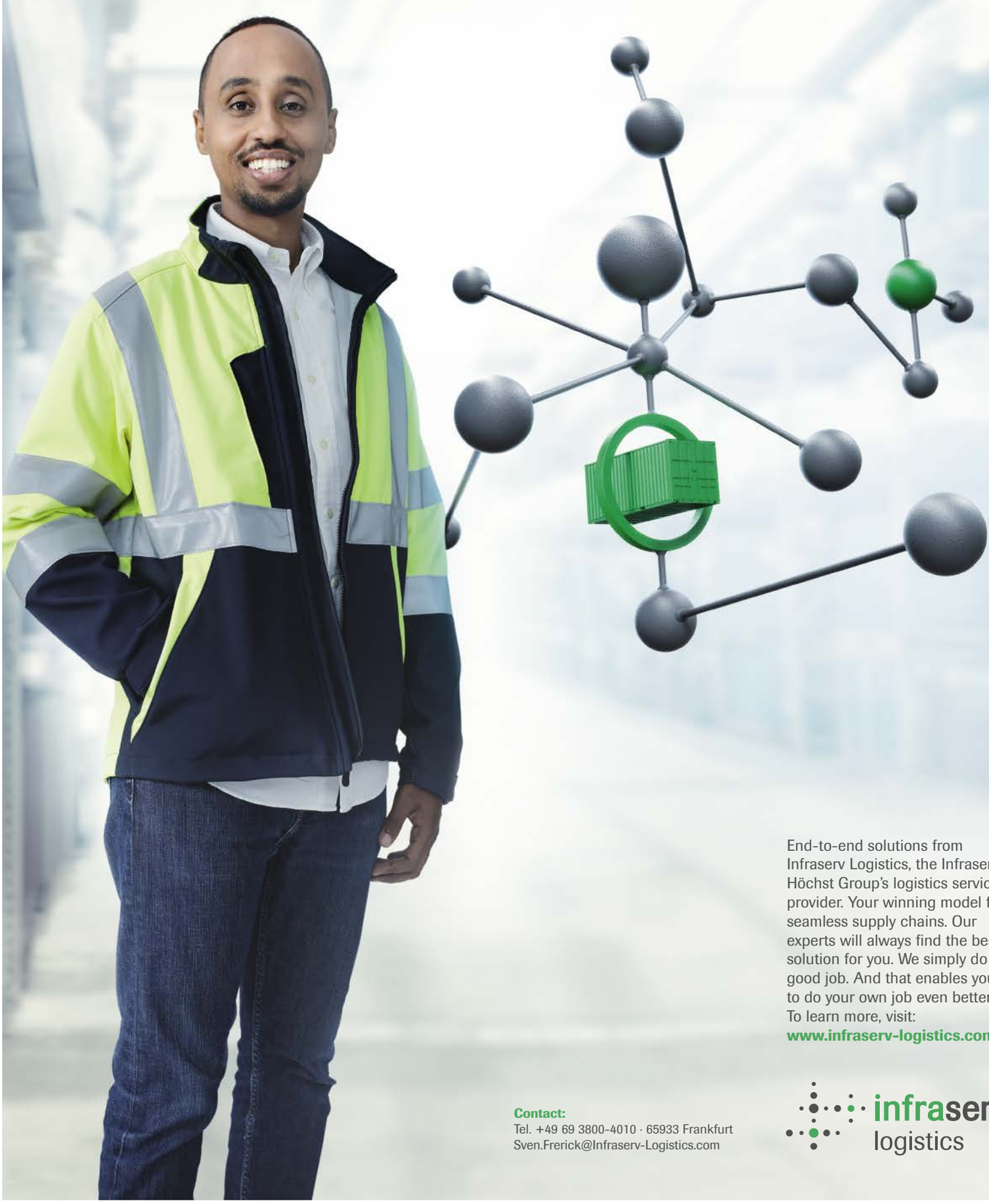

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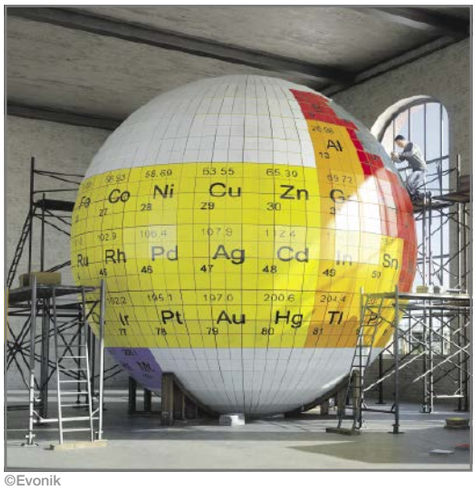

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Innovation

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The European Chemical Industry's New Normal

Brexit is Only One of Numerous Issues Companies Have to Cope With — Not Just in the United Kingdom

Despite general relief over the last-minute Brexit agreement, the British chemical industry and its EU partners are entering into a new era of business and trade relationships. In addition, the Corona crisis is putting pressure on companies and accelerates major paradigm shifts that are underway and need to be dealt with in other areas such as environmental and climate protection. A trusted adviser to major companies with a chemical industry background, and a Global Expert with the World Economic Forum, Paul Hodges, chairman of New Normal Consulting, amongst others, reflects on the issues the post-Brexit chemical industry must tackle and the business scenarios for the — hopefully soon-to-begin — post-Covid era.

CHEManager: With the EU being the most important marketplace for UK chemical companies the post-Brexit EU/UK Free Trade Agreement represents a mixed bag for the chemical industry. Does the agreement provide a predictable trading environment?

Paul Hodges: I think there are two key issues with the agreement—one connected with future UK-EU trade, and the other connected with its rationale. Incidentally, it isn't actually a Free Trade Agreement, FTA, which would have taken years to negotiate. Instead, it's a very modest Trade & Cooperation Agreement, TCA. It's not as bad as "No Deal" would have been, but it is a very thin deal.

What is your assessment of the post-Brexit market situation?

P. Hodges: In terms of today, it is clear that UK-EU chemical trade is already suffering in a number of important areas. One obvious area is transport, where companies are suddenly having to complete large amounts of new paperwork and are suffering from major delays at the border. Rules of Origin have suddenly also become very important. Companies are having to check the origin of their raw materials with their supply chain partners, and then needing to assess whether enough value is added in the UK to avoid tariffs being paid.

And then, of course, there are the problems created by the new border between Great Britain and Northern Ireland down the Irish Sea—which have already led to supermarket shelves emptying in the North, and companies effectively having to treat Northern Ireland as a separate state within their SAP system.

There is also the wider question. This is the first trade deal in history that actually increases trade barriers, rather than reducing them. And the reason for this is that the politics of Brexit proved more important than the economic impact. The TCA reverses the trend towards free trade that has dominated my working life. We have effectively gone back to the pre-globalization world of the 1970s, with different interest groups fighting to gain the lion's share of the economic cake for themselves—rather than working together to try and increase its size.

Paul Hodges,
New Normal Consulting

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What does Brexit mean in terms of regulatory cooperation particularly with regard to the chemical industry's compliance with the EU's REACh regulation?

P. Hodges: The simple answer is that it's very bad news. The UK currently intends to diverge from EU REACh by developing its own UK REACh next year. This may well lead many exporters to withdraw products from the UK market, if they don't make enough profit to justify the time and costs involved in re-registering them. In turn, this will end up reducing the number of chemicals on the UK market and increasing the prices of those that remain.

Can you predict or estimate the economic or financial impact the Brexit will have on the chemical industry?

P. Hodges: Brexit essentially creates a vicious circle. It increases the costs and difficulties of doing business from the UK with the EU. And the benefits it is supposed to create are largely mythical. The UK Chemical Industries Association estimates the cost of building the UK REACh database alone at £1 billion. And the total damage from Brexit in the first few years will be many times this figure. The FTAs so far agreed are simply rollovers of existing EU deals. The idea that joining the Asia-Pacific free trade area can replace the business lost with the UK's neighbors in the EU is simply laughable. Plus, unfortunately, companies now have to consider political risk in their calculations for the first time since the 1970s, which will create uncertainty and damage future investment.

In addition to the Brexit challenges, the Covid-19 pandemic will leave its mark on the industry for years, if not forever. Which issues have been uncovered, accelerated, or provoked by the corona crisis?

P. Hodges: Obviously the pandemic has put the industry under great pressure. But we have survived the test with flying colors and proved not only that we are resilient, but that we are a critical force for good in society. One doesn't hear people complaining about plastic or big pharma in the way that they did a year ago. But at the same time, the pandemic has accelerated paradigm shifts in a remarkable way. People now like plastic, for example, but they want it to be recycled. And having been able to breathe clean air and see a clear sky during the lockdowns, they don't want to go back to where we were in terms of pollution generally.

Which of these issues have the potential to transform the industry or the way companies do business in the future, thus resulting in a 'new normal'?

P. Hodges: We see six key paradigm shifts now underway. Demand patterns have changed and broken the inertia surrounding work and home-based routines. Travel, leisure, construction, real estate and other industries will likely never be the same again, as people's priorities have shifted. Global supply chains have proved fragile and unfit for purpose, and so will have to be reshored—as President Biden is also now arguing in the USA. This move to reshoring in turn enables a third paradigm shift, as it makes no sense to reshore on the basis of outdated technology. Instead, companies have the opportunity to reduce costs and improve safety, quality and reliability by

Continued Page 6 ▶

adopting digital, continuous and bio-enabled technology.

We are also moving toward an era of energy abundance, where the concept of cost-advantaged feedstock is no longer a critical success factor for business. And, of course, the next decade will see rapid progress towards a circular economy as part of the Green Revolution now underway. Plus, we are all becoming aware that the world of work is changing. We are moving on from debating work/life balance to the broader question of how and where we work.

Global supply chains have proven fragile during the pandemic, not only because of the lockdowns around the world, but also due to volatility in demand patterns. Will this question the accomplishments of globalization?

P. Hodges: Globalization was right for its time when the global population was expanding very rapidly. But with today's aging populations, sustainability is now replacing it as the key driver for business. Older people don't need a lot more "stuff"—instead they need to be able to do more with less.

Issues like environmental pollution or climate change have been around for decades but the industry tackled them quite hesitantly. Now, we are seeing increasing public pressure to curb greenhouse gas emissions and plastic waste. What are the key challenges for the chemical industry on the path to become a problem solver rather than being a polluter?

P. Hodges: Our industry is on the threshold of a dramatic transformation. It is equivalent to the one that took place in the 1960s when far-sighted managements, such as my own at ICI, decided to create new pharma divisions, and to replace existing coal-based chemical production with oil and gas-based feedstocks. In turn, these bold moves led to decades of profitable growth around the world. Today we have similar opportunities ahead of us in terms of the move to personalized medicine in pharma, and to use recycled feedstocks in chemicals.

In pharma, for example, advances in genetics and biotech mean that treatments will increasingly be tailored to individual patients, opening up whole new avenues of opportunity. The broader chemicals market is similarly moving into a new era, with today's waste sites likely to be transformed into full-scale recycling centers. And, of course, COP 26 later this year will likely see the EU, China and USA moving ahead with new vigor on climate change and introducing carbon border taxes to reduce CO_2 emissions.

Establishing a circular economy and reducing or reusing waste streams or making its feedstock base sustainable should be the industry's self-interest. Will the EU Green Deal offer enough stimulation—or be the catalyst—for the industry to embrace the paradigm shifts necessary?

P. Hodges: I had the privilege in the summer of being an expert advisor to the World Economic Forum's chemicals CEO Task Force on 'Building back better' after the pandemic. This concluded that we needed to engage with value chain partners, governments and start-ups to build an ecosystem that drives the next wave of innovation. We also argued that the time was right for a new wave of corporate and public venturing to accelerate the process of bringing the necessary new technologies to market as quickly as possible.

What will be the benefits for early movers?

P. Hodges: The EU Green Deal has a powerful financing concept behind it. The companies who embrace this opportunity will gain first-mover advantage in their chosen markets. And this will enable them to capture the 'sweet spots' in the new value chains that will be created, replicating the approach taken by companies such as Apple and others in choosing where to compete in the value chain.

The chemical industry is an innovator and enabler of sustainable technologies. What is needed to advance new technologies faster to marketability?

P. Hodges: The plastics industry is a good example. I was very encouraged at the end of last year to see the detailed route map established in the Sustainable Plastics Strategy developed by CEFIC, Plastics Europe and the Convertors Platform. This focused on the nitty-gritty of what needs to be done today, to move us to where we need to be tomorrow. I think it is an excellent template, and in conjunction with the WEF report, it really covers all the key areas that need to be addressed.

There is also a mixture of 'carrot and stick' involved. 'Business as usual' is no longer viable, given that refineries are closing all round the world as electric vehicles replace gasoline/diesel. So, the naphtha needed to produce virgin plastic will have probably disappeared within 10 years.

You worked in the chemical industry for nearly two decades and have been advising chemical companies for the past 20 years. Did you experience a situation similar—even in parts—to the one today any time during your career?

P. Hodges: I'm actually feeling very young today, because the environment resembles the excitement I felt when joining the industry back in 1978. As new graduates, we were given a lot of scope to make a difference, and of course my career developed rapidly as globalization took off in the 1980s.

The critical issue was that thanks to the post-War baby boom, the world population had already more than doubled from 2.5 billion in 1950 to over 5 billion in 1990. So, demand really took care of itself. Instead, we focused on the supply end of the value chain—offshoring to new markets such as China and India, and building bigger and better chemical plants to reduce unit cost. But all good things come to an end. The issue is that population growth today is now no longer due to new babies being born, but to people living longer.

> *"The next decade will see rapid progress towards a circular economy."*

With sustainability now replacing globalization as the key driver for our industry, we therefore need to return to being demand-led again. This means a renewed focus on better understanding customer needs and how these will develop in the New Normal world. This will be a similarly exciting journey, offering great career opportunities to those who take part.

So, in brief, what will the Chemical Industry's 'New Normal' look like if we travel one, two or three decades into the future?

P. Hodges: The New Normal is a world where it pays to look forward 20 or 30 years to the likely endpoint, rather than focusing on all the twists and turns that will take place on the way. A valuable Gates Foundation-funded study in The Lancet last year gives us the perspective we need to do this, given my assumption that the New Normal means we are now reverting to being demand-led.

The critical takeaway from the Study is that by 2050, the global population will be close to peaking at around 9 billion. And almost all countries will have an aging population, with many facing outright population decline. This paradigm shift is already underway in Europe and the USA, and is set to impact China and most other major economies over coming decades.

In turn, this means we have to adjust to a very different landscape for demand, as older people have very different needs from when they were young. They are no longer setting up home for the first time and having babies. Instead, they are a replacement economy, and their incomes are likely declining rather than increasing as they move into retirement.

In turn, this creates an opportunity for us to develop more service-based business models that don't depend simply on the value of the molecule we are manufacturing. The New Normal is the perfect opportunity to do this, as we are inevitably going to have to develop a whole range of new products and services to meet the new needs created by this major transformation. I'm thinking here about basic areas such as food supply, healthcare, housing, mobility and water supply, as well as the digital economy and other key areas of demand.

And who will be the winners and the losers of that transformation?

P. Hodges: The 'losers' will inevitably be those who decide to stick their heads in the sand and pretend that tomorrow will somehow end up being the same as yesterday. The 'winners' will instead be those who take up the challenges created by the demographic transformation now well underway. They will need to be flexible and risk tolerant, as the way ahead is likely to be bumpy at times. But those managements who embrace an action orientation, alongside a focus on stimulating creativity, will power ahead.

www.new-normal.com

CEFIC Urges Strong EU Industrial Policy

Following a decline of 2% in 2020, European chemical production is forecast to pick up by 3% in 2021, before growth rates taper off slightly in 2022, but output in that year should still land 2% higher against 2021.

In a preliminary look at industry figures for 2020, the European chemical industry council CEFIC said that while these "green shoots" prove that the chemical value chains are among the most resilient in Europe, the longer-term economic outlook "remains highly uncertain," due to the ongoing Covid-19 pandemic and its knock-on effects.

The entire EU manufacturing sector has been hit hard by the pandemic, said the industry association's director general, Marco Mensink. This led to a decrease in overall manufacturing output, including chemicals, of 8% last year – even if the burden was eased somewhat by increased demand for chemicals used to produce public health supplies.

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Overall capacity of the chemical industry in the EU27 dropped by about 6% year-on-year in 2020, and sales were €34.8 billion below the January to November 2019 level. Exports decreased by €7.4 billion (4.5%) in the same period, figures show.

Supported by the multi-billion European Recovery Plan package, the EU's industry can move forward fast, the CEFIC chief executive said. But chemical producers will need the right framework conditions to remain competitive during the transition to a greener economy. This is especially important, Mensink said, if the industry is to stem the "massive investment" the Green Deal will require.

In the transition, CEFIC urged that "Europe must show its leadership in innovating and deploying competitive new technologies for delivering a climate neutral, circular and digital transition, whether it is chemistry for solar panels, wind turbines, batteries, building insulation, medicines or chemical recycling technologies." To do this, it will need a workable industrial policy that will ensure sustainable economic growth and new jobs.

To secure the required investment and maintain the European chemical sector's export success story, Mensink said CEFIC expects the Commission's new industrial policy strategy to provide the markets and conditions for industry to become more sustainable, more competitive globally and more resilient. (dw)

A Marathon at Sprint Speed

CO_2-Neutral Chemical Industry by 2050 — the Challenge of an Industry Transformation, but a Challenge Worth Taking On

The European Chemical Industry has set out on an ambitious path to become carbon neutral. Germany, as one of the major chemical manufacturing nations, has committed to achieve this goal by 2050. But companies need to translate this industry vision into their specific context. System changes of the scale of CO_2 neutrality for a whole industry sector require a suitable attitude from decision makers — the whole system and not only the elements of the individual company need to be investigated and designed.

Hannes Utikal, VCW

Joachim von Heimburg, VCW

Major transformations call for long lead times and require consistent and persistent follow-through. The transformation needs to be supported by policy makers and civil society. It is all but clear whether enough value is created to justify the huge investments required and how new value generated is distributed among critical players and investors. We can learn valuable lessons from the current handling of the Corona pandemic as a multi-stakeholder effort and apply these observations to identify success factors for the transformation of the chemical industry to CO_2 neutrality.

What Mindset to Start With?

The German chemical industry intends to be carbon neutral by 2050. Industry-level concepts have been published underlining that the creation of a CO_2-neutral chemical industry would be potentially technically feasible within this space of time. The public debate now focusses more on how the transformation can be successfully designed and realized and does not question the desirability of the goal itself any longer.

Companies need to translate this vision into their specific context. But how should they frame the challenge? Should they only think about the decarbonization of their current activities ("renovate the building") or should they think as well about the remodeling of their relations to other stakeholders such as suppliers, customers, energy providers, policy makers and civil society ("rethink the inside and the outside of the building").

We believe that the broader view is necessary. A mindset is needed that focusses on the individual decarbonization strategy and integrates as well developments and activities from society, policy, science and other businesses into the considerations.

This broad, system-oriented mindset is necessary, because too many technological, economic, regulatory and societal variables on the path to CO_2 neutrality still remain unclear.

Technological aspects: To achieve climate neutrality, incremental technical changes are not sufficient, but new technologies are required. But it is difficult to estimate when which

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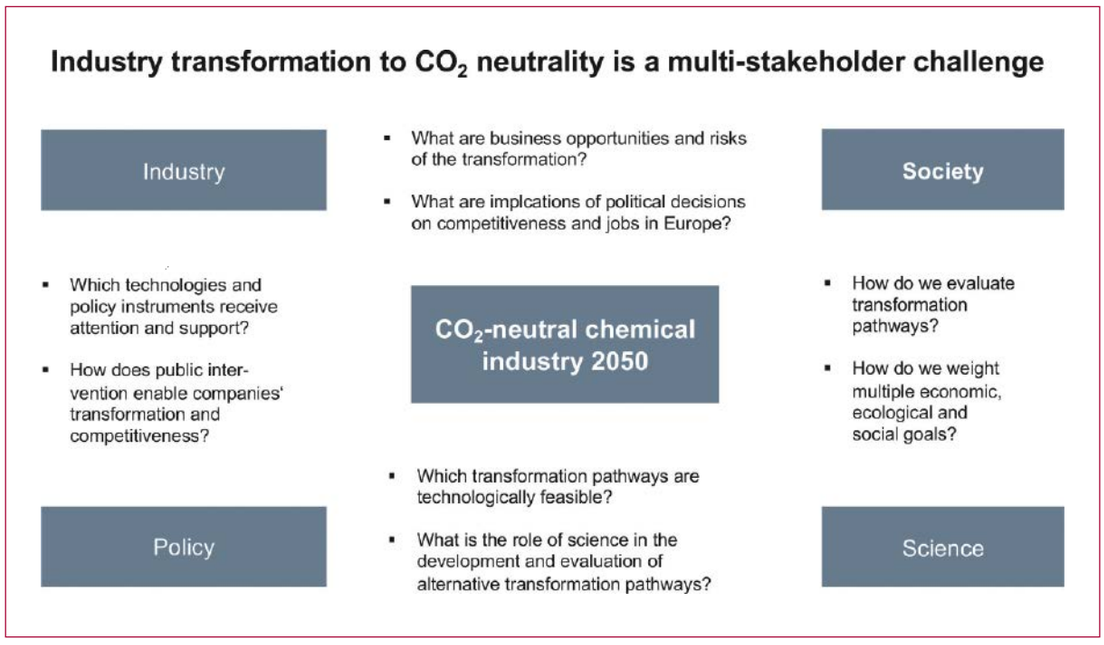
technology will actually be available for large-scale industrial use and at what price. For many alternative technologies, large amounts of renewable electricity are a prerequisite. The ecological transformation of the chemical industry, thus, also requires a cross-sectoral approach, which must take into account new national and international infrastructures to be built.

Economic aspects: Many alternative technologies will not be competitive with conventional technologies without a global CO_2 price, due to their higher production costs. For example, it is estimated that the production of green hydrogen by electrolysis will incur additional costs of 56 % to 178 % compared to steam reforming. Studies estimate the investment costs to be acceptable for society as a whole, but a challenge for individual companies. Against the backdrop of uncertain future conditions, companies must now assess whether and how they will change their business model and in which technologies they will invest. They must plan not only how to enter new technologies (entrepreneurial innovation), but also how to exit established technologies (entrepreneurial exnovation).

Regulatory issues: The regulatory framework faces a conflict of objectives: the policy measures chosen should maintain industry competitiveness and prevent industry leakage (carbon leakage). The measure of choice often cited is the introduction of a global carbon price. This would reflect the social costs of CO_2 emissions and provide an incentive to avoid CO_2 emissions. Decisions on the right policy mix have not yet been made.

Social aspects: The majority of the population expects businesses to actively contribute to climate protection. Decisions on new technologies need to take into account public acceptance, especially in the case of CCS (Carbon Capture and Storage), which may be still in doubt. But even then, if the general public basically approves of a technology, problems may occur during local implementation, as can be observed from time to time with the construction of new wind turbines ("not in my backyard" — NIMB — phenomenon). Societal support must therefore be secured time and again at different levels (regional, national, international) and among different target groups (e.g., experts vs. others; young vs. old).

The transformation is a complex endeavor with multiple influencing and interrelated factors. Companies may have to take decisions under considerable uncertainty because some technological, economic, regulatory and societal aspects may still be unclear at time of decision. Therefore, companies need to plan their individual transformation pathway as a part of an encompassing industry sector transformation.



Major transformations call for long lead times and require consistent and persistent follow-through. The transformation needs to be supported by policy makers and civil society.

Multi-Stakeholder Challenge

Companies in the chemical industry have to see the transformation process not only from a scientific and technical, but also from an economic and social perspective. They need to balance along the way to 2050 their environmental ambition with their economic goals (profitability, competitiveness) and social objectives (jobs). Policy makers focus especially on social goals (jobs in Europe) and intend to design a regulatory framework that supports companies in investing in carbon neutral technologies in Europe.

Here, a big challenge is to strike the right balance between preventing risks and accepting and managing those risks that are inherent to fundamental innovations. Science owns the responsibility to advance relevant technologies and to support decision making processes in business, policy and civil society. And civil society — a very diverse group — may want to make sure that the transformation process is transparent and not dominated by lobbyist groups of established industries.

Thus, multiple actors with potentially conflicting goals reflect about the best potential transformation pathway. In a decision-making model, the best option must be selected from a number of alternatives in the light of a set of objectives. With regards to the transformation, conflicts between stakeholders can be related to different elements of the decision model:

- **Alternatives:** What alternatives (technologies, policy instruments) are considered?
- **Objectives:** Which economic, ecological, social objectives are used for the evaluation of alternatives and how are they weighted?
- **Benefits:** Which benefit function is assumed? What environmental effect does a technology have? What are costs and benefits to companies and society?
- **Timing:** At what point in time should which decision be made? Does it make sense to delay decarbonization measures, because better technologies may be available in the future?

It is obvious that these questions are answered very differently by different stakeholders (companies, politicians, society). A multi-stakeholder collaboration is needed to align societal efforts (cf. figure). Companies from the chemical industry need to engage in cross-industry and cross-disciplinary collaboration and be active participants in the societal discourse to make sure that their perspective is sufficiently taken into account by other stakeholders.

Managing the related complex and sometimes new interfaces between a wide range of business partners, government authorities, academia, and external stakeholders is a management challenge on its own. These actors practically form a new ecosystem. Processes with the objective to generate value that benefits all stakeholders require all actors playing their role within this ecosystem constructively in a spirit of cooperation and co-ownership. Each party has to identify and assume its role and responsibility so that the whole ecosystem can mobilize and capture the necessary resources to deliver against the common objective of achieving CO_2 neutrality. For managing roles and responsibilities of the four groups of stakeholders, we sug-

The Combination of Chemistry and Economics

The Vereinigung für Chemie und Wirtschaft (Association for Chemistry and Economics) is a section of the Gesellschaft Deutscher Chemiker (GDCh, German Chemical Society. Its mission is the combination of chemistry and economics and the formation of an international chemical industry network in order to investigate economic conditions of the chemical industry and to contribute to the discourse on industrial and technological development.

gest following the approach of Marc Dreyer et al. to Responsible Innovation—the so called 4-Gears Model (Journal of Sustainability Research 2020;2(4):e200033).

A Vision Put into Action

Converting the chemical industry to CO_2 neutrality asks for major redesigns and changes of major parts of its technologies, processes, assets, and structures. Implementing these transformations requires major investments in the chemical industry. Their execution commands long lead times and requires consistent and persistent follow-through—just imagine the related permits, stakeholder management, construction, logistics issue. Given the size and impact of these changes, more stakeholders from outside the chemical industry (like consumer associations, policy makers, and NGOs) have to be involved earlier and more deeply. This will demand more efforts and resources of all parties involved and potentially may slow down the transformations.

Net, the journey to CO_2 neutrality resembles a marathon. But getting to the finish line by 2050 requires sprint speed.

The conversion of the chemical industry to CO_2 neutrality poses a challenge only comparable to the evolution of chemistry from a field of research and discovery of individual scientists to the industrial chemistry sector of the 20th century. Looking for other examples, the development of a completely new family of vaccines against Corona with the highest speed possible comes to mind. Considering its success, what learnings may be applied to the transformation to CO_2 neutrality? Here a couple of suggestions:

- Start with crystal-clear objectives shared by all key players involved. For developing a vaccine against a raging pandemic, these goals are obvious. For the less pressing and perceptible need for CO_2 neutrality, the final goal and especially the accepted milestones need to be precisely stated.
- Embrace uncertainty: Accept that success of your activities will depend upon developments of other actors in your ecosystem as well. Start nevertheless.
- Set many horses on the path to the finish line. This can be achieved by forming many and diverse teams utilizing different strategies. Betting on many options will increase chances of success.
- Manage risk proactively. Build resilience into the planning of resources and milestones against unexpected outcomes and put aside additional resources as a contingency reserve.
- Clearly differentiate between the development and the deployment and scale-up phase. These phases pose different challenges, require different resources, and have distinct dynamics.
- Throughout the whole project, manage expectations of key actors, in particular of stakeholders who lack the background for understanding the size of the challenge and its inherent complexity and risk.

The more downstream the projects move, the more difficult and demanding it becomes to adhere to the principles above. With success in sight, many teams are tempted to break away and race to the finish line for claiming victory for them alone—as the European Commission is experiencing in these days of deployment of Corona vaccines.

A Challenge Worth Taking On

Going after the ambitious goal of CO_2-neutrality by the year 2050 will create new growth areas for European and German industry. Exports will receive new stimuli. Indeed, a recent survey by Accenture of European industrial companies estimates the value potential of decarbonization to be €200 billion per year, €40 billion for the chemical industry alone, according to the Accenture survey.

Of course, carbon tax and its projected increases play a critical role here. But all in all, European industrial companies underestimate the perceived value of decarbonization among their customers and affected consumers. Decarbonization, thus, can be seen as a significant business opportunity for Europe and in particular Germany. Germany's deep-rooted engineering and science culture may serve to demonstrate thought leadership, and its high technical, engineering, and scientific competence in chemistry and complex production systems ('Verbund' approach) can generate significant societal benefits.

Joachim von Heimburg, Managing Director, JvH Innovation GmbH, Riehen, Switzerland; Deputy Chairman, Vereinigung für Chemie und Wirtschaft (Association for Chemistry and Economics), Frankfurt, Germany
joachim@jvhinnovation.de

Hannes Utikal, Head, Center for Industry and Sustainability, Provadis School of International Management and Technology AG; Board Member, Vereinigung für Chemie und Wirtschaft (Association for Chemistry and Economics), Frankfurt, Germany
hannes.utikal@provadis-hochschule.de

	Companies	Science	Policy	Civil society
Key Question	• How do we transform the company to become carbon neutral and still be profitable and competitive on a global scale? • How do we achieve this goal vs. a tight deadline (2050)?	• How do we advance the relevant technologies? • How do we support decision making processes in business, policy and civil society?	• How do we design a regulatory framework companies can invest in carbon neutral technologies in Europe so that jobs are safeguarded and environmental goals are met? • How do we moderate the public discourse?	• How do we support the transformation process towards carbon neutrality and still benefit from the economic, ecological and social benefits of a modern manufacturing industry?
Additional fields	Observe technological, societal, and political developments and create partnerships	Make sure that your findings can be understood by all societal actors	Always observe the interplay of political and regulatory measures and their impact on business and society	Make sure that the transformation process is transparent and not dominated by lobbyist groups of established industries
Actions (examples)	• Define your transformation pathway • Create a transformation related trend radar • Cooperate with associations and think tanks • Do technological and economic experiments	• Focus on joint projects with industry and society • Support citizen science to ensure engagement with society	• Finance and support formats for multi-stakeholder collaboration • Participate in company sustainability boards • Invest in new technologies and start-ups	Get involved, argue fairly, accept and support resolutions through e.g. • Public hearings • Challenging published transformation roadmaps • Demanding detailed and verified reporting

VCW's "Guide to Action" towards a carbon neutral chemical industry.

CO_2-Neutral Chemical Industry

The Challenge of an Industry Transformation

The European Chemical Industry has set out on an ambitious path to become carbon neutral. Germany, as one of the major chemical manufacturing nations, has committed to achieve this goal by 2050. But companies need to translate this industry vision into their specific context.

System changes of the scale of CO_2 neutrality for a whole industry sector require a new mindset. Major transformations command long lead times and require consistent and persistent follow-through. It is all but clear whether enough value is created to justify the huge investments and how new value generated is distributed among critical players and investors.

CHEManager asked executives and industry experts to share their opinions on this industry transformation, which is a multi-stakeholder challenge and comprises economical, technical, societal and political aspects. We proposed to discuss the following aspects:

- What is your strategy / timeline to become carbon neutral and what are the key challenges on the path to achieve this goal?
- What political / regulatory measures are needed to encourage companies to invest in carbon neutral technologies?
- What economical / societal benefits do you expect or hope for by decarbonizing your business?
- How do you plan to involve external stakeholders critical for achieving CO_2 neutrality?

Read the insightful answers of the experts on the following pages.

People. Planet. Paint.

Wijnand Bruinsma, Program Manager Sustainability, AkzoNobel

"Tackling climate change by reducing carbon emissions is a global imperative."

Tackling climate change by reducing carbon emissions is a global imperative that features prominently on the agenda of governments, corporates, NGOs and civil society organizations. Reducing emissions demands an integrated, collaborative approach across industries and value chains.

We strive to lead our industry by pioneering a world of possibilities by empowering people, reducing our impact on the planet and consistently innovating to deliver the most sustainable solutions for our customers. That's why we call our approach to sustainable business — People. Planet. Paint.

In 2017 we announced our long-term goal to be carbon neutral by 2050 and set an ambition to reduce carbon by 50% in 2019 (off a 2018 baseline with no offsetting). We are on track to achieve our 50% ambition and made good progress in 2020 having reduced carbon emissions by 19%.

Carbon reduction is achieved by reducing our energy consumption and operating on 100% renewable electricity by 2030 (2025: >50%). We currently have 34 locations and 12 countries on 100% renewable electricity and have set an ambition to reduce energy use by 30% in 2030 (2025: 15%).

Our sustainable product portfolio accounts for 40% of our sales and our ambition is to increase this percentage to >50% by 2030. Our sustainable solutions help reduce energy consumption and thus carbon emissions in the coating application phase and in the use phase of the coated end-product. We develop paints and coatings products with low embodied carbon through water-based low VOC technologies, and reduced and renewable materials usage. Our longer lasting solutions protect substrates longer thus reducing carbon emissions from repair and renewal activities.

AkzoNobel actively contributes to the UN SDGs and we support global programs and organizations like the EU Green Deal, Renovation Wave and CEO Alliance amongst others. We are also a proud member of the World Green Building Council.

Climate Stimulus Packages for Industry

Rudolf Staudigl, President and CEO, Wacker Chemie

"Crisis management as the catalyst for a climate-neutral transformation."

The economic fallout of the coronavirus pandemic poses exceptional challenges to industry — and energy-intensive companies in particular. Transforming industry and putting it on a path toward climate neutrality while strengthening its ability to innovate and compete in today's difficult economic climate will require new political tools.

Europe's energy-intensive, basic-materials industry needs a stable industrial electricity price in order to compete on a level-playing field with Northwest China and other regions.

Otherwise, industrial processes and energy procurement cannot reach climate neutrality by 2050 without the loss of competitiveness and business.

For Germany, Wacker proposes that roughly 120 TWh per year should be made available on an annual basis to the energy-intensive industry at a maximum price currently set at 40 €/MWh. The price level however needs to be flexible, as the reference point for effective carbon leakage protection is never the absolute price of electricity, but always defined as the relative difference to that paid by international competitors. The typical international costs of generating electricity from coal could serve as an index, as could a mix of international industrial electricity prices from relevant competitor regions.

Domestic production of renewable electricity must at least double by 2030. The success of energy-intensive industry's transformation will depend on an ambitious expansion of renewable energy and power distribution grids. Renewable energy represents the backbone for climate protection in German and European industry.

Over the past few years, we have achieved substantial progress on both the political and technological front — from energy storage and electromobility to global climate agreements. The coronavirus pandemic is no reason to let down our guard with respect to climate change. It is instead a call to set the right course for the future now.

Innovations, not Emissions

Martin Babilas, Vorstandsvorsitzender, Altana

"Policymakers need to promote renewable energies much more strongly and swiftly."

We want to leave our footprint on innovations, not on emissions. Therefore, we have already consistently pursued an ambitious sustainability course for many years. Currently, we are on target to reduce our CO_2 impact from production and energy procurement worldwide to zero already by 2025.

We believe that industry plays a decisive role in driving forward global climate protection. But the climate protection targets cannot be achieved without sufficient electricity from renewable energies at competitive prices and the corresponding grid infrastructure. Therefore, policymakers need to promote renewable energies much more strongly and swiftly. Incentives must be created to ensure that sufficient electricity and heat energy from CO_2 neutral sources will continue to be available in the future.

Furthermore, policymakers should create comparable competitive conditions for the industry with internationally uniform CO_2 pricing.

As more and more companies strive to become climate neutral themselves, the need for our experience in researching and developing innovative solutions that make industrial and consumer products more sustainable will even rise. Wire enamels from Altana's Elantas division, for example, are increasingly being used in electric vehicles and extend their service life. Byk offers a solution for the recycling of polypropylene in car batteries, which was previously not recyclable. An aluminum pigment in wall paints developed by our Eckart division ensures that up to 50% of the heat is radiated back from the walls into the room. And a PVC-free seal from the Actega division helps beverage bottlers save 10,000 tons of steel for their crown caps.

With regard to our suppliers, we have set up a program to consistently further improve the CO_2 balance of purchased raw materials.

Helping People and the Planet Thrive

Delf Bintakies, Head of Ecological Footprint, Bayer

"Politicians must set the right incentives for climate-friendly agriculture."

Our sustainability strategy aims to help more people thrive and to decrease the ecological footprint — according to Bayer's vision: "Health for all, Hunger for none."

Regarding the ecological footprint, we aim to be climate neutral in our own operations by 2030. Therefore, we will reduce our emissions by 42% through energy efficiency measures and converting 100% of the purchased electricity to renewables. The remaining emissions will be offset by purchasing certificates from climate protection projects with recognized quality standards. Our targets are in line with the Paris Agreement's goal to limit global warming to 1.5 degrees Celsius.

Additionally, we will reduce greenhouse gas (GHG) emissions in our value chain (scope 3) by 12%. These targets have been approved by the Science Based Targets Initiative. Until 2050 we have committed to being Net Zero along our entire value chain.

To achieve these targets, we need stable and predictable access to large amounts of renewable energy and raw materials with a low CO_2 footprint at competitive pricing. Reduction in the value chain will only be successful through broad collaboration and advancements in calculation methods and transparency. Bayer drives these efforts through the sustainability initiative of the chemical industry, Together for Sustainability, TFS.

Beyond our industrial footprint, Bayer will work with farmers to reduce the ecological footprint of agriculture, which currently accounts for about 25% of GHG emissions worldwide. We want to help reduce GHG emissions by 30% per kilogram of crop yield in major agricultural markets where Bayer is active by 2030.

Politicians must set the right incentives for climate-friendly agriculture, especially in the downstream supply chains, to support this. Uniform certification must be supported and promoted to raise the GHG reduction potential in the agricultural sector and give farmers planning security for participation in voluntary carbon markets.

Turning Sustainability into Business

Stefan Haver, Head of Sustainability, Evonik

"Addressing the opportunities underlying sustainability as a guiding economic principle."

Evonik is committed to acting in line with the Paris Agreement, aiming for climate neutrality by 2050. In fact, this is easier said than done. Which makes it all the more important that we focus not only on the ambition itself, but also keep a close watch on the stepping-stones that will take us there. We can do so by addressing the opportunities underlying sustainability as a guiding economic principle and driver for innovation, resulting in questions like: How do we highlight our contribution as an enabler of CO_2 reductions in many other sectors? Or: How do we translate sustainable development into proper earnings? We can also take a more risk-based approach, asking: How do we account for the impact of climate change and resource scarcity on our business? At least: How do we make our portfolio more robust?

Our sustainability strategy is derived from the above questions, simultaneously aiming at four dimensions: exploring opportunities as well as risk mitigation, the footprint of our production as well as the handprint of our products. Consequently, it is deeply embedded in our company's purpose itself: Leading beyond chemistry to improve life today and tomorrow.

For the footprint-related part we have announced our target of reducing absolute emissions by half by 2025, compared with the baseline of 2008. For the coming years this is a reduction path of 3% a year, underpinning our commitment to the Paris Agreement. This is supplemented by internal CO_2 pricing, calculated using the baseline of €50 per ton CO_2.

On the handprint side of things, we are fostering sales from our most advanced products, that come with a proven sustainability benefit above market level. These A-ranked products form what we call our "next generation solutions". Having analyzed all of our businesses we can profoundly say, that Evonik generates about 90% of its sales with products or solutions that are on or above the market reference point in terms of their sustainability performance. More than 30% of our products and solutions even meet the highest standards of our next-generation-solutions category.

So, to Evonik the challenge of industry transformation comes with a strong message: It is not just about going green. It is all about business itself.

Responsibility for our Planet

Walmir Soller, Vice President Olefins/Polyolefins, Europe and Asia, Braskem

"The opportunities for action by far exceed the risks of inaction."

The race to zero emissions is on — and Europe has firmly set its eyes on becoming the first carbon-neutral continent by 2050. All of us in the chemical industry, in Europe and globally, do have big a role to play as we share a responsibility for our planet. The scale of the risks from climate change, deforestation and water scarcity for the economy is huge — however, we also know that the opportunities for action by far exceed the risks of inaction. The private sector's leadership will create a ‚cycle of ambitions' for greater government action and will ensure that global intentions for a sustainable net-zero economy become a reality.

Braskem has been committed to sustainability since our creation in 2002, and we consider ourselves to be a pioneer in the production of biopolymers. During ten years of growing sales, for example, the materials from our 'I'm green portfolio', which comprises products focusing on the circular economy, have helped avoid the emission of 5.54 million tons of CO_2-equivalent alone. And in November 2020, Braskem has announced an expansion in its efforts to become carbon neutral by 2050. To achieve this ambitious target, we will launch material initiatives for carbon reduction, offsetting and capture, expand our 'I'm green portfolio', and ensure the proper disposal of 1.5 million tons of plastic waste. And we will continue working on chemical recycling to provide the missing link for a circular plastic chain.

Due to our efforts, Braskem again was selected as a leading company on the Climate List for the sixth year in a row by the non-profit Carbon Disclosure Program (CDP) in 2020, underscoring our engagement and positive impact on our way towards a circular economy in the chemical industry. We all still have some way to go, but we are ready to play our part together with our partners in the industry. Our initiatives for the coming decades are aligned with the UN 2030 Agenda, its 17 Sustainable Development Goals and the Paris Agreement to control impacts from climate change.

Avoiding and Decreasing Value Chain Emissions

Lucrèce Foufopoulos, Executive Vice President Polyolefins, Innovation & Technology, Borealis

"Climate protection and economic success must go hand in hand."

Without any doubt, climate change is our biggest threat on a global scale. Therefore, we at Borealis see it as our responsibility to reduce our carbon footprint, as well as our products' total life-cycle emissions. We firmly believe that climate protection and economic success must go hand in hand, to ensure that the innovations needed for global climate protection continue to be developed. We also believe that a real step change can only be achieved through intra- and cross-sectoral cooperation, as well as developing robust internal pricing that stimulates companies to permanently reduce CO_2 emission.

Whilst it is essential to decrease emissions in our operations, we are also contributing to both avoiding and decreasing value chain emissions during the life cycle of the solutions we enable with our innovative and value-add product portfolio.

We continue driving the circular economy, reducing end-of-life emissions from plastic waste by designing for recycling, increasing recycled content or using chemically recycled feedstock. We will also reduce total life cycle emissions by using renewable energy and feedstock.

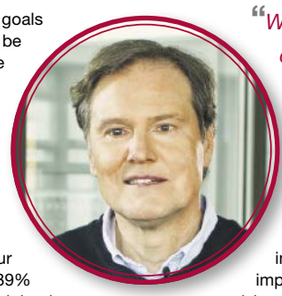
We are committed to reducing the carbon footprint of our operations to ensure we are climate neutral by 2050 or sooner by sourcing renewable electricity to avoid emissions, by continuing to implement energy efficiency improvements and zero continuous flaring, to reduce emissions, and by driving innovation to find solutions for end-of-pipe CO_2 emissions.

We have set the following goals in our journey towards climate neutrality by 2050, or sooner: Source 50% of electricity from renewable sources by 2030, to reduce indirect (scope 2) emissions that are caused by electricity consumption. And implement energy efficiency improvements equal to 20% of the absolute energy consumption in 2015 by 2030.

To reach net zero for scope 1 and 2 emissions, Borealis will go beyond the targets set out above and is therefore exploring opportunities to handle emissions as they arise through carbon capture and utilisation projects.

Keep Pushing for Energy Efficiency

Heinz-Jürgen Bertram, CEO, Symrise



"We integrate suppliers into our climate strategy."

We have set ambitious goals and expect not only to be carbon neutral, but to be climate positive by 2030. As interim goal, we want to reduce our CO_2 emissions in terms of value added by 60% by 2025 compared to the base year of 2016. Via the CDP Supply Chain Program, we integrate suppliers into our climate strategy. By now, 89% of our main suppliers have joined, meaning Symrise has far exceeded its Science Based Target (SBT) of 80%. The key challenge is our dynamic growth. As we are growing especially in the emerging markets with rising incomes, we want to offset the impact of rising sales while minimizing greenhouse gas emissions in our value chain. In order to accomplish this, we keep pushing for energy efficiency in our production facilities.

Focus on the Low Carbon Technologies of Tomorrow

Ralf Brinkmann, President Dow Germany, Central Europe, Italy, Israel and Greater Russia

"The EU Green Deal is both, an opportunity, but also a challenge."

We at Dow are committed to the Paris Climate Agreement and the EU Green Deal. In 2020 Dow set new targets to reduce GHG emissions, stop plastic waste, and drive toward a circular economy. We intend to be carbon neutral by 2050 and are committed to implementing and advancing technologies to manufacture products using fewer resources and that help customers reduce their carbon footprints. Hydrogen, alternative feedstocks, recycling technologies, circular economy and CO_2 reduction are the most pressing topics of the future. We believe that collaboration with the right partners from the industry, politics, NGO´s, research and science institutes will bring the most value to reach this goal.

However, for us as a globally operating Material sciences company the EU Green Deal is both an opportunity, but also a challenge. Our industry, mainly being increasingly exposed to carbon leakage, needs a reliable political framework now for investments in tomorrow's low-carbon technologies. This is essential to achieve our goal of carbon neutrality by 2050 and includes a reliable and cost-effective supply of green energy, which must be available in large quantities. In addition, markets must credit and refinance CO_2-free or CO_2-reduced products through the pricing of products. This is crucial to maintain our international competitiveness through the transition period and to support investments in low-carbon technologies until a global playing field is realized.

Committed to Speeding up Transformation

Richard Haldimann, Head of Sustainability Transformation, Clariant

"We have made carbon reductions bonus relevant."

Addressing climate risks and opportunities has been embedded in Clariant's sustainability journey over the past 10 years, but we are committed to speeding up our transformation. Our vision is to be carbon-neutral by 2050. To get there, we have just committed to ambitious 2030 climate targets, approved by the Science Based Targets initiative. They set out absolute reductions in emissions from our operations and purchased energy (-40%) as well as from our raw materials (-14%).

These new science-based targets are complemented by other targets to ensure continuous improvement in our environmental footprint, in all important parameters by 2030. The biggest lever we have as a specialty chemical company in supporting customers in their transition to a climate neutral economy is through our enabling solutions, be it low carbon intensity surfactants or catalysts.

Internally, we are both steering and incentivizing the improvement of our carbon footprint. Like applying carbon pricing for evaluating capital expenditures, reflecting our support for a global CO_2 price. Clariant will focus on improving energy efficiency through digitalization and increasing the use of low carbon electricity and fuels. To ensure this stays high on the management agenda we have made carbon reductions bonus relevant.

Outside of our operations, we are accelerating innovation in our value chains with increased use of waste streams and sustainable bio-based materials. For example, our high performing, EcoTain labelled glucamides for personal care are based on renewable sugars. They demonstrate a significantly reduced carbon footprint versus alternatives.

Clariant sees partnerships as critical for achieving CO_2 reductions. Examples include our strategic collaborations with sustainable raw material suppliers and customers to help decarbonize value chains. Such as with Neste for low carbon intensity raw materials used in flame retardants, and Carbon2Chem, a cross-industry project for the reduction of industrial CO_2 emissions in steel production.

Circular Raw Materials and Renewable Energy

Christian Haessler, Global Program Lead Circular Economy, Covestro

"Circular economy must become a global guiding principle."

To become climate neutral along its entire value chain the chemical industry has to switch from fossil-based to circular raw materials and renewable energy. Circular economy must become a global guiding principle to achieve this.

The chemical industry is as a solution provider to many industries ideally positioned to push this transformation towards a circular economy forward, break new ground in the development of those circular and renewable raw materials. At Covestro we are already integrating biomass into production, developing innovative recycling technologies to retrieve raw materials and even use CO_2 as another raw material source for our high-performance materials. Plastics are indispensable for a more sustainable, climate-neutral future. However, carbon, as a central plastics component, has to be kept in circle as far as possible. For example, the potential for industrial use of CO_2 as a raw material has never been better and the journey only just started. CO_2 is already used as raw material for plastics, basic chemicals, proteins, and many others. Covestro is a pioneer in this area. Since 2016 we produce polyols with up to 20% CO_2 under the brand name Cardyon using CO_2 from waste gas streams from a neighboring chemical plant. The CO_2 is chemically bound in the polyol where it cannot escape and thus serves as basis for a variety of applications such as foam for mattresses and automotive interiors, binders for sports floorings or elastic textile fibers. A good example is the EU Green Deal promoting CCU (Carbon Capture and Utilization) projects.

At Covestro, it is our vision to becoming fully circular and we align our company toward this vision with the ultimate goal to lead raw materials and carbon in loops, over and over and switch our energy supply to renewable sources.

Encouraging Policies and Regulations

Tatsuhiko Tokunaga, General Manager, Sustainability Strategy Planning Department, Asahi Kasei

"We believe that accelerating decarbonization will lead to business growth."

Asahi Kasei is working toward the realization of a carbon-neutral and sustainable society based on the „Care for Earth" policy anchored in our current mid-term plan. Regarding CO_2 reduction, we are taking a two-pronged approach of reducing emissions from our business activities and providing materials and technologies that allow for reducing CO_2 in society. As society progresses to decarbonization, we believe that accelerating decarbonization of our products will lead to our business growth. Because of the unique portfolio, Asahi Kasei is able to work on a carbon-neutral and sustainable society from various perspectives, not only in regard to basic chemicals but also by leveraging our expertise in the fields of housing, healthcare, electronics, hydrogen, as well as for materials for next-generation batteries and automotive in general. We believe that this approach allows for synergies that will profoundly contribute to a sustainable society.

Encouraging companies to invest in carbon neutral technologies is the right approach. Carbon neutrality is obviously a big challenge for all companies and society in general. We believe that this can be achieved by the effort of each single company, supported by encouraging policies and regulations that support these activities and pave the way for social systems harmonizing with decarbonization.

Achieving CO_2 neutrality requires global companies to take global efforts. With R&D laboratories in Japan and Germany and Corporate Venture Capital offices in the United States, Germany and China, we are in close contact with partners, suppliers and start-up companies around the globe, aiming at incorporating the most advanced technologies to support our efforts.

Transition to a Carbon-neutral Lifestyle

Uwe Bergmann, Head of Sustainability Management, Henkel

"We aim to become a climate-positive company by 2040."

The next five years will be decisive, whether we as a society will manage the transition to a carbon-neutral lifestyle, reducing the pressure on our resources and reach the well below 2-degree target of the Paris Agreement. We at Henkel want to lead the change and therefore committed to an ambitious long-term vision: we aim to become a climate-positive company by 2040. This means decarbonizing our own operations and supplying surplus carbon-free energy to third parties.

At our production sites, we have identified both the potential to further increase energy efficiency and to convert all remaining fossil fuels to climate-neutral alternatives. Our aim is to reduce our production-related carbon footprint by 65% by 2025.

In addition to our activities at our own sites, we want to leverage our influence on areas of our value chain that are particularly relevant to CO_2 emissions. Responsible sourcing is one approach that we realize by cooperating with our suppliers. The industry-wide responsible sourcing initiative Together for Sustainability, TFS, co-founded by Henkel in 2011, is only one example.

Finally, the most important approach for Henkel's CO_2 reductions lies in the use phase of our products, accounting for around two thirds of our carbon footprint. Therefore, we have developed a CO_2-saving portfolio to help our customers and consumers save 100 million tons of CO_2 in a ten-year-period until 2025 by using our products and solutions.

We are convinced that our strategy to create more value, while reducing our environmental footprint, makes an important contribution to climate protection and is the way to lead our company to future success.

Climate Protection is a Business Case

Hubert Fink, Member of the Board of Management, Lanxess

"We need fast approval procedures for emission-reducing technologies and energy-efficient plants."

When my colleagues and I decided in 2019 that Lanxess should become climate-neutral by 2040, we were guided by two ideas: First, we have a responsibility to contribute to the Paris Agreement's goal of limiting global warming to less than two degrees Celsius. Second, we see the business benefits. We will become an increasingly sustainable partner for our customers in the coming years. And thanks to greater resource efficiency, we will save costs in the long term. In a nutshell, climate protection is a business case.

Of course, it is first and foremost up to us to achieve the goal of climate neutrality. Only recently, we put a plant into operation at our Antwerp site to reduce nitrous oxide, which emits during the production of the plastic precursor caprolactam. A second facility will be added in 2023. In India, we are converting our energy supply to renewables. This has already been achieved in Brazil. At our major sites on the Lower Rhine, Germany, we will only use natural gas in the mid-term, which is more climate-friendly than coal. With our focus on specialty chemicals, we will do more business with lower emissions in the future. Our research focuses more strongly on climate-neutral process and technology innovations. All of this requires investment, but it pays off in the long term, for our business and for the planet.

However, the transformation to climate neutrality is not solely in our hands. We need political support. In Germany, for example, we urgently need more green energy, and at competitive prices. It is also essential that the European emissions trading system remains functional and that there is no double burden from national systems. Finally, yet importantly, we need simple and fast approval procedures for new, emission-reducing technologies and energy-efficient plants.

Return to Reasonable Measures

Bernhard Hettich, Chief Technology Officer, CHT Group

"The regulatory effort from the European legislation bears the risk of deindustrialization."

CHT has integrated sustainability into its midterm strategy 2025. Becoming a carbon-neutral company requires affordable energy with a sufficient share of renewably generated electrical energy, as pointed out in VCI's statement.

For CHT as a specialty chemicals provider for multiple industries the transformation to climate neutrality means to analyze and evaluate the whole value chain upstream and downstream including the customers' processes. This will be done in a systematic and comprehensive way by means of science-based targets, SBT, to make sure that each individual measure adequately contributes to the target achievement.

CHT drives its business in the focus of sustainability, well balanced on the three pillars ecology, economy, and social aspects.

However, the relentless regulatory effort from the European legislation bears the risk of vast deindustrialization in Europe, which happens in very small but manifold steps. 30 years from now, the results of the ideologically driven legislation activities of the last 10 years, today and the coming decades cannot be corrected anymore.

Therefore, we are urging now the European legislation to return to reasonable measures as their responsibility to enable the chemical industry to remain in Europe and to become climate neutral according to its self-commitment.

Leveraging Science and Technology

Herwig Buchholz, Head of Group Corporate Sustainability, Merck

"Sustainable entrepreneurship and profitable growth go hand in hand."

At Merck, reducing our greenhouse gas emissions is a core element and one of the three goals of our sustainability strategy: By 2040, we want to be climate-neutral —not just in terms of emissions at our own sites and from energy purchases, but along the entire value chain.

This goal cannot be achieved without major changes. Starting with our product developments, we are already working to reduce our greenhouse gas footprint through a wide range of initiatives and projects. Cutting down on energy consumption, utilizing renewable energy sources, and minimizing our process emissions are key elements of our climate mitigation efforts.

In recent years, we have focused on reducing greenhouse gas emissions through energy efficiency projects. We are continuously improving the energy efficiency of our buildings as well as our research and production activities by adapting and modernizing them. In addition, we are working to reduce process-related greenhouse gas emissions and emissions from our own energy generation. Since 2019, we have increasingly been purchasing electricity from renewable sources, and we are committed to engage in green virtual power purchasing agreements.

However, it is also clear that climate change is a global challenge that can only be resolved together. And while global attention to the issue is important, solutions are even more important. We need different, visionary approaches in many areas. For example, agriculture is a huge producer of CO_2. A recent United Nations report calls on people everywhere to substantially cut down on their meat consumption in order to help save the planet. That is why we are committed to the topic of clean meat: meat grown in the lab has the potential to significantly reduce greenhouse gas emissions.

We are working closely with a broad range of partners across different sectors — including academia, start-ups, non-profits and large corporations. Our ambition is to leverage science and technology to achieve lasting progress for mankind. For us, sustainable entrepreneurship and profitable growth go hand in hand.

Creating a Powerful Coalition

Zanna McFerson, Managing Director of the Renewable Chemistries, Avantium

"Weaning away from fossil-based resources on a global scale is happening too slowly."

Avantium's path to achieving carbon neutrality looks at a number of different areas, including our technologies, operations, people and leadership. We have outlined several measurable goals for these, such as achieving 1.5 million tons of CO_2 savings and a fully carbon neutral operation by 2030. We are also mobilizing our colleagues and the next generation of scientists, as well as focusing our leadership team's advocacy efforts. These goals have been put in place to help us accomplish our overall ambition of a fossil-free chemical industry by 2050.

The key challenge currently is that weaning away from fossil-based resources on a global scale is happening too slowly. Also, sustainable alternatives are still in the development stage and need to be scaled up in a cost effective and efficient way. At Avantium, we are applying our scientific and research expertise to improve existing processes and invent new technologies for the chemical industry, to not only address the world's dependency on fossil-based resources, but also create a more sustainable, circular future.

By setting our plans, we can hope to bring a number of economic and social benefits. We can engage with and educate the public on the impact of climate change, work with important stakeholders to fundamentally change the plastic value chain for the better, as well as collaborate with governments and industry associations to help inform the debate and shape climate policy.

We hope to galvanize many others that share similar values and are guided by the same end goals into action, so that together, we create a powerful coalition to reach our ambition of a fossil-free chemical industry by 2050. We not only want to be a leader in sustainability, but also create a ripple effect that draws others into action.

Improve, Grow, Engage

Vivi Hollertt, Chief Sustainability and Communications Officer, Nouryon

"We should not underestimate the drive of market forces."

Markets worldwide rely on our chemistry in the manufacture of products, such as paper, plastics, building materials, food, pharmaceuticals, and personal care items. That is why we believe that in addition to improving our eco-footprint, we also need to grow — to provide more sustainable products, more bio-based materials, more circular chemistry. And we can't operate in a silo: We serve our customers and at the same time also need to engage our employees and the communities in which we operate to drive progress together.

Improve, grow, engage: These form the three pillars or our sustainability approach 'Nouryon's Commitment to a Sustainable Future.' And we have a strong foundation to build on: We are a top-quartile performer in safety, we have reduced our carbon footprint per ton of product by almost a third since 2009, and we continuously grow sales from our more sustainable 'Eco Premium Solutions'.

When looking forward, we believe in making concrete steps right now, rather than focusing only on a distant future. Our next milestone is to reduce absolute emissions from our operations and energy use by 25% between 2020 and 2025.

But more importantly, we will grow our sustainable product portfolio as an integrated part of our business strategy to serve growing markets. For example, one of our largest recent acquisitions was in CMC, a cellulose product which supports the growth of more bio-based products for personal care, buildings and infrastructure, and other growth markets.

We strongly believe that sustainability will be a key growth driver in the coming years, and we should not underestimate the drive of market forces in pushing the large transformation in our industry.

Transformation — with a Sense of Proportion

Matthias Braun, Managing Director Active Ingredients, Sanofi-Aventis Germany

"Isolated European solutions or even ideological considerations will not lead to the goal."

Immediate coal phase-out, higher industrial electricity costs, binding targets — the demands in the discussion about more climate protection and a CO_2-neutral industry are diverse and occasionally exempt from all constraints. One can wish for a lot, demand even more — but one should also keep in mind a sensible and, above all, technically feasible implementation. Actionism does not help here. For we need both — climate protection and an economy that can hold its own in global competition. As a country poor in raw materials, Germany is dependent on a functioning industry that secures jobs and creates the prosperity that is necessary for an energy transition.

An energy transition cannot be achieved at zero. The central question is, what do we have to do, and can we do it?

The European Commission's Green Deal has set the goal of making the EU greenhouse-gas-neutral by 2050. At Sanofi, we will achieve this: We have set the goal of meeting our primary energy needs only from renewable sources by 2030 at the latest — and to be completely climate neutral by 2050. But one should not forget: What is a growth strategy from the EU's point of view is a major challenge for the chemical and pharmaceutical industry. For example, how do you make climate-neutral „green" steam, which as an energy supplier is crucial for production and operations? We will still have to find answers to such questions!

It is true that the deal contains the opportunity to strengthen Europe's competitiveness through new business models and technical innovations. But the Green Deal must become a Sustainable Deal that is implemented with a sense of proportion. For example, competitive electricity prices are essential for the switch to renewable energies and climate-friendly technologies.

Sanofi naturally supports ambitious and effective climate protection in Germany, the EU and worldwide. This must be implemented consistently. If not, there is a threat of relocation of production with negative effects. That benefits no one — and least of all the climate. So, isolated European solutions or even ideological considerations will not lead to the goal. Instead, it must be a matter of investing in research and improving existing concepts. Because we want to continue to be part of a modern, forward-looking society. That is why we are consistently pursuing our path towards climate neutrality.

Creating a Level Playing Field

Mark Williams, Vice President Europe, SABIC

"A collaborative approach between the private and public sector is needed."

While we support the EU Green Deal and transitioning toward a climate-neutral and fully circular economy, a collaborative approach between the private and public sector is needed to reach this ambition.

Alongside others, we want to work with the EU to create a level playing field. Access to affordable renewable energy and a reliable supply are key enablers of decarbonization, and both supply and public infrastructure continue to be a challenge. To accelerate our transition, we are pursuing a number of low carbon options including the development of a 100 MW solar plant to power our operations in Cartagena and we are investigating further opportunities for electrification across Europe — but on-site solutions are not always practical or possible. There is a role for industry to play in working with policymakers to ensure the right resources are in place.

In many cases, current energy efficiency initiatives and technologies are reaching their limit and investment is needed to research, develop and deploy new solutions. Policy reform is needed to drive and support innovation, and public demand for low-carbon and circular products is essential.

If policies like the ETS could account for all emission reduction savings including scope 1 from direct emissions, scope 2 from renewable resources and scope 3 from chemical recycling — or the cap was adjusted — industry would be more open to taking risks and revenues could be recycled to offset the cost of developing or introducing carbon-neutral technologies. In turn, Europe would be able to maintain its competitiveness and technological leadership throughout the world. Care is required with EU protective measures like carbon pricing schemes and border adjustment measures as they can have unintended consequences that further limit our ability to be competitive.

We will continue to invest in low-carbon-emitting technologies, but time is short and collaboration is vital. We are working with CEFIC to ensure that we achieve the goals of the EU Green Deal in parallel with growing our business in Europe and demonstrating global leadership. The challenge is too great for one company or organization; we work together to make a climate-neutral future happen.

Driving the Plastic Circular Economy

Samia Nehme, VP Chemicals Europe and Africa, Global Excellence and Product Stewardship, Shell Chemicals

"Plastic end products bring important benefits to society."

Our ambition at Shell is to become a net-zero emissions energy business by 2050 or sooner in step with society and our customers, and our chemicals business has a vital part to play. We aim to be net-zero emissions from making our products and to reduce the carbon intensity of the products we sell. We will also work with sectors which use energy to help them find their own path to net-zero emissions.

We are looking at four main areas to drive down CO_2 from our chemicals production: Firstly, each of our chemical plants is improving energy efficiency, through investing in things like heat and gas recovery systems, hybrid boilers and new catalysts. Secondly, our production sites are increasingly using lower-carbon energy sources such as solar and hydrogen, which Shell's New Energies business is playing a leading role in developing. Thirdly, we are exploring carbon capture and storage (CCS) options, to capture the CO_2 emissions our facilities produce. And lastly, we are developing alternative feedstocks for making our chemicals, such as biomass and plastic waste.

Plastic end products bring important benefits to society - helping to improve living standards, hygiene, and nutrition. Shell, like others, wants to be part of the solution to the growing problem of plastic waste. We are developing new technology to use plastic waste as an alternative feedstock to make our chemicals. We are making good progress toward our ambition to use 1 million tons of plastic waste every year in our facilities by 2025. At Shell Chemicals, driving the plastic circular economy is a key part of our growth strategy.

Sustainable Corporate Management Pays Off

Bernhard Kott, Chief Sustainability Officer, Symrise

"Ambitious sustainability management reinforces long-term partnerships."

I am convinced that sustainable corporate management pays off — not least in economic success. We contribute to the UN Sustainable Development Goals (SDGs) and global efforts to stop global warming. Our shareholders and investors are paying greater attention to this commitment. If we act sustainably today, we can avoid higher costs later, for example due to regulatory requirements, reputation losses or — last but not least — our dependence on natural raw materials. Thus, analysts and rating agencies such as MSCI, Sustainalytics, ISS ESG, CDP, EcoVadis and SEDEX increasingly ask us about our ESG performance. Also, an ambitious sustainability management reinforces long-term partnerships with our suppliers and local communities — and is demanded by our employees. Where necessary, Symrise compensates emissions through climate certificates, preferably by funding projects where we operate. The impact can be better monitored and employees and the population in the region benefit directly from the measures.

Technologies for Tomorrow's Challenges

Jürgen Vormann, Chairman of the Management Board, Infraserv

"We need pragmatic sustainability policies in Germany and Europe."

The Covid-19 pandemic currently dominates the headlines and has displaced sustainability and climate change from the top of society's agenda. However, these issues have lost none of their urgency or significance for the chemical and pharmaceutical sector.

It is my hope that the sustainability debate will — for various reasons, and not just in response to the economic fallout from the pandemic — become less one-sided in the future than it was before the pandemic, when climate protection activities were demanded at times without considering how they would affect Germany's competitiveness.

We need pragmatic sustainability policies in Germany and Europe — policies that target ambitious but achievable goals and acknowledge the realities of global competition instead of focusing on the crowd-pleasing appeal of a "green new deal". That will only happen if we have a critical, constructive and solution-driven debate, not a dogmatic and occasionally one-dimensional vision of sustainability that is geared toward the political mainstream. Sustainability policies that ignore socio-economic facts and allow value generation to be offshored outside Europe quickly lose their claim to being sustainable. Indeed, they run the risk of creating more numerous and serious problems than they purport to solve.

The chemical and pharmaceutical industry has always driven the kind of innovation that is so essential to developing new energy, healthcare, transportation and environmental technologies. It has thus done much to help achieve climate targets, make Germany a socio-economically sustainable place to do business and provide environmentally relevant technologies for tomorrow's challenges. It is thus in all our interest to do everything we can to give the chemical and pharmaceutical sector a future in Germany and Europe.

Chemical Industry: a Key Player in Climate Protection

Thomas Wagner, CEO, GETEC

"Every industry must review its entire value chain."

Decarbonization is probably the strongest driver of transformation today. Only if every sector makes a significant contribution to reduce greenhouse gases (GHG), climate neutrality in 2050 according to the EU Green Deal will succeed. To achieve these goals, every industry must review its entire value chain.

The chemical industry is one of the main emitters of CO_2. Therefore, a holistic view to tackle GHG is required. From sourcing of raw materials not only from oil and the improvement of processes for the incorporation of CO_2 in products, to energy used and materials and gases recycled in order to get to net zero production.

This transformation comes at enormous speed with many new regulations in the introduction phase. On top of political and consequently regulatory framework, the capital markets require very clear and dedicated ESG strategies to commit to this transformation. Thus, a major focus of top management is needed, major investments, major knowledge and speed are necessary to tackle that challenge. This is when outsourcing is being considered by most chemical companies — when focus and resources needs to be on core processes. Therefore, a strong partner is required in order to manage speed and complexity.

In addition to the provision of highly efficient energy solutions, innovative energy service providers such as GETEC have developed further solutions for their chemical customers based on the Waste2Value approach. For example, in the thermal utilization of highly climate-damaging special gases such as nitrous oxide or vent gas out of production or storage. Or in the completely climate-neutral energy supply of Clariant's new production site in Romania. Here, Clariant produces bioethanol from wheat straw, while GETEC uses the residual lignin for the energy supply. Doubly innovative and sustainable.

These examples show, however, that the chemical industry should not only be considered in terms of its own scope, but also in terms of its additional climate-contribution as one of the main players. The entire future field of hydrogen synthesis, for example, will not work without according catalysts produced by the chemical industry. This is a more honest and holistic view of the chemical industry's contribution to CO_2 reduction and it offers considerable opportunities.

Playing a Pioneering Role in the Global Energy Transition

Frank Hyldmar, CEO, Currenta

"Green hydrogen can completely decarbonize production processes."

Currenta is part of the „European Alliance for Clean Hydrogen". The initiative, founded by the European Commission, supports the development of a clean and globally competitive hydrogen industry. It aims to contribute to the EU's goal of becoming climate neutral by 2050. The goals of the alliance fit perfectly with our ideas and convictions on sustainability. We want to make a substantial contribution with our know-how and infrastructure to establish the market for green hydrogen in the long term: as a basic material for the chemical industry, energy storage or fuel.

We want to play a pioneering role in the global energy transition. As a sustainable company, we are convinced of this and are playing our part in making the economy in Europe CO_2-neutral in the future. Clean hydrogen technology is one of the key technologies for the energy transition. Especially in the chemical industry, green hydrogen is seen as one of the alternatives to fossil fuels and can completely decarbonize production processes.

Currenta manages and operates three Chempark sites, in Leverkusen, Dormagen and Krefeld-Uerdingen. We can draw on a wealth of experience and in-depth knowledge in operating industrial plants and managing complex approval processes. The Chempark sites also have the necessary land and infrastructure such as electricity and gas grid connections. We therefore offer ideal conditions for establishing a regional hydrogen hub in the future.

In addition, hydrogen is already produced on site by steam reforming and chlor-alkali electrolysis and used in production by Chempark companies. In the future, climate-neutral hydrogen will continue to gain importance as a key raw material for a greenhouse-gas-neutral industry - also in other areas, for example in the mobility and logistics sector. The technical and investment challenges are huge. We operate one of the largest chemical parks in Europe. For us, one thing is certain: We will do our part to ensure that production there can be climate-neutral in the future.

Full Commitment and United Efforts

Clemens Mittelviefhaus, Managing Director, Yncoris

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"Partnering and collaboration is key to success."

To become CO_2-neutral as industrial manufacturer is — in face of the challenges coming along with climate change — a question of inter-generational contract: This responsibility we all have to take for the benefit of the coming generations, for our kids and grandchildren! It will be the most ambitious challenge for all of us. And, as I do not know the one and single answer to this question: what I know is that we only will succeed if we all cooperate and follow one single goal — with full commitment and all united efforts.

Yncoris as a provider of technical services in maintenance and engineering and operator of a chemical site is fully integrated in these activities and takes responsibility in turning its own carbon footprint to neutral, but also offering services in site operation as well as in engineering and maintenance services to support customers on their journey toward minimizing CO_2-emissions. Therefore, we support and are engaged in collaborations and projects in search of extraordinary solutions in bioprocess technologies and circular economy.

Our responsibility it is to enable our employees to use open space for new ideas, provide adequate means and money and have the willingness to learn even from risks and failures on this path. Partnering and collaboration is key to success, politics have to set up appropriate legal framework conditions in the context of international competition.

Renewable Hydrogen

A Growth Opportunity for the European Chemical Industry

For a successful European chemical industry, growth, competitiveness and climate neutrality are and will remain key areas of focus. While growth and competitiveness are well-established challenges for the industry, the path to climate neutrality for European chemical firms must align with the substantial European Union (EU) targets for reduced CO_2 emissions.

Indeed, according to European Economic Area (EEA) data, the EU recently increased its emissions-reduction target from 40% to 55% by 2030 compared to 1990 levels, and other countries are adopting similar targets. Projections indicate that, under the existing measures, there will be an excess of 960 million tons (Mt) of CO_2 emitted per year by 2030 in the EU, compared to the amount produced if the new target is achieved. Looking at the current sources, 55% of CO_2 emissions originate from fuel and combustion for power and heat, 27% from transportation, 6% each from the metals and minerals industry, but just 4% comes from the chemical industry. Of that 4%, 2.2% originates from steam and heat production and 0.8% from ammonia production.

Hydrogen — a Solution Molecule

Electrification is part of the solution. However, an additional "solution molecule" is required to bolster energy storage capabilities, mitigate the volatility of wind and solar energy and, most crucially, convert CO_2 back into hydrocarbons. Hydrogen's unique properties suggest it could be the solution. Hydrogen can also be used to decarbonize production processes for iron—direct reduction of iron—or ammonia and can replace fossil fuel combustion.

Currently in Europe, a substantial amount of hydrogen production is in place. In 2018, pure hydrogen production capacity was 9.9 Mt of hydrogen per year, with 7.5 Mt from on-site captive production at about 140 plants—mainly refineries and sites for ammonia, methanol and hydrogen peroxide production. However, more than 90% of hydrogen plants use fossil fuels as feedstock.

That means at least 7.5 Mt of hydrogen production would need to be decarbonized. This would require a shift to renewable energy, or the application of carbon capture and storage (CCS) or carbon capture and utilization (CCU) technologies. However, the far greater decarbonization opportunity involves replacing the combustion of fossil fuels, and in the conversion of CO_2 into syngas, which could then be used to synthesize methanol, aromatic compounds or other base chemicals such as ethylene, propylene or benzene (see fig. 1).

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Bernd Elser, Accenture

Cost Drivers of Renewable Hydrogen

Two drivers stand out when looking at the cost of renewable hydrogen: the cost of electricity and conversion losses in the overall system.

Our cost models show that energy accounts for 75% to 80% of the cost of renewable, electrolysis-based hydrogen, which reinforces that the key to renewable hydrogen's future is ultimately the development of cheaper and more abundant renewable energy sources.

While energy cost and the use of electrolysis can often be a source of intense debate in the chemical industry, there are additional areas for improvement in the overall system too (see fig. 2).

There is significant potential for end-to-end optimization, especially in the reduction of conversion losses, which occur during the generation of renewable hydrogen from water using climate-neutral electricity, followed by the compression, storage, transportation and eventual conversion of hydrogen back into electricity. Considering additional conversions that might be needed—for example, the conversion of hydrogen to ammonia and back for easier transportation—the need for efficiency becomes even more pressing.

Some of these conversion losses are already being addressed by installing clusters of hydrogen production and decarbonization or "hydrogen valleys" around industrial parks to minimize grid and distribution losses, integrating energy and material flows in Verbund-like structures. Hydrogen production can also be optimized through better membranes, electrodes and process stabilization.

As it stands, the EU's hydrogen strategy calls for an additional 80 GW

of renewable hydrogen generation capacity, and the production of 10 million tons of hydrogen by 2030—backed by €25 billion to €30 billion in stimulus funding. However questions remain over how to provide internationally

"Chemical companies can build on their unique strengths to help make renewable hydrogen competitive and play an important role in Europe's decarbonization progress."

competitive energy in the EU, how to deal with imports and exports including online marketplaces, and how to safeguard competition in hydrogen production, transport and distribution.

Business Models for Chemical Companies

Ultimately, however, this chemical represents a huge opportunity. When it comes to decarbonization, hydrogen is clearly a potential solution molecule, with clear political will, production targets and public funding committed to build a market for it. For chemical companies there are several possible business models they could adopt to capitalize on this opportunity:

- Supplying materials and system components, including electrolyzers, membranes or electrodes for electrolyzers, and linings for hydrogen pipes.
- Operating hydrogen-production assets, and marketing, selling and/or distributing hydrogen.
- Decarbonizing chemical processes—by utilizing hydrogen by-products in chlorine production or by shifting to green ammonia, for example.
- Decarbonizing other industries—this could involve supplying hydrogen and process technology to sink CO_2 emissions or for the direct reduction of iron.

Considering the volume of emissions produced by other industries, the latter model is by far the most lucrative, yet, to establish new and competitive chemical and physical processes for customer industries, innovative approaches will need to be taken.

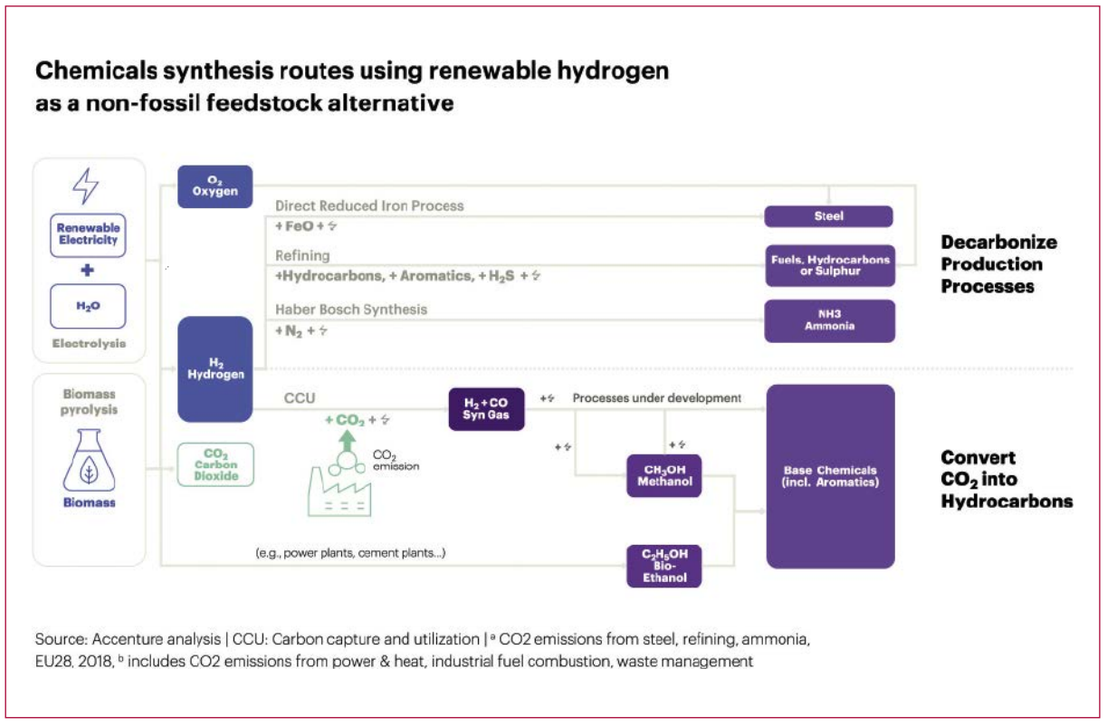


Fig. 1: Chemicals synthesis routes using renewable hydrogen as a non-fossil feedstock alternative.

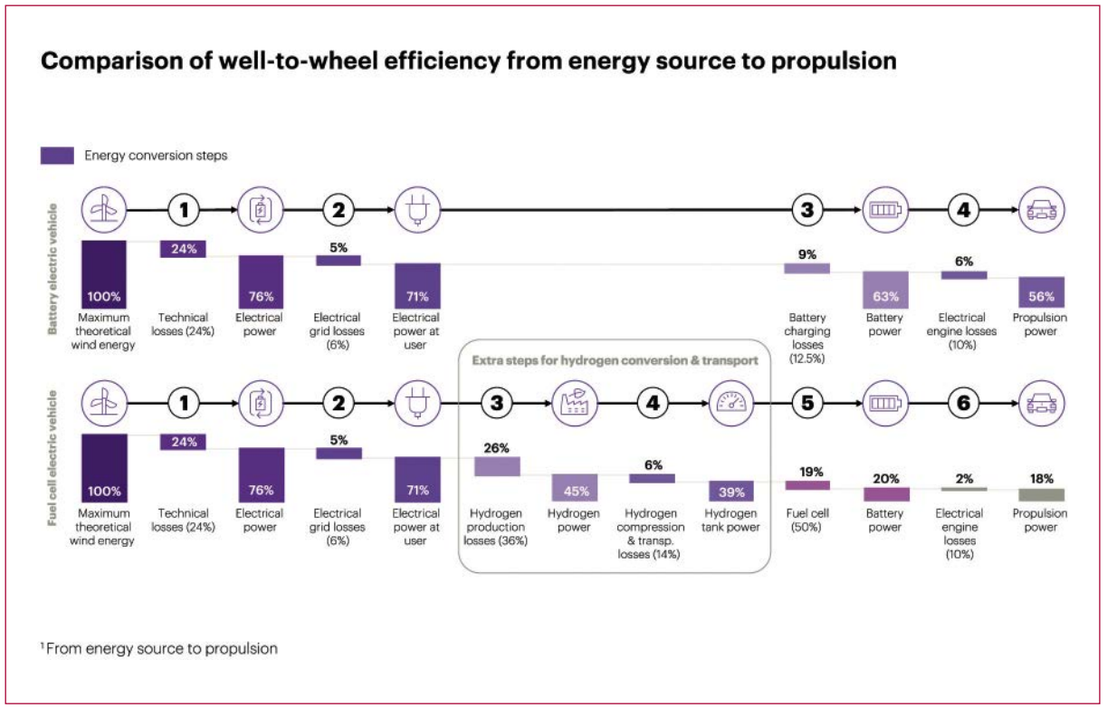


Fig. 2: Comparison of well-to-wheel efficiency from energy source to propulsion.

Engagement in the Hydrogen Market is Key

To take advantage of the opportunity hydrogen presents, chemical firms must engage in the emerging hydrogen market now, setting up specific pilots—whether that's in electrolysis or decarbonized processes—, develop an appropriate partner and ecosystem network and, most crucially, adapt the R&D portfolios and investment plans needed to capture a share of the hydrogen opportunity. If they embark on this journey today, chemical companies can build on their unique strengths to help make renewable hydrogen competitive and play an important role in Europe's decarbonization progress.

References can be requested from the author.

Bernd Elser, Managing Director, Global Industry Sector Lead Chemicals, Accenture, Frankfurt/Main, Germany

bernd.elser@accenture.com
www.accenture.com

Steady in the Long Term Despite the Crisis

The Chemical Industry Must up its Resilience now — also to Weather Future Crises

The Covid-19 pandemic hit the chemical industry hard: Sales fell by 9% worldwide in 2020. A recovery of around 10% is expected in 2021; this would just about match the pre-crisis sales of around $4 trillion from 2019. For the report "Value Creation in Chemicals 2020: Bouncing Back from a Year of Adversity", the strategy consulting firm Boston Consulting Group (BCG) analyzed the development of the global chemicals market in the Covid-19 crisis in 2020 and in the years 2015 to 2019 using key figures.

The result shows: The current crisis is forcing companies to increase their resilience. The entire value chain, exposure to the end industry, and technical, commercial and digital capabilities must be put to the test in order to respond more effectively to changes in the markets in the future.

Covid-19: Impact on Sales, Profitability and Production

The chemical industry's key end markets were affected differently by the pandemic. Pharmaceutical manufacturers and suppliers to the food industry were among the winners, with average sales increases of 4% in the first half of 2020. By contrast, companies serving the automotive and aerospace industries saw sales plummet by an average of between 15% and 20% in that period. Looking at the profitability of the segments, a similar picture emerges: of 20 chemical product segments studied by BCG, only agrochemicals and food ingredients posted an increase of their EBITDA.

The markets also developed differently from region to region. The Global Chemical Production Index (GCPI) by the American Chemistry Council (ACC) shows that although production in Europe declined in the summer, it was up 10% year-on-year again in December. China and India also recovered from production declines in the first half of the year, ending the year up 13% (China) and 5% (India). North America, on the other hand, is recovering much more slowly and had not yet reached pre-Covid levels by the end of 2020.

The long-term impact of the Covid shock depends on whether demand in the segment in question has fallen or risen because there are structural reasons for it, or whether it is a temporary phenomenon. For example, companies in the composites or engineering plastics sectors were already challenged by declines in demand before the pandemic. The Covid-19 crisis has exacerbated this, while the construction chemicals or personal care sectors have not been hit at all.

Long-term Development of the Industry Continues

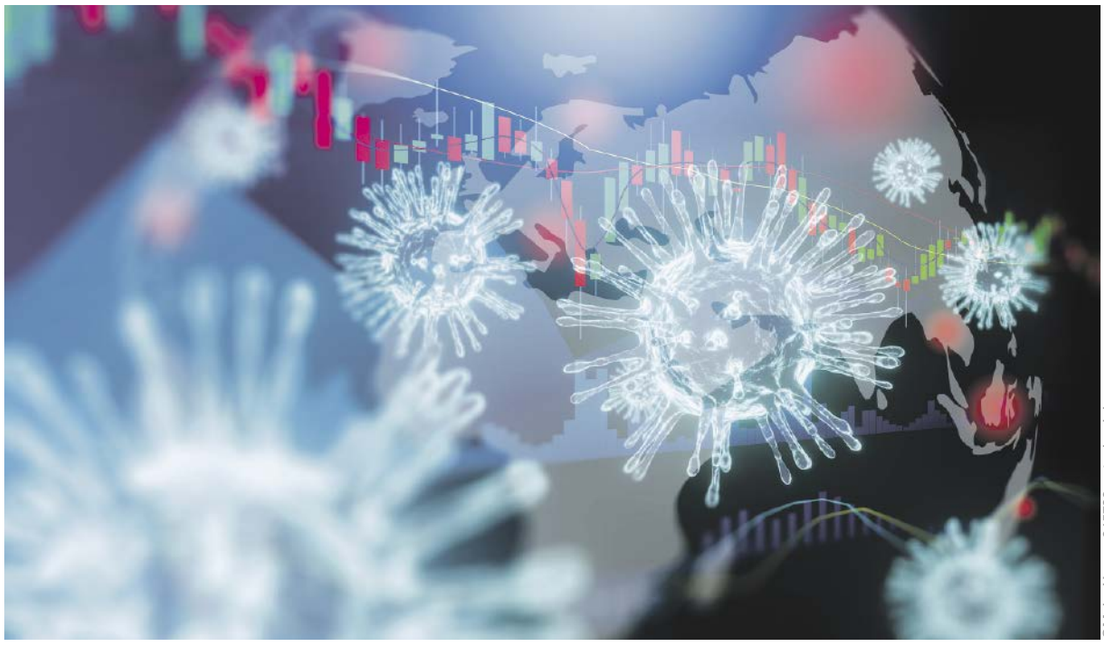
The Covid moment followed a stable, but by no means outstanding, growth period: between 2015 and 2019, the chemical industry's total shareholder return (TSR; takes into account the change in share price as well as its underlying drivers such as change in sales, margin, trading multiples, and cash-flow effects over a given period) developed below all industries' average, with an annual increase of 8%. By comparison, financial institutions achieved a TSR of 20% over the same period, and technology companies 18%. The automotive industry brought up the rear in BCG's TSR ranking, with a five-year TSR of zero.

This metric also shows significant differences between individual regions and sub-segments. European chemical companies had the best TSR between 2015 and 2019 at 11%. The focused specialties segments performed best in this region with a 14% TSR—as in previous five-year periods, in which these segments outperformed the base chemicals and multi specialties segments. Sales also had a positive impact on TSR: In Europe, the chemical industry´s sales grew by 4% during the period under review.

The development in North America was quite different: the weakness of the chemical industry there is also reflected in the comparatively low TSR of 5%. The low oil price has almost leveled out the cost advantages offered by shale gas, and as a result, investments have been cut back. In addition, the trade conflict with China has hit US base chemicals companies hard. Sales stagnated accordingly. International Flavor & Fragrances and Sherwin Williams bucked the trend, with annual sales growth of 10%.

Company Size Affects TSR

Strikingly, large chemical companies with a market capitalization of over



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Andreas Gocke, Boston Consulting Group

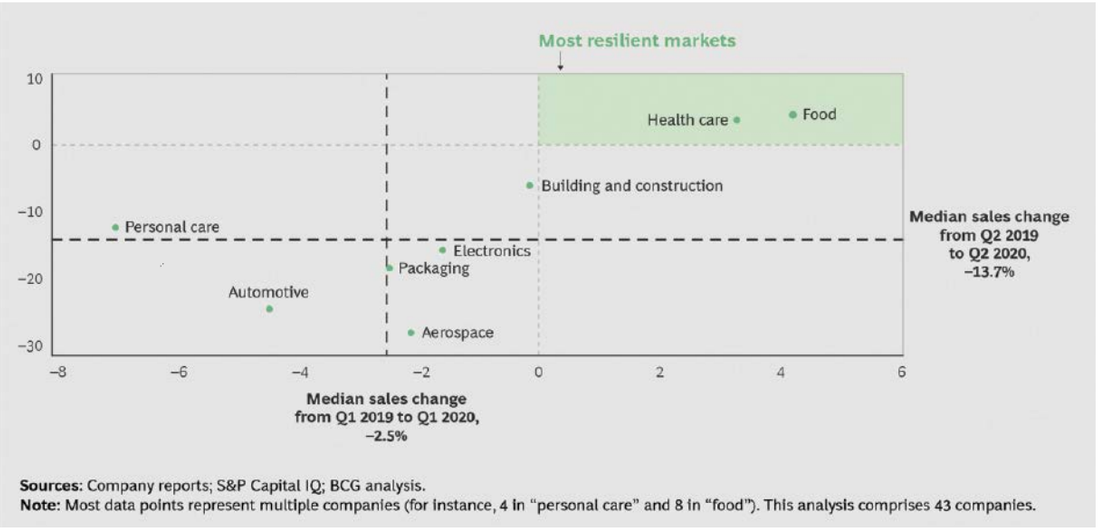
Adam Rothman, Boston Consulting Group

Hubert Schönberger, Boston Consulting Group

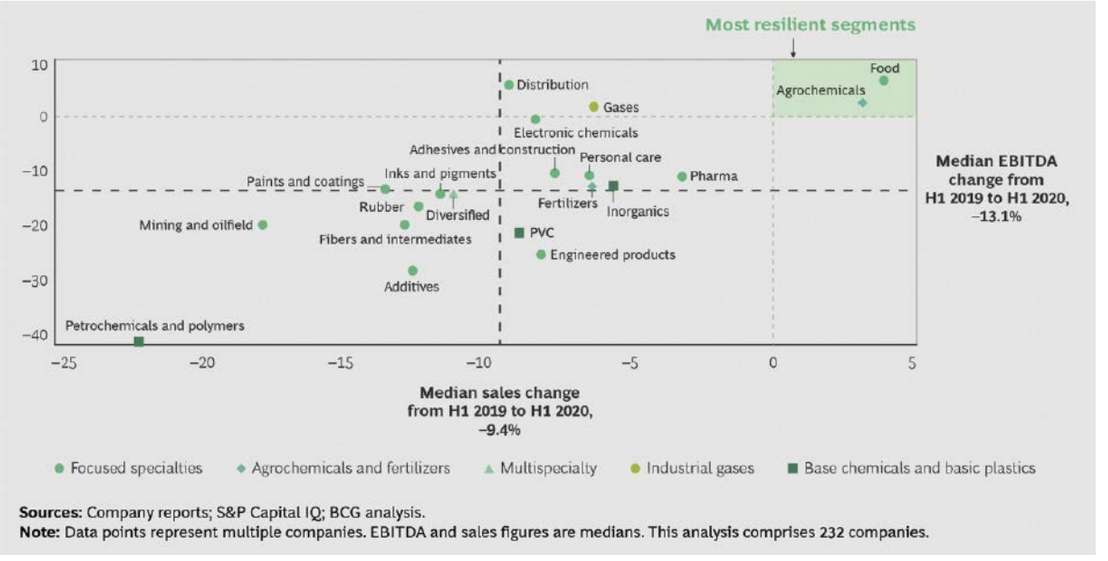
$7 billion performed significantly better in terms of TSR than medium-sized chemical companies with a market capitalization of between $1 billion and $7 billion. The industry's large players consistently occupy the midfield, while mid-sized companies are in the bottom fifth. Among the top performers, with a five-year TSR of 32% and a ten-year TSR of 23% is Sika, a Swiss company that has become a global leader in construction chemicals through an effective M&A strategy. Lonza has also positioned itself well in the fast-growing pharmaceutical ingredients market.

In addition, three Indian companies outperformed: Berger Paints (five-year TSR 30%), Pidilite (30%) and Asian Paints (21%). This was certainly due to India's remarkable economic rise, but all three were hit particularly hard by the Covid-19 crisis: In the second quarter of this year, they suffered a drop in sales of more than 40%.

The pandemic appears to be accelerating these long-term trends. Chemical companies contributing to the pharmaceutical and healthcare value chain had the highest TSRs in the first half of this year. The food ingredients and electronic chemicals segments also recovered quickly after the slump in the first months of 2020 and showed positive TSRs again from mid-2020. These segments are particularly resilient because they are less asset-intensive, their dependence on commodity cycles is lower, and they are less sensitive to macroeconomic fluctuations—as they capitalize on long-term consumer trends. This makes them particularly attractive for investors. The commodities products segments, here for example vinyl chloride, synthetic rubber or fertilizers, are quite different. Companies in these segments already had low TSRs before the Covid-19 crisis. With the pandemic, these then fell again, in some cases by double digits.



Graphic 1: Sales declined in most chemical end markets in Q1 and Q2 of 2020.



Graphic 2: Profits sank for all but a few chemical segments in the first half of 2020.

Falling Yields Hit the Sector

Another metric that points to a fundamental challenge is return on capital employed (ROCE). The decline in ROCE had been accelerating even before the pandemic. Combined with lower cash flows, this can have a negative impact on the valuation of existing investments and the consideration of future investments. One way to stop this trend is to improve margins through higher plant utilization, a better product mix or a reduction in transaction costs. Many chemical companies are already doing this. Less common, but quite effective, is increasing asset productivity, e.g. by managing capital allocation so that preferably those businesses, products and regions with the highest returns receive capital. Changing the allocation model would also mean rigorously reviewing new capital projects, introducing asset-friendly business models—including make-or-buy—and divesting poorly performing assets. A combination of these measures will put chemical companies on a path to better ROCE and can provide a TSR boost to the industry.

Learning from the Crisis

By and large, the Covid-19 crises did not cause the existing strengths and weaknesses of chemical companies but brought them more clearly to light. The enormous speed of the demand and supply disruptions of the first six months of 2020 does show how important it is to be able to reduce costs quickly, e.g. through a high proportion of variable costs or by pursuing a leaner CAPEX strategy (e.g. fewer integrated value chains, more asset sharing/leasing). Regionalizing supply chains reduces the risk of failure. To be successful, the chemical industry must increasingly use digital technologies and innovate its business models. Most chemical companies use digital technologies only as a means to reduce costs. Neither in the important go-to-market area nor in product and application development has digitalization played a significant role so far. Agile R&D functions are also crucial to success. The pandemic has once again clearly shown that needs are not static. Therefore, chemical companies need to align their development efforts with ever-changing needs.

Those who are most adept at dealing with an uncertain present will have the greatest chance of generating value in the future.

Andreas Gocke, Managing Director and Senior Partner, Boston Consulting Group, Munich, Germany
gocke.andreas@bcg.com

Adam Rothman, Managing Director and Partner, Boston Consulting Group, Chicago, USA
rothman.adam@bcg.com

Hubert Schönberger, Senior Knowledge Expert, Boston Consulting Group, Munich, Germany
schoenberger.hubert@bcg.com

www.bcg.com

Innovation is the Driver to Delivering Value

Catalysts Are at the Very Heart of Chemical Processes and Pioneers of Sustainability

Catalysts are a value generator in the chemical industry. By means of catalytic processes chemicals can be manufactured in higher yields, selectivity and with less energy input. Evonik, a leader in catalysis for more than 75 years, has expanded its catalysts business significantly in recent years. Following the acquisition of Indian producer Monarch in 2015, the German group in the fall of 2020 took over US manufacturer Porocel. Sanjeev Taneja, who assumed responsibility for Evonik's Catalysts business line in July 2020, emphasizes the importance of catalysts for the company and the industry in general. A process engineer with an MBA degree, he began his career in 1987 at what was then Degussa and has held several positions at Evonik locations in Europe, the US and Asia since. Michael Reubold talked to him about the role of catalysts in the company and their value to the industry and the society.

CHEManager: Mr. Taneja, Evonik's catalysts business is part of the company's Smart Materials division. Without a doubt, catalysts are smart in many ways. How do your products embody "smartness"?

Sanjeev Taneja: The products Evonik develops and manufactures under the roof of this division are the smart answer to the major challenges of our time: environment and climate protection, urbanization, energy efficiency, clean mobility, and health care. I think where catalysts really represent the division well is how our products and solutions are continuously developed and adapted to the needs of the customers. This paves the way to greater resource efficiency and more sustainable technologies.

So, catalysts are catering to the mega trend of sustainability. Is this also the major market and growth driver for the catalysts business?

S. Taneja: Recently sustainability has certainly gotten a lot of attention, but for Catalysts, sustainability has been our focus from the get-go. Obviously, the whole strategic importance of catalysts is and has always been sustainability. They accelerate chemical syntheses or make them possible them in the first place, reduce raw material consumption, increase energy efficiency, reduce waste, just to name the most important benefits. Now, in the last few years, there is more talk about sustainability as a mega trend, and I am convinced catalysis will play an even bigger role in the future to enable circular economy and the decarbonization of the chemical industry's value chains, especially if you think about biobased raw materials.

In addition to the sustainability topic, there are several other areas where catalysts can contribute, not only to the overall economy, but also to society: think about the development of active ingredients for pharmaceuticals or agrochemicals, where catalysts play a vital role. That is why I am very bullish about this industry.

Sanjeev Taneja, Evonik

Evonik is one of the few manufacturers of specialty chemicals that have a strong catalysts business in-house. What is the advantage of combining specialty chemistry and catalysis?

S. Taneja: Catalysis is a core technology for any specialty chemical company which is why I am very pleased that Evonik recognizes this fact. We have been on a sustainability journey for quite some time and, as we just discussed, a strong catalysis foundation is very beneficial to achieve this. Thus, the Catalysts business line is of strategic importance for Evonik.

The critical success factors of a specialty chemicals business and a catalysts business are aligned, for instance as both require innovation spending, focus on diverse applications and markets, profound project management skills and a very good knowledge of process technology. So, this synergy offers a mutual benefit, if you will. For both, a specialty chemicals business and a catalysts business, innovation is the driver to delivering value. This cannot be emphasized enough.

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You said that the Catalysts business line is of strategic importance for Evonik. Is this why the business has been provided with quite some investments recently, for instance the acquisitions in India and the US?

S. Taneja: The companies we have bought are of strategic importance for us and an integral part of the overall growth story. The expectation from Evonik is for us to have an accelerated growth, and with that expectation comes responsibility and accountability. We will continue to seek attractive targets that make strategic and financial sense, obviously, in new markets and applications accessible for Catalysts. But one thing is clear, that any acquisition must support the sustainability and the circular economy trends. That is part of the criteria when we consider acquisitions. And obviously, that criterion was a big part of the Porocel acquisition in 2020. In addition, of course, it's always good to add more complimentary competences, manufacturing capacities, and innovation capabilities.

What does the Porocel acquisition add to your business in terms of these criteria?

S. Taneja: It is a combination of everything. Porocel fits in very well with our sustainability approach bringing to the table a technology platform that contributes to the reduction of CO_2 emissions. It is also an enhancement of our growth potential in relevant markets as Porocel brings the refining and petrochemical catalysts part, which further sharpens our portfolio with a focus on stable and high-margin specialty chemicals. Also, Porocel's Excel rejuvenation technology is a significant step beyond standard catalyst regeneration. Last but not least, with the continuous process catalysts capacity additions, we are able to expand upon our custom catalyst offerings. So, this acquisition fits in very well with all three criteria.

Beyond providing us with a new technology platform and access to new markets, the acquisition is also quite meaningful in terms of our regional footprint because Porocel gives us access to their blue-chip customers in the US.

Evonik acquired Monarch five years ago. How has the Indian site and business developed since and what role does it play for your growth strategy?

S. Taneja: This has been a bolt-on acquisition, which also complemented our portfolio with Monarch's oils & fats hydrogenation catalysts. The Indian site east of Mumbai is fully integrated and has been upgraded to Evonik standards. We produce three product groups at the site: precious metal catalysts, activated nickel catalysts, and as mentioned before oils & fats hydrogenation catalysts. The activated nickel catalysts and precious metal catalysts are mainly used in the pharmaceutical and agrochemical sector which are both very strong in India.

The site is an asset hub that caters to our growth in Asia. When looking specifically at the oils & fats hydrogenation catalysts the Southeast Asia market is particularly important, but also in the Americas because we have a big customer base for these catalysts there as well. In order to support this product group's continued growth, in 2019 we enhanced our R&D facility at the site and in 2020 we inaugurated the pilot plant for these catalysts.

Also, during the last three years, we have strengthened the complete in-house precious metal catalysts loop there. So, the service offering to our customers is just tremendous, because we can cover the whole catalyst life cycle.

Are you able to leverage some kinds of synergies between the custom and branded catalysts businesses?

S. Taneja: Yes! For example, active metal catalysts and precious metal catalysts are very synergistic. Our approach, having this multi focused strategy enables us to leverage synergies pretty much across all product groups, for instance regarding competences and critical mass in research, development & innovation, scale-up, manufacturing, and the whole metal loop.

What is your innovation strategy?

S. Taneja: We are currently utilizing a lot of resources right now to enhance our research, development & innovation capabilities. Clearly, going forward, one part of our strategy is to establish centers of excellence, depending on the footprint across the globe, not only at our German sites in Hanau or Marl. For the oils & fats hydrogenation catalysts the center of excellence is in India. We have a good RD&I footprint in China already, but we must have some knowledge transferred to the Asia-Pacific North region.

Having worked in the US, Europe and Asia, do you think that Western chemical companies have a lead in terms of working in R&D partnerships? Is this a competitive advantage?

S. Taneja: I would not say it is a competitive advantage because no competitive advantage, as we all know, is everlasting. But at least the Western companies can use their footprint in Asia and elsewhere to get a head start. But believe me, I have seen this with my own eyes: the Asian companies are catching up very fast.

Innovation is crucial when competing along the value chain. I truly believe Western companies need to concentrate even more on RD&I to not only compete but also to survive. Wherever the RD&I initially takes place, competency transfer to all regions needs to happen so we can always support local customers.

www.evonik.com/catalysts

A Strategic Advantage and Economic Hedge

Precious Metals from Secondary Sources are a Smart Way to Minimize Risk and Uncertainty

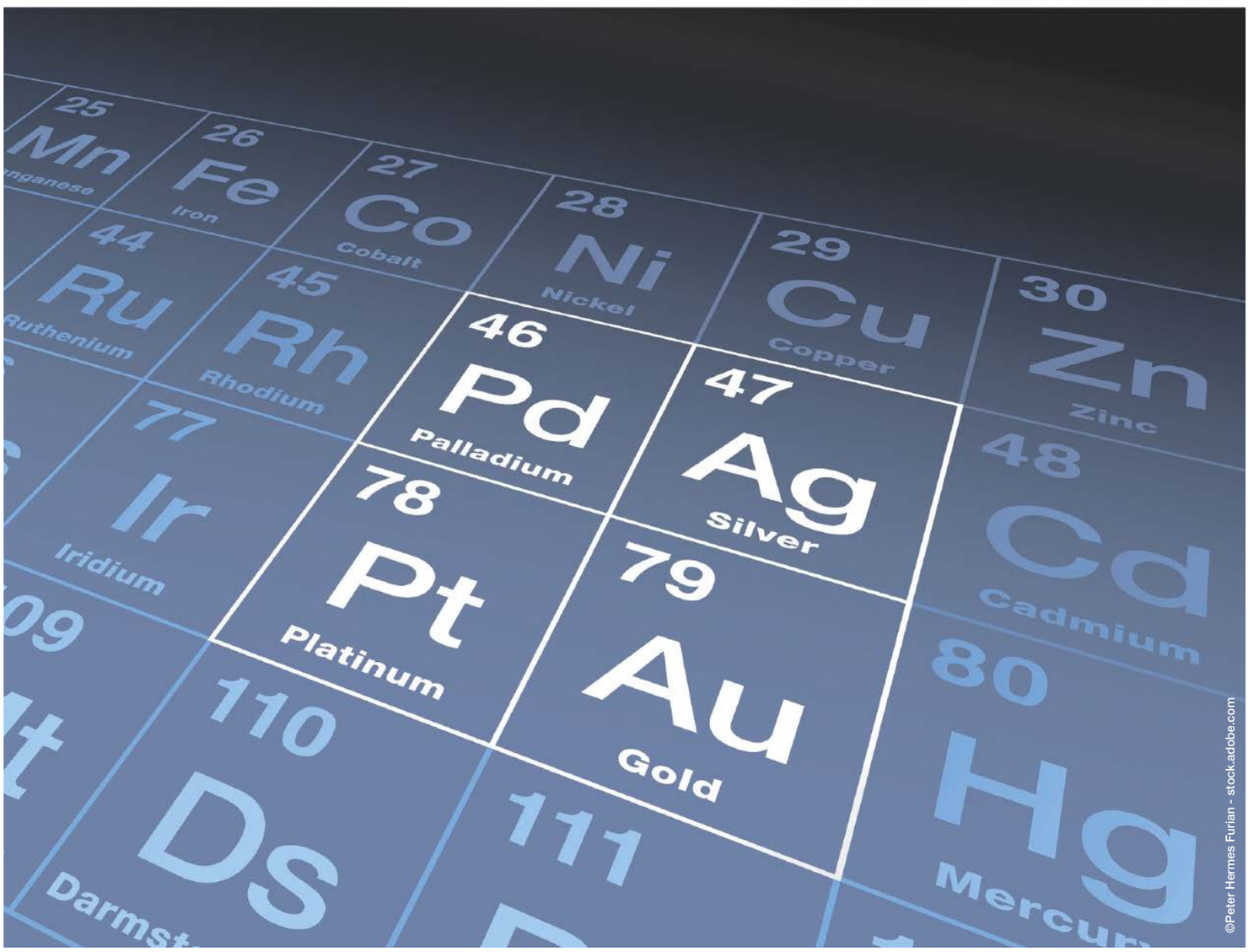
Over the years, sustainability has evolved from an aspirational goal to an operational priority. Companies in every industry are being asked to incorporate more environmental stewardship into their operations and business practices. Sustainability is no longer an option; customers are requiring sustainable practices from suppliers and developing scorecards to measure progress.

Robin Kolvenbach, Heraeus Precious Metals

The Paris Agreement has been a driver for nations and industries around the world to address reducing CO_2 emissions. Today, the chemical industry is facing tightening global legislation requiring the defossilization of all chemical value chains. In response to these global mandates, all major pharma and fine-chemical producers have committed to challenging CO_2 reduction targets.

Another important consideration goes beyond meeting an industry mandate: it's the law of supply and demand. Precious metals, by their very definition, are precious because of their limited, finite quantities on the earth. The combination of increased demand and potential scarcity can cause recycled precious metals to become more expensive. Implementing a sustainability strategy today can be a buffer that can help protect companies if precious metals become scarce or prices increase in the future.

Many of the processes to produce fine chemicals and pharma products are catalyzed by precious metals, both in homogeneous and heterogeneous form. Due to the currently high-average CO_2 footprint, there is opportunity to reduce this footprint. Both primary producers and recyclers of precious metals are working diligently towards carbon neutrality. Precious metals from secondary sources may serve as a good intermediate step, offering a reduction of more than 85% carbon footprint compared to primary sources.



Precious Metals in the Value Chain of Fine Chemicals and Pharma Products

In 2019, both industry segments fine chemicals and pharma together demanded 28.9 t of platinum, 16.9 t of palladium and 2 t of rhodium. Based on these figures, the overall precious metals related carbon emission within the fine chemistry and pharma area equals approximately 1.3 million t of CO_2 p.a., which is less than 1% of the overall scope 1, 2 and 3 emissions of this industry segment.

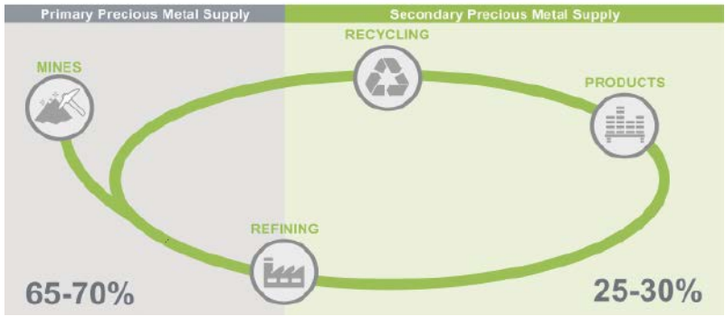
These figures show that the impact of de-fossilization of precious metal value chains on the overall fine chemicals and pharma industry is small but still remains a significant single driver that can be tackled relatively easy and fast. Thus, it is an important factor on the way to reach the CO_2 commitments of all major players in the market and ultimately a zero-carbon footprint.

Defossilization of the Complete Precious Metal Value Chain

The overall precious metal value chain is rather complex as it is a mixture of primary and secondary sources that are typically combined in the refining step. By this means mining concentrates and waste streams are mixed during the purification of the precious metals.

Looking at the carbon footprint, the majority of the CO_2 equivalents emitted accrue during the mining step itself. The reason is the low concentration of platinum group metals (PGMs) in a typical ore (2–6 g/t) leading to energy-intensive processes for

Physical Precious Metal Supply Chain



mining, extraction and concentration. The other factor that further increases the carbon footprint is energy mix in South Africa, the major producing country of PGMs. Nearly 90% power used for producing comes from hard coal. The following refining of the precious metal concentrates only adds a minor part to the overall carbon footprint.

Thus, the biggest lever towards a complete defossilization of the precious metal value chain is the reduction of CO_2 equivalents within mining operations. For this reason, basically all South African mining companies are working towards more sustainable operations. These measures include the usage of renewable energy sources such as solar, fuel cell powered trucks and generating power from waste heat recovery during the smelting operations within the concentration step.

„Some fine chemical and pharma companies already started to look into long-term supply contracts of secondary material."

However, this is not a quick fix. It will take time and significant investments to reach a reduction of carbon emissions to a reasonable level or even zero.

Precious Metals from Secondary Sources — a Quick Fix

A much faster alternative to optimize the carbon footprint is using precious metals from secondary sources only. That exhibit only 15% or less of the CO_2 footprint compared to primary production. As 25–30% of the annual precious metal supply is already coming from secondary sources, sufficient amounts for the fine chemicals and pharma sector are readily available.

The automobile industry is the largest user of precious metals. As it continues to strive for more carbon efficient products, it is expected that precious metals from secondary sources will get scarce; as a consequence, premiums are expected to increase in the coming years. On top of that global CO_2 tax will further drive premiums for low carbon alternatives. Despite the expected higher premiums for secondary-only metals in the coming years, they remain an available alternative to reduce the carbon footprint by 85% or more. In order to mitigate supply risks early on, some of the fine chemical and pharma companies already started to look into long-term supply contracts of secondary material to secure long-term supply.

Sustainability is Possible for Pharma and Fine Chemical Companies

All major fine chemical and pharma companies are working towards challenging carbon reduction targets. Precious metals account for approximately 1.3 million tons of CO_2 equivalents annually of the scope 3 emissions within the fine chemistry and pharma value chain.

The major driver for the CO_2 emissions is mining operations. In order to defossilize the production of precious metals, all major mining companies are working towards CO_2 reduction. However, this takes time and significant investments. An already available alternative are precious metals from secondary sources, which exhibit only 15% or less of the carbon footprint. Taking these steps now are not just good sustainability practices, it is also a smart way for companies to minimize risk and uncertainty.

Robin Kolvenbach, Head of Innovation Chemicals & Product Chemicals, Heraeus Precious Metals, Hanau, Germany

robin.kolvenbach@heraeus.com
www.heraeus.com

Fueling Growth

WeylChem Advanced Intermediates Broadens Scope of Market Activities

WeylChem, part of International Chemical Investors Group (ICIG), has extensive experience in the field of chemistry related to advanced intermediates and reagents. The Frankfurt, Germany-based chemical group uses this expertise to develop new molecules for several applications such as agrochemicals, personal care products, pharmaceuticals, polymers, and specialty chemicals. CHEManager asked Antti Koivisto, managing director and vice president of Sales, Marketing & Sales, and Michael Badine, technical marketing manager, both representing the Advanced Intermediates business line of the commercial platform of WeylChem International, to discuss the strategy for their business segment.

Michael Badine, WeylChem

Antti Koivisto, WeylChem

CHEManager: WeylChem has consistently developed the Advanced Intermediates business area in recent years. Can you briefly explain the growth steps and the strategy behind them?

Antti Koivisto: True, although WeylChem is well-known of its capabilities, especially in custom manufacturing, we have also been able to gradually strengthen our market position for a number of line products, i.e. advanced intermediates and reagents, the last few years. Aligned with our first two strategic growth pillars, not only have we improved the business relationships with many important global key accounts, but we have also further developed the group's presence in our growth markets in the Americas and Asia.

As a major enabler for the above, we made some changes to the organization. When we centralized our marketing and sales organization under the WeylChem International umbrella in 2019, We also launched a few new roles aiming to further support our strategy of broadening the scope of our market activities and fueling growth. In addition to "traditional" sales and business management roles, we, for example, launched roles focusing more on new business development in markets we had identified as growth regions and/or applications for the AIR business line.

In addition, we also launched a new role of technical marketing manager in the sales & marketing team, focusing on combining market needs with our product development as well as further supporting our application know-how enabling us to serve our customers even better. I am happy that Michael Badine was up for the challenge. This has all been part of a strategy of strengthening new product development and increasing the emphasis on the technical interaction with customers. We have already started to see benefits of these activities.

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Advanced Intermediates offers a broad range of molecules for several applications starting from the development up to commercial scale. Which applications are most important for your business today, and do you plan to shift focus in the future?

A. Koivisto: Indeed, the diverse mix of end-market applications is one of the keys to the resilient performance of our business in the last years. We

have a strong foundation in market segments such as agro and pharma. These will likely continue being strong going forward while we expect pharma to grow in significance in the future, especially our growing regions of Asia and the Americas and likely a number of value chains coming back and/or further strengthening in Europe. To further support the growth in Pharma, we have plans to provide our customers a more comprehensive, cross-departmental offering. Already today, we have a lot of know-how, ever developing product offering and services in the WeylChem Group. In addition, we also have growing shares in polymers, coatings, and a wide variety of industrial applications. All this diversity and growing presence gives us a good basis for the future.

Are there other changes ahead for the Advanced Intermediates business, perhaps in light of the ongoing Covid-19 pandemic or changing market conditions?

A. Koivisto: There are a lot of exciting changes coming up in the AIR business but not so much related to Covid-19. What makes me especially happy is that these activities will strengthen our third and last growth platform built around new product development.

We are currently investing a lot of efforts in finalizing our update on Aromatic Ring Chlorination and Halex production assets. At the same time, our sales and marketing teams are working together with the customers to finalize plans for delivery and identifying additional global business opportunities.

Michael Badine: Even though the macroeconomic situation is currently difficult, we still believe that this year will be a very exciting one for us based on our growth initiatives.

We have also developed new products for pharma and personal care applications at our facility in Lamotte, France. We will be launching the first of these products a little later this year. More information will soon be provided on our communication channels (you can follow us on LinkedIn).

"Customers are increasingly showing interest in sustainability and materials based on renewable feedstocks."

We are looking to expand growth opportunities in the USA, and as part of my role I will be contributing to this initiative.

We have also launched an initiative to identify new building-blocks we can produce which would capitalize on the strengths of WeylChem and thereby help our customers building their end-products more efficiently.

Additional new product development projects together with the customers that may have been put on hold in 2020 due to Covid-19 will resume, giving us also added benefits and possibilities for longer-term growth. Given the likelihood of Covid-19 being brought under greater control by 2022, we want to get ready with the right portfolio for growth already in 2021.

We have finalized upgrading our digital platforms. We are in the final stages of having a harmonized group-wide installation of SAP S/4HANA and an improved CRM platform, this is part of our continuing investment in digitization.

One of your latest investments is a production plant for aromatic ring chlorination in the Industrial Park Höchst in Frankfurt. Why is this plant important for your business?

M. Badine: We want to participate in the markets' growing need for halogenated aromatic compounds. These compounds are key building blocks for a range of sophisticated end-products, for example in Pharma and Agrochemical Active Ingredients. Not only can we sell chlorinated products to the market, but we can also convert these via our HALEX plant to fluorinated analogs which are also valuable intermediates. We have extensive halogenation production know-how, which we can now better use to serve the market, opening doors for new applications and customers.

What are the environmental benefits of this investment, and to what extent can this plant improve the offering for your customers?

M. Badine: With this investment WeylChem will optimize its use of resources. For example, 4-chlorobenzotrichloride, a by-product of side-chain chlorination, can be elaborated by aromatic chlorination to 2,3,4,5-tetrachlorobenzoyl chloride in the new plant, and therefore will not need to be disposed of anymore. As all the other by-products are already being used or sold, the side-chain chlorination will then be almost waste-free. Customers will have the peace of mind knowing that they have a competent partner that is producing these complex building blocks sustainably, to the highest environmental standards, with chemistry that is actively contributing to a circular economy.

In general, which trends are driving chemistry innovation in the advanced intermediates segment, and how do you position the business in order to fulfill the requirements and offer value to your customers?

A. Koivisto: Customers are increasingly showing interest in sustainability and materials based on renewable feedstocks. This is a trend we are following, for example with our Velvetol bio-based poly-1,3-propanediol and our bio-based glyoxylic acid product ranges. It goes without saying that lifecycle analysis and carbon footprint analysis are key elements we use to support our customers sustainability goals.

M. Badine: We are striving to be a partner that can understand customers' applications and develop chemistry to suit them. The challenge is for us to "walk in the customers shoes" and understand how our materials are performing in their applications and how we can use our chemistry to solve their problems. We are eager to rise to this challenge by, for example, investing in front-line sales resources with more technical profiles to serve customers even better.

www.weylchem.com

Sustainable Chemicals from Renewable Raw Materials

Innovative Technology Enables Advantageous Oleochemistry Products

The Kanzler Verfahrenstechnik group (KVT) has been engaged in the production of high-quality glycerin grades at Glaconchemie for 15 years and in the technology of residue-free production of epichlorohydrin via glycerin for 10 years. Currently, the largest plant for the production of glycerin-based ketals and formals is being commissioned at the subsidiary company Alteqo (a 50% joint venture of KVT and Chemcom) while developing a new generation of plasticizers.

Walter Kanzler, Kanzler Verfahrenstechnik

Florian Kanzler, Kanzler Verfahrenstechnik

Oleochemistry represents the area of industrial chemistry in which natural oils and fats are used as raw materials. This has attracted great interest in recent years, as some of the products it supplies have preferable properties and comparable performances to conventional products. In addition, these are safer and more sustainable chemicals through which health and environmental challenges of fossil feedstocks can be addressed. In the past, complicated manufacturing processes and the lack of mature technologies have hindered the success of this industry. But recently, thanks to new innovative technologies, more and more petrochemical products have been replaced by products of biological/organic origin, which neither have toxic properties nor pose a threat to the environment.

Since 2004, KVT's Oleochemicals division has been dedicated to the production of sustainable chemicals from renewable raw materials. In addition to economic aspects, the focus in technology development is primarily on closing the cycle and avoiding negative environmental impacts. Driven by the glycerin market expansion caused by the first biodiesel wave, KVT's subsidiary Glaconchemie in Merseburg produces glycerin of the highest quality used in applications varying from toothpaste to skin care and from pharmaceuticals to confectionery production.

These purely vegetable non-GMO glycerin feedstocks are increasingly being overtaken in Europe by glycerin coming from biodiesel production using used cooking oils (UCO) and are therefore only suitable for technical applications.

Glycerin Replaces Propylene in the Production of Epichlorohydrin

The availability of low-cost glycerin from UCO and palm oil processing has made it permanently more economical to use as a feedstock for epichlorohydrin production than propylene. However, the production of Epichlorohydrin via glycerin did not really increase until the Chinese environmental legislation prohibited to discharge wastewater from the propylene process.

KVT's Epiprovit process, with its integrated process for high-pressure oxidation of the brine from saponification, allows to reduce the amount of brine by 90% on the one hand and to purify it so efficiently (99.9%) that the brine can be reused in chlor-

The plant of KVT's 50% JV with Chemcom, Alteqo.

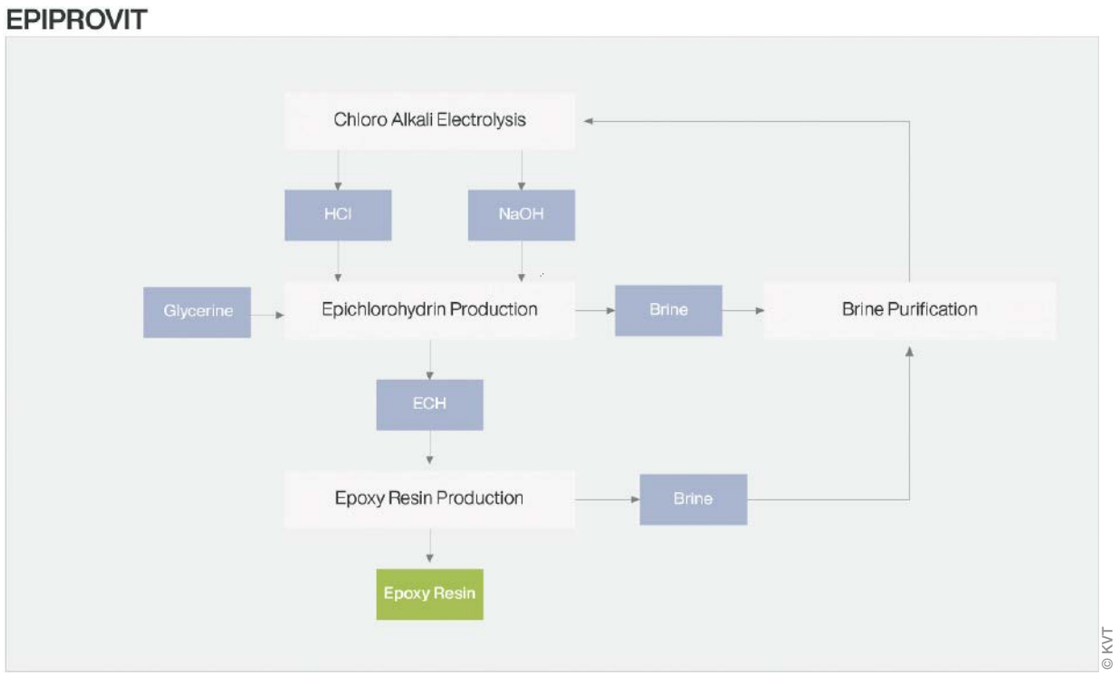

Fig. 1: Epiprovit: only glycerin and electricity input

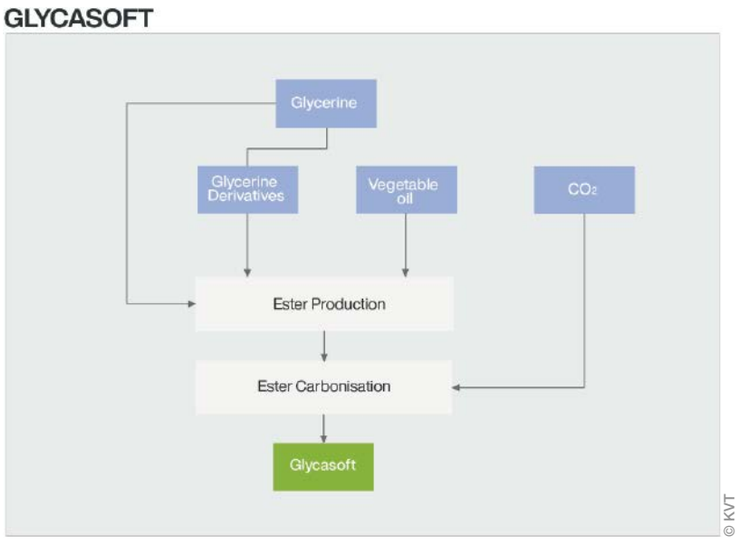

Fig. 2: Glycasoft: plant oil and CO_2 product

alkali electrolysis plants as a raw material for the production of caustic soda and chlorine.

The value of the recovered brine fully covers the costs incurred by the brine purification plant. Originally, this process was developed to clean the contaminated wastewater from epichlorohydrin production, which is toxic to biological wastewater treatment plants. In recent years it has been shown that the technology is also suitable for the purification of other wastewaters such as those from the production of epoxy resin or propylene oxide. Usually, the contaminated brine contains salt in high concentrations and organic contaminants such as hydrocarbons, oxygen, nitrogen, and chlorinated compounds. The purified brine can be recycled for reuse in other processes.

This brine purification process is currently in operation or being implemented for epichlorohydrin productions with a total capacity of about 700,000 t/y worldwide and provides recovery of about 550,000 tons of sodium chloride/year. In sum, this technology is the best example that environmentally friendly processes can indeed be economical and how important it is to promote the efficient use and recovery of resources.

Ketals and Formals from Glycerine Provide Interesting Solvent Properties

Solketal, commonly known as isopropylidene glycerol, has been popular for decades as an odorless and skin-compatible solvent and solubilizer between polar and nonpolar liquids. So far however, it has not been easy to find on the market and it has not yet received the proper attention that it deserves.

KVT's 50% JV with Chemcom, Alteqo, in Farmsum, Netherlands, produces up to 20,000 t/y of „Glycasol" (Solketal), which is used as a solvent for biogenic active ingredients, odorants, cleaning agents, antioxidants, and is also used in cosmetic products.

Glycamal (glycerinformal) is also produced in a similar manufacturing process and is used in veterinary medicine drugs, as a solvent and building block for exciting syntheses.

Plasticizers Can also Serve Environmental Protection

The new plasticizer Glycasoft is based on glycerin derivatives, vegetable oil and carbon dioxide.

In the known applications, Glycasoft not only scores with its non-toxic features and its processability equal to that of the usual phthalates, but even surpasses them in essential properties such as temperature resistance and migration behavior.

The incorporation of carbon dioxide into the molecular structure not only improves the properties of the plasticizer, but also contributes to the reduction of greenhouse gases. Thus, Greta Thunberg will also be pleased with it.

The mission of our industrial group is to develop technologies and manufacture essential chemical products with a conscious choice of renewable raw materials and closed loop concepts.

Walter Kanzler and Florian Kanzler, Managing Directors, Kanzler Verfahrenstechnik, Graz, Austria

w.kanzler@kvt.technology
f.kanzler@kvt.technology
http://kvt.technology

Advancing Scientific Breakthroughs

Providers of Outsourcing Services Help Pharma Companies Dedicate Space, Time, and Resources to the Core Aspects of R&D

Avantor is a global provider of research and development products and services to customers in the biopharma and healthcare industries. For its Services business, Avantor specialists and associates work with customers to deliver expert optimization of lab, clinical, and production operations and workflows. Michael Reubold asked Christophe Couturier, Executive Vice President, Services and Claudia Berrón, SVP Clinical Services at Avantor, about the current market trends and how the Covid-19 pandemic amplifies certain developments.

Christophe Couturier, Avantor

Claudia Berrón, Avantor

CHEManager: To begin with, could you give us a quick history lesson on the origin of the company and its main business activities?

Christophe Couturier: The story of Avantor is broken down to its two legacy companies. One of them was founded in 1904 under the name of J.T. Baker, its founder. It then turned into a standard-setting manufacturer of high quality and high purity chemicals. The other one, VWR started in 1852, selling products to serve the mining and laboratory markets. Over time, it became a leading global provider of product and service solutions to laboratory and production customers. In 2017, Avantor acquired VWR, bringing together the knowledge of a manufacturer and the network of a worldwide distributor.

We provide mission-critical products and services to a wide range of industries: biopharma, healthcare, education and government, advanced technologies, and applied materials. Our portfolio is used in virtually every stage of the research, development, and production activities of our customers. From small-scale bench to full commercial manufacturing, we help them provide, among other things, new treatments for patients in a smarter and faster way.

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Which role does the Services business play within the company?

C. Couturier: Services offers a holistic supply chain management solution for lab operations. Combined with Avantor's distribution offerings, we become a one-stop shop extending the delivery of lab consumables to the scientist at point-of-use, enabling productivity and supporting key workflows in research, scale-up and production. Even for hard-to-find, non-core lab consumables, our procurement services can develop customized solutions.

Claudia Berrón: Clinical Services support our customers during the development phase, when their products are being tested in the pre-clinical and clinical trial stages. Our capabilities are focused on the clinical supply chain and sample management to help our clients optimize their trials.

Avantor Services uses its experience in order to help customers propel the journey of a drug forward. Where in your opinion are critical bottlenecks in the drug development and deployment process and what solutions does Avantor provide to overcome these challenges?

C. Berrón: Drug development is complex and full of challenges. With the increased number of studies and their globalization, access to patients and the integrity of the research results represent potential bottlenecks: In pre-clinical lab activity, there are many critical testing and biorepository requirements. In the clinical phase, focus switches to the trial participants where logistic capabilities like equipment, drug comparator, ancillaries, sample collection kits and sample management, including chain of custody, cold chain, sample processing and testing and biorepository, are critical to the evaluation and outcome of a drug. We are active in these areas, offering customized solutions fitting our customers' research objectives. Combining our capabilities and international expansion, we enable end-to-end support and address their handover points.

> "Drug development is complex and full of challenges."

Globalization, digitalization, and systems automation/integration are transforming pharmaceutical R&D. What is your vision of the "lab of the future" concept and how much of it is already real?

C. Couturier: The lab of the future is happening and it is very exciting. Scientists are and will be able to leverage years of knowledge through data analytics and operational efficiencies to make recommendations based on machine learning to advance science faster. Technology is at a point where IOT, RFID, sensors, digitization are mature enough to enter the lab and enable further optimization of daily operations. We are tapping into all these elements to help our customers take advantage of these innovations. Integration of lab data from point of use, equipment, ELN, LIMS will lead to better efficiencies and understanding of the best working combinations for specific areas of research within the lab. When integrated into our e-commerce platform, the lab becomes a secured, optimized ecosystem that supports the scientific space at the heart of its discovery stage, leading into the pre-clinical and clinical stages where our dedicated teams add a unique level of expertise.

In November of 2020, Avantor opened its new biorepository and sample archiving facility in Europe. What is the purpose and significance of the new facility for Avantor's strategy?

C. Couturier: The investment in developing the purpose-built, state-of-the-art facility in Frankfurt underpins Avantor's continued focus on clinical trials and services being delivered globally. It offers unparalleled capabilities in meeting pharma professional exacting biorepository and archiving needs as well as the logistical challenges and regulatory requirements of the market.

C. Berrón: We offer flexible and refrigerated and deep-freeze cold storage, scalable capacity, adaptable archiving and retrieval, critical data administration and client management. While our focus has traditionally been on pre-clinical and clinical stages, we also provide storage of manufacturing materials and bulk drug substance. Avantor's experience in providing meticulous care to clients' research assets has also been leveraged: all materials are controlled within an audited environment, sustained by dedicated operations management, industry standard operation procedures and quality assurance teams.

C. Couturier: We embarked upon the creation of the Frankfurt facility back in 2018, well before Covid-19. It was part of our international deployment plan aimed at providing customers best-in-class solutions. Our facility delivers a complete range of biorepository and archiving solutions. Avantor has been providing said solutions for over 40 years and will continue to support developments not just against Covid-19, but also in a wide range of therapeutic areas: oncology, CNS, cardiovascular, etc.

Clinical trials are critical in the development of all vaccines and drugs and we deliver end-to-end solutions: custom kitting, clinical trial equipment & ancillary solutions, as well as biorepository and archiving services such as we offer at Frankfurt. Our solutions can be customized to meet customers' development needs, whether they're a global pharmaceutical company, CRO or biotech.

What are the major technological requirements to run such a specialized facility and how important are logistical requirements such as easy and fast access?

C. Berrón: Our new facility has been built to provide a safe and secure location for irreplaceable research assets. Indexing and traceability are of paramount importance, so our proprietary material management system ensures visibility of the whereabouts of any materials anywhere across our global network. 24/7/365 monitoring and advanced security systems, plus fire suppression systems, combined with back-ups and redundancies technologies are all incorporated and meet the standards of the German Quality Management Association.

> "The lab of the future is happening and it is very exciting."

We are also EnEV certificated for Energy and meet the DGNB Gold Award for Sustainability. Just 13 km from Frankfurt airport, our facility offers direct service to 300+ global destinations and answers our customers' need for easy and fast access to their research materials. Quality-controlled shipments and specialized cold chain logistics are enabled throughout Europe and across the globe.

Do you expect the trend of pharmaceutical companies outsourcing their sample management, as well as other critical operations, to external service providers to continue or even grow?

C. Couturier: Yes. All indicators show the increase in clinical trials will continue in the near future. The logistics they imply require capabilities and scale that often go beyond the reach of pharma companies to be run effectively and economically. The market is also comprised of smaller biotech companies who just can't perform this themselves. Outsourcing to service providers such as Avantor ensures they can dedicate the necessary space, time and resources to the scientific aspects of R&D.

www.avantor.com

Avantor's History

Avantor was founded in 1904 as J.T.Baker Chemical Company and acquired by Procter & Gamble in 1985. P&G sold the company to Mallinckrodt in 1995. 5 years later, Mallinckrodt Baker was acquired by Tyco, which subsequently renamed itself Covidien. In 2010, New Mountain Capital acquired the company from Covidien and took the Avantor-named company public in May 2019 for $3.8 billion, the largest US healthcare IPO in history. The company generated over $6 billion of revenue in 2019.

Streamlining the Path to Market Supply

Expert CMOs Provide High-quality Peptide APIs to Pharmaceutical Innovators

More and more active pharmaceutical ingredients are based on peptides. However, the production of peptide APIs is demanding and requires special know-how and equipment. AmbioPharm specializes in the development and production of peptides and peptide-related products. The US company recently opened a branch in Zurich, Switzerland, to serve European customers from there and to establish and expand partnerships. Michael Postlethwaite, senior director, Sales & Business Development, European Territories, at AmbioPharm, explains market trends and his company's growth strategy, particularly in Europe.

CHEManager: Mr. Postlethwaite, what trends are currently dominating the peptide market?

Michael Postlethwaite: The peptide field is responding strongly to the current Covid crisis, where there is great promise in peptides being developed for acute Covid symptoms and the longer-term effects of this debilitating condition. Aside from this, cancer and diabetes continue to dominate the clinical and commercial peptide API space. New targets and peptide-based treatments for cancer are being discovered all the time, often based on new approaches and new technologies like toxin conjugates.

It should be noted that one of the oldest peptides on the market, Goserelin, is still hard-hitting and one of the higher grossing peptides on the market. The GLP-1 market is immense, and continuously innovated by dual-agonist molecules, co-formulations for greater efficacy and ever greater improvements in pharmacokinetics brought about by molecular design. The rise of innovative manufacturing processes and in particular oral peptide molecules and formulations such as Semaglutide has energized this segment.

What are the growth drivers on the peptide market?

M. Postlethwaite: The peptide market has shown strong and consistent growth over the previous years, with 8–9% growth year on year. This is expected to continue as the 'druggability' of peptides improves, as does the discovery of new targets and innovation. Cancer and metabolic conditions will continue to drive growth, but there are many new areas being explored. For example, treatments for Alzheimer's will be a huge driver if successful, as would treatments for pain, maybe using nature's toxins as templates, novel antimicrobials and even cosmetics/cosmeceuticals. AmbioPharm is well positioned with expertise and capacity for all of these.

What has triggered the upswing of peptide chemistry in the pharmaceutical industry?

M. Postlethwaite: Peptide therapeutics have suffered in the past from challenges such as poor pharmacokinetics, high manufacturing costs, parenteral routes of administration, et cetera. However, peptides offer high selectivity, efficacy and are relatively safe and well-tolerated as a drug class. As technology and manufacturing know-how increased across the peptide field, this has led the costs downwards, becoming much more attractive to innovators, and to long-term medicine development. Being a highly specialized area of manufacturing, CMOs have established the expertise, equipment and GMP infrastructure to provide the highest quality peptide API to the pharmaceutical industry.

Michael Postlethwaite, AmbioPharm

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Where do you see the critical success factors for a CMO to grow in the peptide market?

M. Postlethwaite: There are many factors that contribute to successful growth within the peptide field. From the perspective of a CMO, we must meet the needs of our customers and sponsors. These are often driving the requirements as we move forwards. Innovation is key as technology is constantly changing, as are the challenges brought to us by our customers in terms of chemistry, material requirements and demand, quality, cost and timelines. AmbioPharm has developed expert know-how and capacity to respond to these demands, and provides cutting-edge innovation to manufacturing, while adhering to the strict quality guidelines existing in all

the different territories across the globe. In addition, we have built up the largest capacity for GMP manufacture in the peptide field, setting ourselves up for the growth of the peptide market.

Environmental awareness has accelerated the peptide field towards 'green chemistry' approaches to manufacturing. Many sponsors now consider this when innovating a new peptide, but also in the process of selection of a CMO for manufacturing clinically and commercially. AmbioPharm has taken huge steps in this direction to embrace the reduction of solvents, as well as recycling solvents, and to introduce less solvent-intensive approaches to synthetic peptide manufacture. This can also have a benefit of cost reduction once technology and infrastructure are established.

What role does the European market play in the expected growth?

M. Postlethwaite: The largest market for peptide therapeutics has been in North America, however, Europe has always provided a significant and growing market. Increasing prevalence of conditions such as diabetes and cancer within the European territories lends itself to market growth. There are many innovators in the peptide field located within Europe, and investment into development of peptide-based medicines is very strong. In addition, many top-tier academic institutes are located throughout Europe, often in the vicinity of hubs for innovation or academic/industry exchange. Several peptide blockbusters have originated in Europe, e.g. liraglutide, and the peptide pipelines of European companies both large and small are strong.

How do you position AmbioPharm in this market?

M. Postlethwaite: In other territories, especially in the USA where the headquarters are located, AmbioPharm is already strongly established. Our company has already established manufacturing capability and know-how and has devoted much investment into responding to the needs of the peptide market in terms of batch sizes and manufacturing timelines. Our philosophy is that with our unique approach to large-scale manufacturing, we can capture cost-savings and efficiencies during synthesis by leveraging our Shanghai synthesis capacity, located near the points of supply of most starting materials, and follow it up with the large-scale downstream capacities and isolation capabilities in North Augusta, USA.

In Europe, the market strongly suggests a need for readily available capacity for large-scale peptide manufacturing, and that is what we are here to deliver. We have capacity from grams to multi-tens of kilo batch sizes to sponsors in all phases of development and commercial supply with minimal lead-times. Process development, analytical validation etc. are also managed with minimal lead-time and highest efficiency, streamlining the path to market supply.

What specific peptide manufacturing capabilities and technologies does AmbioPharm have in the US and in China?

M. Postlethwaite: Since its inception AmbioPharm has had significant growth and boasts world-class facilities in both Shanghai and South Carolina in the USA. The Shanghai facility has recently moved into a dedicated state-of-the-art campus and encompasses all aspects of peptide manufacturing, including large-scale facilities for liquid-phase and solid-phase peptide synthesis, respectively. This is backed up by appropriate downstream facilities, including large-scale HPLC columns, and significant lyophilization capacity.

The North Augusta facility in South Carolina has also undergone a large expansion and encompasses the largest scale downstream facilities in the peptide field, including large-scale HPLC purification and scale-appropriate isolation, mainly lyophilization. The new processing buildings in North Augusta also house large-scale development and manufacturing capacity for alternative isolation techniques such as crystallization and precipitation, as well as the infrastructure needed to install a spray-drying suite that is currently in advanced evaluation.

Both sites, Shanghai and North Augusta, have the appropriate analytical capabilities needed for GMP API release and are overseen by the same stringent quality system, which is fully FDA compliant.

With these facilities, we are confident that we can supply from milligrams to multi-hundreds of kilograms per year of the best quality R&D and GMP peptide APIs in a cost-effective and timely way.

www.ambiopharm.com

Smart Manufacturing

Optimizing Pharmaceutical Production Processes with Intelligent Engineering

Pharmaceutical manufacturers need to accelerate innovation and cope with ever stringent regulation before getting market approval for new treatments. These challenges also call for more efficiency and compliance of drug manufacturing and formulation processes. Mumbai, India-based ACG Group offers services and solutions to tackle these challenges. Founded as Associated Capsules Group in 1964, ACG today delivers end-to-end manufacturing solutions for the pharmaceutical industry in over 100 countries. In December, ACG appointed Marcus Michel as CEO of its Engineering division. Looking back at many years of engineering experience for the global pharmaceutical industry he will lead ACG Engineering into the future. Michael Reubold asked him to analyze pharma market trends and present his strategy.

CHEManager: ACG is a well-known company in the pharma sector, so it is no surprise that the opportunity to join them must have been appealing. Did you have any concerns leaving equally respected German company GEA and moving to India in these uncertain and troubling times?

Marcus Michel: Certainly, at first you might have these concerns. However, with a few exceptions, all countries are currently affected by the pandemic. Lockdown, home office, sanitary regulations and social distancing rules determine our everyday life and it therefore makes no significant difference where you are currently working from.

The coronavirus pandemic has shown that the pharmaceutical industry and the associated pharmaceutical process engineering industries are able to face challenging tasks worldwide. It is less important from which local base you operate, but how you can contribute to the global effort in terms of innovative products and comprehensive service. In addition, it is only a matter of time before we will be able to get back to a normal, safer life with the vaccinations that have started worldwide.

Which challenges are ACG's customers currently facing and which trends are dominating today's pharma engineering sector?

M. Michel: There are regional as well as corporate differences here. While some customers are strongly concentrated on optimizing production processes in order to minimize their production costs, others attach great importance to the highest degree of flexibility and product quality. Different solutions are required to meet the individual needs of the customers.

> *"Digital solutions will play an essential role in drug research and pharmaceutical production in the future."*

ACG offers tailor-made and customized solutions for the respective requirements. We are also very much oriented towards monitoring and responding to the trends that emerge in the pharmaceutical industry, as well as adjacent industries. These trends are determined by the introduction and application of new technologies, which are behind the keywords like digitization, IOT, smart manufacturing, personalized medicine and—ultimately—Pharma 4.0.

Which experiences and expertise from your former jobs can you bring into your new position to develop ACG's solutions portfolio and market approach?

M. Michel: During the past 25 years I have dealt with international plant and mechanical engineering companies for various technology industries. This has enabled me to gain extensive experience that allows me to quickly recognize complex issues and to implement adequate measures successfully. In today's VUCA world, agility, resilience and decisive action have become even more important. It is precisely the knowledge from the various industries, and from the respective regional markets with their cultural differences in customer's behavior and needs, that will enable me to develop the ACG Engineering division further strategically into a global player in the field of pharmaceutical engineering.

Can you please give us a quick overview of ACG Engineering's core competences and capabilities?

M. Michel: A comprehensive portfolio in the field of pharma oral solid dosage applications, that encompasses process and apparatus solutions for the production of tablets and capsules. This includes materials handling, fluidized bed drying, tablet press and capsule filling machines, coaters, blistering and packaging machines, as well as corresponding analysis technologies.


Marcus Michel, ACG Engineering

In particular in the area of capsule production and filling, ACG has an almost unique core competence that has been developed and expanded over almost 60 years. In addition, our very well-trained after-market service ensures regular support for our customers around the world, which is especially critical in this current Coronavirus period.

How can ACG Engineering help drive pharmaceutical innovation and meet regulatory as well as quality, anti-counterfeiting, and cost efficiency requirements?

M. Michel: ACG Engineering sees itself as a solution provider and we will expand this claim even more in the next few years. This means that ACG Engineering and the technology center Scitech, which belongs to the ACG Group, work together with their pharmaceutical and food customers even earlier and more intensively to find sophisticated solutions that meet the required quality, counterfeit, and cost-efficiency requirements. Here ACG Engineering focuses on the in-

tensified application of digital technologies. It is therefore not surprising that ACG will invest several million euros in the development and expansion of digital technologies in its machines and processes in the upcoming years. Our genesis presence in India offers significant advantages when it comes to almost unlimited IT resources.

Digitalization has umpteen faces; how will digital solutions transform drug formulation and pharmaceutical manufacturing?

M. Michel: Digital solutions are already significant today and will play an essential role in drug research and pharmaceutical production in the future. Personalized medicine and the correct evaluation and use of big data are just two examples of how digital transformation can contribute to significantly shortening the go-to-market time. The area of pharmaceutical manufacturing is also experiencing a transition to smart manufacturing.

All of these applications call for new design and engineering approaches, which digital transformation can support. Utilizing augmented reality and virtual reality, for example, 3D design, process unit design and the digital twin in machine design, will contribute to improvements. It will reshape the individual project process steps, from the offer management, design, engineering, procurement, project execution, to the FAT / SAT, as well the after-market service. Our current 'new normal' business life, caused by the restrictions of the Coronavirus pandemic, has already demonstrated in the last few months what is possible and necessary with regards to digital transformation.

In 2019, ACG Engineering acquired pharma processing equipment company Xertecs in Germany—that now serves as ACG's European innovation center. What will the facility contribute to ACG's products, services, and capabilities, and how will it interact with ACG's global innovation network?

M. Michel: Xertecs has been a 100% subsidiary of the ACG Group since 2019 and is operationally part of the ACG Engineering division. Due to its history, it has served the technology groups' materials handling and fluidized bed processing as a design and engineering unit. It thus contributes significantly to the qualitative and reliable process solutions for our customers around the globe. In order to meet the demands of our customers in Europe, especially in the DACH region, we will further expand the location and activities of Xertecs in Muellheim, Germany, with regards to innovative product design, a customer test center, and a European service hub as an integrative part of the global innovation network of ACG.

www.acg-world.com/engineering


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ACG Engineering's comprehensive portfolio in the field of pharma oral solid dosage applications encompasses process and apparatus solutions for the production of tablets and capsules. Recently, the group added a new process development lab in India to provide ACG's customers and partners with a research, development, testing, and training environment.

Merz – 15 Years of Contract Manufacturing at the Reinheim Facility

Merz is a global, diversified healthcare company based in Frankfurt. Family-owned for more than 111 years, the company operates in the fields of aesthetic medicine, neurological movement disorders, and consumer care.

Merz's business activities as a contract manufacturer at the Reinheim site are less well known. The location has a long-standing 75-year tradition and is technically and pharmaceutically state-of-the-art. „Merz Reinheim has now been opening its lines for contract business and successfully producing semi-solid forms, liquids and blisters, also for external partners," says Torben Weilmünster, Site Manager in Reinheim. The plant in Reinheim has developed into a leading production location in the Merz Group. Merz employs around 230 people in Reinheim. Contract manufacturing began with the blistering and packaging of tablets. As a competence center for packaging, the location has also developed further within the Merz Group.

„We see ourselves as a premium provider and still try to offer an optimal price-performance ratio," says the Key Account Manager at Merz, Herbert Werner, who is responsible for CMO activities in Reinheim. Cost efficiency is made possible by optimized campaign production. We offer the greatest possible flexibility in production, even for small batches. Thanks to the wide range of technologies, Reinheim can serve several product categories. With services such as: technology transfer, process development, scale-up/validation and development of analysis methods, we offer customers a comprehensive range of services up to commercialization. This also includes stability studies from ICH-compliant to on-going, as well as the creation of PQRs.

Several years ago, Merz put a new high-performance tube machine from IWK in Reinheim into operation. With a four-million-euro investment, this increased the filling capacity of tubes by 30%. The new machine can fill and pack both aluminum and plastic primary containers. „With the new fully validated system, we can best meet the increasing demand for products," says Torben Weilmünster. „This investment is a commitment by the company to production here in Germany." Further investments of well over one million euros, including for an automated syringe packaging line are due for the year 2021.

The new tube line fills up to 200 tubes per minute; calculated over the year, that's around 20 million pieces. The tubes are not only filled fully automatically, they can be also be packed and palletized as part of our CMO portfolio.

The plant meets all regulatory requirements for pharmaceuticals, medical devices and cosmetics and is also certified according to the guidelines of the US FDA and supplies the American market. You can find more information about the Reinheim facility on the new, dedicated online presence at www.reinheim.merz.de.

Dr. Herbert Werner,
Key Account Manager,
Merz Pharma GmbH & Co. KGaA,
Reinheim

Contact

Merz Pharma GmbH & Co. KGaA, Reinheim
Dr. Herbert Werner
Phone: +49 6162 8009 663
mobile: +49 162 2643 081
herbert.werner@merz.de
Ludwigstraße 22,
64354 Reinheim, Germany
www.reinheim.merz.de
(website online end of March)

CHEManager INTERNATIONAL

INNOVATION PITCH

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Operational Excellence
Smart Tools for Complex Operations in the Process Industry

Ammonia Synthesis
Electride Catalyst Technology for Small-scale Ammonia Production

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Complex Operations Call for Smart Tools

Streamlining Communication, Collaboration and Workflows in the Process Industry

Gemsotec was founded in 2017 by three engineers looking to increase efficiency and safety in the process industry by applying the latest digital technologies. Today, the company has two products on the market which have been awarded for their user friendliness. On one hand, the GoRound platform offers a 100% digital and mobile solution for daily operations and on the other hand, the intervention app INA makes all relevant information about an intervention easily available and streamlines communication between all stakeholders.

Geert Sergoyne (left) and Stefan Ruyters, Gemsotec

CHEManager: What was the starting point and motivation for founding Gemsotec?

Geert Sergoyne: While working in the chemical industry, I was surprised that despite the level of automation and the challenging environment, people were still very dependent on paper. Workflows, instructions or the sharing of information were all paper based processes. We lost time on finding the right documents. Furthermore, these documents mostly consisted of text and were therefore a missed opportunity to give clear instructions to the personnel. What does the valve look like that needs to be turned? Where can I find it? Given the digital revolution and the improved availability of smart devices for the industry there were no more excuses to continue this way. This was the reason we decided to start Gemsotec.

Stefan Ruyters: We founded Gemsotec back in 2017 with the vision to reach an even more safe and sustainable industry by means of digital technologies. The aim is to further reduce incidents and gain more efficiency in manual operations. We first did many interviews in the industry to better understand the general needs and the problems being faced. The founders, although three engineers, combined very complementary and essential skills to start the company and especially to build the right solutions. That's how Gemsotec was born.

What does the company name Gemsotec actually stand for?

S. Ruyters: Looking for a good name, we spent quite some time and discussions on it. I did not want a name that clearly depicts the names of the founders. That's how we came up with Gemsotec. A gem is a bright and highly valued stone, and in Dutch it refers to a goat/antelope-like animal (chamois) able to quickly climb rocks and mountains. These are two characteristics that we could associate with our company. But, yes, it also refers to the letters of our first names.

What problem does Gemsotec's technology specifically solve, or what previously untapped opportunities does it open up?

G. Sergoyne: We focus on streamlining operations and communication in a production site reaching the next level of operational excellence. As mentioned, a lot of paper is still circulating in production.

In addition, while everybody uses a smartphone and tablet in their daily lives, they are only rarely found on the production floor. Both observations drove us to developing mobile apps for production companies. That's how we came up with the GoRound platform to reduce paper forms, and INA, our communication platform for intervention management and preparation.

Who are your customers and in which markets do you find them?

G. Sergoyne: The GoRound platform is very flexible allowing it to be used for various use cases. In essence it is a no-code platform that enables business users to configure their paper checklists, tasks, instructions et cetera. Our biggest customer is H. Essers who uses it to streamline and standardize their internal audits, like 5S, of warehouses across the EU. We immediately became active internationally in six countries. Our platform has been designed for the process industry, including food and chemical industries. Our clients are, for example, breweries in Belgium but also chemical multinationals such as Oleon. INA is equally relevant for chemical industries, both in operations as in the company fire department, and for public fire departments. For example, INA is used by the Fire Department of the city of Antwerp, the largest in Flanders.

What do you see as the main drivers for your success and what is the feedback from the industry?

S. Ruyters: Our customers always say that our apps are very easy to use and align very well with the workflows and requirements of the process industry. As mentioned, we put user-friendliness at the forefront of development, taking into account the specific nature and circumstances of a production plant and its workers. As an example, our mobile app is made for operators & technicians of all ages and digital skill levels. It does what it needs to do, and that is highly appreciated. Through our kick-off program we help our customers to configure the platform and identify all the possible use cases, so that they get the maximum out of our platform. ■

Personal Profile

Stefan Ruyters is Co-Founder of Gemsotec. He obtained a PhD in environmental sciences (Bioscience Engineering, KU Leuven) in 2010 specializing in microbial ecology. After his post-doc, Stefan has been active in R&D and innovation in the food and chemical industry. He has managed a Horizon2020 project focusing on supporting innovative start-ups and SMEs before starting his own venture Gemsotec. Stefan is specialized in managing innovation projects in a multidisciplinary way, giving a 360° view on the project. He has gained expertise in digital product development, IoT sensors and circular economy.

Geert Sergoyne is CEO and Co-Founder of Gemsotec. He obtained a master's degree in catalytic chemistry (Bioscience Engineering, KU Leuven). He soon joined Air Liquide thereafter and has been active for more than 10 years in different operational management roles. He dealt with the optimization of the entire supply chain from the production in the plant to the distribution through pipelines or trucks. These years of experience were very valuable in order to better understand the needs and to come up with the appropriate solutions.

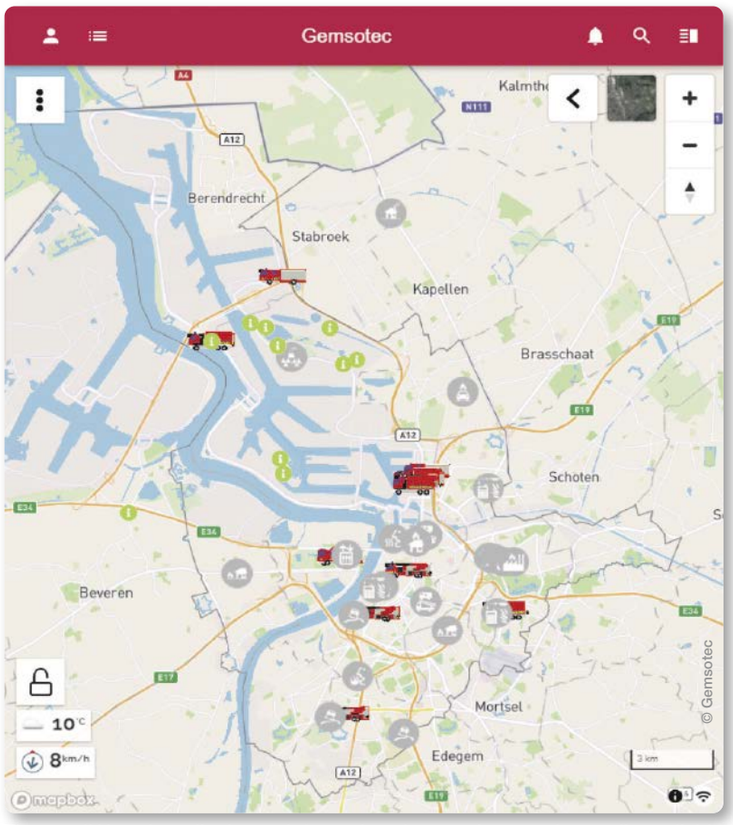
Business Idea

Making Operations Smart and Mobile

The idea of Gemsotec is that operators and technicians should be geared with the right digital tools to maintain the highest level of operational excellence. Tools that make their work easier, more effective and that offer them all the information they need. And since mobile devices are so common in personal life, it was about time to adopt them in industrial operations. Essential in the GoRound platform is our mobile app which is used by operators and technicians to execute inspections, register data, consult instructions and perform tasks right from their smartphone or tablet. This digital system allows data to flow seamlessly throughout the organization, breaking down data silos (like maintenance, production, quality) which are typical in production plants. In addition, whereas data usually sits down on paper forms, it is now activated and allows to automatically update dynamic reports and dashboards with the latest data. Typical use cases are 5S audits, lockout tagout instructions, operator rounds, safety inspections et cetera.

INA has been developed in co-creation with the Antwerp fire department. INA is an innovative concept that integrates GIS with a smart chat application. The map shows all the relevant data such as hydrant locations, the incident location, while the chat application allows to directly communicate with experts and automatically share documents and other information with all stakeholders. When an incident happens, every minute counts. And with INA they save time in preparing the intervention. INA has won the e-gov award in Belgium for the most user-friendly solution, a recognition of which we are very proud.

■ Gemsotec BV, Herent, Belgium
www.gemsotec.com



The app INA makes all relevant information about an intervention easily available and streamlines communication between all stakeholders.

Elevator Pitch

Futureproofing Operational Excellence

Gemsotec offers smart and mobile tools to streamline collaboration and workflows in complex and critical environments such as the process industry. These solutions contribute to a more sustainable and safer world. The Gemsotec GoRound and intervention app INA is being used in the process industry, logistics and fire brigades—and this already in six countries. The Gemsotec team grew to eight people and now consists of five developers and three business-oriented profiles.

Milestones

2017
- Gemsotec was founded and was admitted to the KBC start-it incubator in Leuven, Belgium. Gemsotec managed to receive an innovation subsidy from the Flemish Government.

2018
- Gemsotec hired its first employees and started the developments of the GoRound platform. The first version was ready and tested in proof-of-concepts in the industry in Q4.

2019
- The first GoRound customers were onboarded. The developments of the intervention app INA started. Gemsotec managed to receive a second subsidy from the Flemish government.

2020
- The first version of INA was ready and rolled out in Q3 2020 at the fire brigade of Antwerp. The GoRound platform is evolving rapidly and is being used in six countries in the process industry and in logistics. Gemsotec received the Agoria e-Gov Smart City award for most user-friendly e-gov app and won an "AI for maintenance" hackathon organized by Aquafin.

Roadmap

2021
- Rollout of INA to other public and company fire brigades. The GoRound platform will integrate sensor data coming from production plants. All the gathered data will be used in an intelligent way to notify operation personnel.

2022
- The collaboration and integration capabilities will be further improved for both the GoRound and the intervention app INA. Gemsotec will enter into partnerships to boost the distribution of the GoRound.

GoRound is a platform that assists operators and technicians to perform visual inspections, instructions and tasks.

New Ammonia Synthesis Technology

A Process Based on an Electride Catalyst Enables Small-scale Ammonia Production

Tsubame BHB was established in April of 2017 based on a new catalyst technology developed by Prof. em. Hideo Hosono at the Tokyo Institute of Technology (Tokyo Tech), which allows an ammonia process at lower temperature and pressure. The overall process designed by Tsubame BHB provides a new small-scale ammonia production technology as an alternative to the common large-scale, centralized production. The Japanese start-up company aims to put the world's first on-site ammonia synthesis system into practical use and provide ammonia in remote areas via this process with low environmental impact. Masahiro Watanabe, representative director and CEO, explains the vision and strategy of the company.

Personal Profile

Masahiro Watanabe graduated from the International Christian University with a degree in physics. In 1976, Mr. Watanabe began his career at Chiyoda Corporation and worked for refinery plant constructions in Saudia Arabia and in Indonesia for an LNG production project. Mr. Watanabe joined Chiyoda Advanced Solutions called ChAS, an affiliate company of Chiyoda Corp., as sales director in 2002 and was later promoted to executive director, and, in 2009, to president and CEO. In June 2019, Mr. Watanabe assumed the position of CEO of Tsubame BHB.

CHEManager: How did the company, Tsubame BHB start?

Masahiro Watanabe: The new ammonia synthesis catalyst developed by the group of Professor Hosono at Tokyo Tech provides the possibility to run the process at lower temperatures and lower pressure than the conventional Haber-Bosch synthesis. As a consequence, this catalyst provides the possibility to produce ammonia economically on a smaller scale. We founded Tsubame BHB to commercialize this new technology by developing and designing the process around the catalyst.

What had been the biggest hurdles to overcome so far?

M. Watanabe: The development of the catalyst manufacturing process was one of the big hurdles so far. The electride catalyst needs to be produced on a large scale for the commercial plants. Since the catalyst manufacturing process consists of synthesis, kneading, molding, drying and calcination, all steps require a suitable method to provide high catalyst activity, stable catalyst lifetime and safe handling. As our catalyst is a new material, there was no established method for such manufacturing, and our catalyst engineering team spent lots of efforts in developing the manufacturing method. After more than two years we could finally establish the catalyst manufacturing method for mass production.

The catalyst you are using is quite extraordinary. How did its development start at all?

M. Watanabe: For the first time, Prof. em. Hosono realized the synthesis of an electride—an electronized material where electrons behave as negative ions—at Tokyo Tech. He discovered an electride by replacing oxide ions inside the cage structure of $12CaO \cdot 7Al_2O_3$, a constituent of commercial alumina cement, with electrons. The discovery was published in 2003.

The Hosono group later on applied the compound as a catalyst for synthesizing ammonia, thinking that the bond of nitrogen molecules could be easily cleaved by utilizing the electron-donating property of this C12A7 electride, and it was found to be better than the conventional catalysts.

In which development phase is your process?

M. Watanabe: In December 2019 we constructed a pilot plant in order to demonstrate the commercial viability of the technology as well as to optimize process conditions and the catalyst. So far, the tests run in the pilot plant showed that the catalytic activity is higher than in laboratory tests, so the catalyst amount can likely be reduced by 30%. Also, we found that continuous operation with an annual capacity of 20 tons is possible without any significant loss in catalytic performance. The ease of handling, the safety, and the activity of the catalyst could be confirmed, and a number of verifications could be conducted with the goal of improving the practical use in the next years.

Where could this new process be applied?

M. Watanabe: We believe, there is a big market potential for an on-site production technology that provides an alternative to the common monopolar concentration and mass production of ammonia. On one hand, it reduces transportation and storage costs and can provide ammonia in remote areas or in countries without domestic ammonia production. On the other hand, the technology contributes to an environmentally friendly and sustainable energy supply by offering the possibility to complement 'green hydrogen' as a means of transportation and storage.

Is Tsubame BHB already open for business?

M. Watanabe: The basic design phase of our standard-size modular system with 3,000 mto/y and 5,000 mto/y, respectively, is already completed, and currently customers are evaluating our proposal. Moreover, we also offer an EPC-type sales model, which is suitable for customers with a demand of more than 10,000 mto/y. We believe, that we will received the first purchase order for a commercial plant within this year.

What is Tsubame BHB's vision and mission?

M. Watanabe: Our mission is: We will solve current issues related to environmental problems and food supplies by utilizing a unique technology and realize a sustainable society.

Our vision has various aspects: Firstly, applying a new technology originating from colleges and universities, promoting development through active collaboration with other companies, and initiating supply chain innovation in the ammonia industry.

Furthermore, our innovation will provide means to solve the problems of the uneven distribution of supplies and the depletion of resources in the food sector, and it will support sustainable and more environmentally friendly energy supply and distribution.

And finally, we will develop human resources who can implement creative technologies in society, promote technological development that reduces environmental impact, and ensure sustainability.

What does the name Tsubame BHB mean?

M. Watanabe: Tsubame is the Japanese term for swallow, which is the bird depicted in the seal of Tokyo Tech. In Japan, swallows traditionally portend good fortune. And BHB stands for „Beyond Haber-Bosch", which is how we define our mission.

BUSINESS IDEA

Onsite Small-scale Ammonia Production

Although developed about 110 years ago, the Haber-Bosch process is still the standard process for ammonia synthesis all over the world. However, the Haber-Bosch process requires high pressure and high temperature conditions, such as 400–600 °C and 20–100 MPa. Due to those special conditions, typical ammonia plants are constructed in large scale and mainly concentrated in specific areas with adequate raw material supply.

New technology enables easy and convenient use of ammonia

The target of Tsubame BHB's process is to achieve small-scale onsite ammonia production in distributed areas where ammonia or nitrogen fertilizer is needed. The current centralized production of ammonia requires transportation and storage between the production and demand location. Because ammonia has a very low dew point and is poisonous and environmentally hazardous, the transportation and storage costs are high. Therefore, it is difficult and expensive to distribute and supply ammonia as a base chemical to all places in the world. The technology developed by the start-up enables small-scale ammonia production, therefore decentralized, onsite ammonia production becomes feasible to provide easy and convenient use of ammonia in many locations where it is not possible today.

Electride catalyst makes green ammonia production possible

Environmentally friendly solutions are needed to achieve a sustainable society, and 'green ammonia' is in the focus of various industries. When renewable energy is used to produce hydrogen in an electrolyzer as a raw material for the ammonia synthesis, the produced ammonia is called 'green' as there is no CO_2 emitted from the process. Green ammonia is expected to be used for conventional ammonia applications as well as fuel for power generation, substituting existing fuels such as oil and gas. For green ammonia, onsite, small-scale production is needed, since it has to be used in decentralized locations in any country or region. Tsubame BHB's solution using an electride catalyst will help to achieve these targets and with that establish a sustainable society.

■ Tsubame BHB Co., Ltd., Kanagawa, Japan
https://tsubame-bhb.co.jp/en

ELEVATOR PITCH

Mission, Milestones and Roadmap

Tsubame BHB owns a proprietary ammonia synthesis catalyst technology and develops small-scale ammonia production systems. The company aims to solve the environmental and societal issue of CO_2 emissions as well as food farming-related issues in developing countries as ammonia is an essential chemical for fertilizers. Moreover, conventional ammonia is produced from fossil fuel, and with that emits large amounts of CO_2 during the production process.

Tsubame BHB's new process enables ammonia to be produced at lower pressure and lower temperature than the conventional process, and therefore, can be produced in smaller scale. Based on a modular system, the technology can support ammonia and fertilizer production anywhere economically. When combined with renewable energy for hydrogen production, the process contributes to one of the key aspects of the UN SDGs, to reduce CO_2 emissions.

The start-up continues to develop its technology in order to meet the variable supply of hydrogen by renewable energy. Recently the start-up entered into a cooperation with Mitsubishi Chemical for investigating the possibility to use membranes in the reactor in order to continuously separate the ammonia from the feed gas. This would allow to run the process as a single throughput, and the cost and energy intensive recycling of the feed gas could be omitted.

Milestones

2017
- Company establishment by Tokyo Tech professors, Ajinomoto and Universal Materials Incubator

2018
- Selection of commercial catalyst from various electride catalyst candidates upon evaluation in the lab

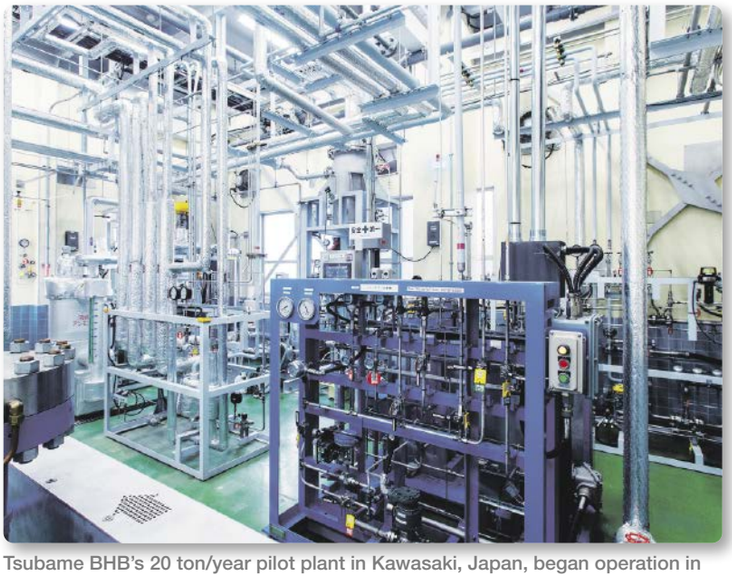
2019
- Construction of pilot plant at Kawasaki City

2020
- Catalytic activity in pilot plant confirmed higher than laboratory result
- Basic concept of 3000 TPA and 5000 TPA modular system established
- Investment round for business development by four additional companies
- Start of joint evaluation with Mitsubishi Chemical Corp.
- Tsubame BHB selected for the Japan International Cooperation Agency (JICA) SDG program

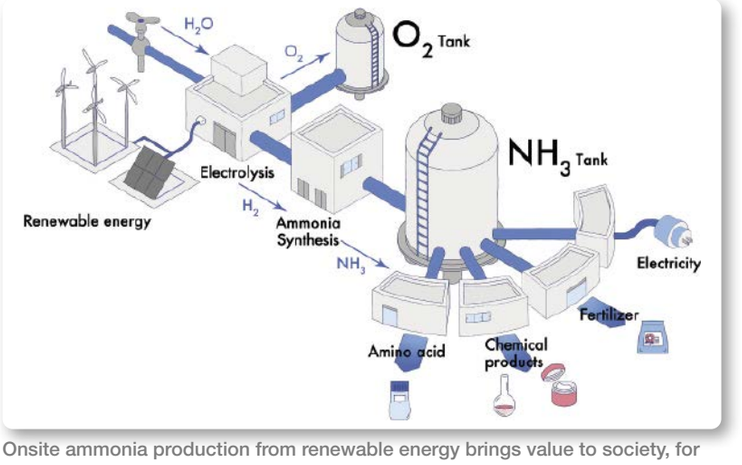
Roadmap

2021
- First order for a commercial plant expected

2023
- Start of operation of first commercial plant



Tsubame BHB's 20 ton/year pilot plant in Kawasaki, Japan, began operation in December 2019.



Onsite ammonia production from renewable energy brings value to society, for example as electricity and fertilizer.

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The IIoT Needs You and Me

The IIoT continues to evolve, with countless solutions touting end-to-end process automation. However, one of the most important elements of IIoT — the human element — has taken a back burner in this hype cycle.

To realize its potential, IIoT solutions must address the role of the connected industrial worker in this brave new world. "People-focused" IIoT brings back the balance of power between people, processes and technology, and ultimately will enable industrial enterprises to unleash their true potential to optimize plant operations, improve productivity, enhance efficiency and ensure worker safety.

Refocusing on the Human Element of the IIoT

At the center of the IIoT is the human being who is charged with making use of the applications and services enabled by the devices and their unprecedented integration provided in the IIoT. The human element is an important one within an IIoT infrastructure because ultimately it holds the final decision on how the system will learn how to react to processing anomalies.

In any processing operation, it is also important not to overlook the vital role of communications. Today, we think of this more as people-to-people, among or between teams. This is because industrial processes are largely controlled by human operators, who have final oversight and responsibility for a safe operation. As emerging automation systems come online with the ability to crunch vast amounts of IIoT data, decision-making is being shared between humans and machines, thus taking the communication between operators and machines to a new level.

Now comes the time when chemical processors need to instrument the people tasked with using and managing machinery in the overall process. A safe and effective plant needs to be able to rely on a workforce equipped with contextual information about the physical processes taking place. Plant process management (PPM) helps to do that and embraces the "you and me" with IIoT, the missing link that supports smart manufacturing.

PPM describes a system that enables processors to manage, monitor and optimize their operations around work activities and production assets. Applicable to any type of plant regardless of the amount of IIoT instrumentation, AI, machine learning or predictive maintenance, PPM ensures knowledge can be ingested and analyzed from any human contact point in a process.

People-focused during a Crisis

With Covid-19 still a concern, consistent capture of team-to-team communication has become a must-have capability, especially as irregular work patterns have been emerging for individuals due to isolation and social distancing measures. As many operations have learned recently, having an electronic knowledge base describing issues and their resolution based on this communication is an essential investment in maintaining an operation resilient in times of crisis.

Beyond Covid-19, an investment in PPM capabilities will also serve the organization's IIoT strategy — think AI applications that "learn" from historical observations by experienced operations staff (again, the human element). In this way, PPM offers a low-risk, high-impact investment.

Andreas Eschbach, Eschbach

Solutions for the new Digital Age

Any investment in digitalization for processing operations must address how a company's workforce and automation infrastructures work together. Successful digitalization projects make a difference on the shop floor by reflecting the needs and experience of the workforce. Plant digitalization initiatives must include the support of all stakeholders, which also means the plant floor workers doing the everyday tasks. Make them the companions on your digitalization journey. A "people-focused" IIoT with PPM capabilities will help chemical processors get ready for the next crisis, as well as address today's great crew change.

Andreas Eschbach, CEO, Eschbach

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CHEManager INTERNATIONAL

LOGISTICS

Supply Chain Management
A Roadmap to Digital, Sustainable and Circular Chemical Value Chains

Pharma Logistics
Mastering the Global Production and Distribution Challenges

Intralogistics Efficiency
An Adaptable Warehouse and Distribution Concept Enables Flexibly

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Turning from Linear to Circular

Sustainable Supply Chain Management in the Chemical Industry

Besides digitalization, sustainability and the circular economy are the key issues facing the chemical industry at present and in the coming decades. Supply chain management (SCM) in the chemical industry is particularly affected by this: scarce resources, the energy transition, and the focus on social justice with simultaneously globalized value chains lead to procurement, image, and sales risks.

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The understanding of an optimized and digital supply chain can be the concrete starting point for further development with regard to the topics of sustainability and circular economy. There should be meaningful links between these three strategically important management concepts.

Classic, linear supply chain management is evolving in three stages to meet these challenges. In addition to continuous optimizations to an increasingly digital supply chain (stage 1), SHE aspects (Safety, Health and Environment) and the development to a Sustainable Supply Chain are more and more taken into account (stage 2). At the end of this development, the ideas of the circular economy are integrated into the supply chain (stage 3). The result is Circular Supply Chain Management (see figure).

Digital Supply Chain Management (DSCM) in the Chemical Industry

Digital supply chain management encompasses both the integrated planning and control as well as the execution of all material, information and financial flows. Transparency, speed and accuracy are the effects of this optimization. This is only possible through a high level of process orientation and the integration of all stakeholders involved (suppliers, producers, customers and partners). Most companies in the chemical industry are introducing digital optimization in their supply chain. The integrated end-to-end optimization is now on the agenda and will occupy the chemical industry in the coming years.

Sustainable Supply Chain Management (SSCM) in the Chemical Industry

Many companies in the chemical industry have also already begun to focus on sustainable supply chain management. This is because a focus on sustainability in the supply chain is an essential prerequisite for the future viability of companies. For the supply chain, this means that in addition to economic criteria, ecological and social criteria must also be met by all players along the entire supply chain. This includes not only the origin and production of products, but also their use and disposal. Safety, health and environment are concrete requirements for this SSCM.

In principle, the sustainability of the supply chain begins in the company itself, in the self-image of the entrepreneur and the managers in the company. This nucleus of sustainable action must then be transferred to the functions involved in the supply chain (people, organization, technology) via targets, metrics, measures, code of conduct.

Sustainable supply chain management represents an enormous challenge, which the chemical industry is already tackling today through various initiatives. For example, the „Together for Sustainability (TfS)“ initiative—a global network of 29 chemical companies—was founded back in 2011. The aim of this initiative is to standardize supplier assessments and audits worldwide for the responsible procurement of goods and services and to improve environmental and social standards. This is based on initiatives such as the United Nations Global Compact (GC), Responsible Care Global Charter, the guidelines from the International Labor Organization (ILO), the International Organization for Standardization (ISO), Social Accountability International (SAI). In addition, there are other initiatives that promote the sustainable transformation of existing supply chains, such as the Guide to Sustainable Supply Chain Management for Medium-Sized Companies in the Chemical Industry. This was initiated by the Sustainability Initiative of the German Chemical Industry (Chemie^3). Another example is the Action Plan on the Circular Economy by the European Union.

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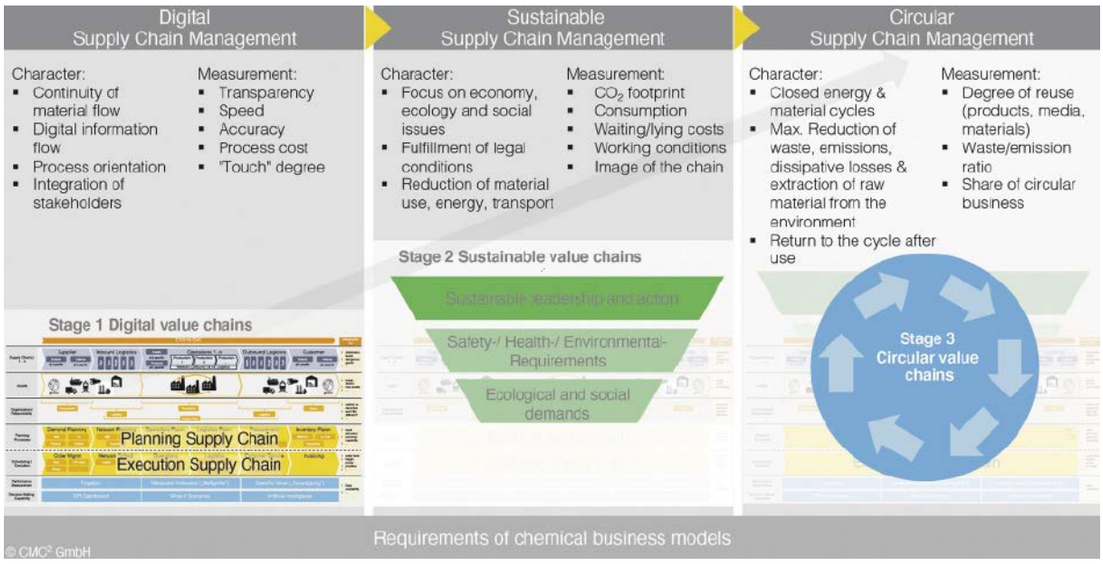
The focus of the initiatives often tends to be on suppliers/pre-suppliers. The concrete measures and the SSCM project roadmap, which refers to the planning and handling of different supply chains in the company, is a challenge for the chemical industry. A measure such as transferring the safety requirements of one's own production plant to the entire chain would be a concrete SSCM project (reporting chains, safety claim, equipment, availability of information). An agreement on the highest possible transparency on inventories in the supply chain would enable better planning for deliveries. This would lead to fewer ad hoc operations and increased use of less polluting means of transport. Supply chains from the supplier to the customer should be made measurable according to aspects of sustainability, in addition to the criteria of DSCM such as costs and times.

Circular Supply Chain Management (CSCM) in the Chemical Industry

Circular supply chain management can be seen as a consistent further development of digital and sustainable supply chain management.

Circular supply chain management is derived from the circular economy (CE). Its aim is to minimize the consumption of materials and resources by closing material and energy cycles. This means that the materials used in the circular economy remain in a material cycle beyond the entire life cycle of the goods produced with them. In this way, waste, emissions, dissipative losses and the extraction of raw materials from the environment can be avoided or at least reduced. Pollution is reduced and biodiversity is protected. Aspects that characterize the Cir-



Evolution of the supply chain in three stages

cular Economy include the reuse of goods, the recycling of materials and substances, the extended life of goods and their return to the cycle at the end of their use.

For the circular supply chain, this means that it is no longer planned and controlled only from the supplier to the customer (or the customer's customer), but that the disposal or reuse (recycling) and return of goods and materials must also be planned directly.

As a basis for CSCM, the solution approaches and measures of DSCM and SSCM are a very good preliminary work. Circular Economy can only be holistically successful if it is integrated into the entire supply chain.

Conclusion and Outlook

The three different ways of looking at digital, sustainable and circular chemical value chains show the urgent need to realize each stage—the sooner, the more future-proof. In practice, convincing ideas and solutions already exist for each development stage. The task now is to develop a clear roadmap in the companies, which will enable prototypes in these SCM development stages and thus new learning progress.

Carsten Suntrop, Senior Expert, CMC² GmbH, Köln, Germany

Clara Hiemer, Consultant, CMC² GmbH, Köln, Germany

www.cmc-quadrat.de

Pharma Logistics: A Global Perspective

A Closer Look at Pharma Distribution and Logistics in Different Parts of the World

Over the past few years, Camelot has been monitoring pharma distribution in different regions of the world. Our insights have been published in various editions of CHEManager International. We covered North- and Latin America, Asia, Africa, and Russia, highlighting real-life project and operational experience, market specifics as well as trends we observed. This article summarizes the key take-aways and provides a global view on trends and perspectives in pharma distribution.

Andreas Gmür, Camelot Management Consultants

Thomas Schnur, Camelot Management Consultants

One of the most important objectives of pharmaceutical companies is to ensure safe and reliable distribution of drugs to their patients. However, companies are confronted with very diverse maturity levels of the pharmaceutical markets, different growth potential depending on the geographical region, varying logistics infrastructures as well as political and tax regulations. Therefore, different region-specific approaches in pharmaceutical distribution are necessary.

Opportunities and Challenges

The global revenue of pharmaceuticals has seen a steady increase every single year since 2001, accounting for $1.25 trillion today. Moreover, a further increase of approximately 4.6% annually is expected from 2020–2027. Today, North America, with total sales amounting to approximately $523 billion 2019 is the largest single pharma market. However, while mature markets like the US and Europe are saturated with growth mainly depending on new products and services, emerging markets such as Latin America, Asia, and Africa, still offer a high potential for growth with existing portfolios. They are therefore closely monitored by pharma companies.

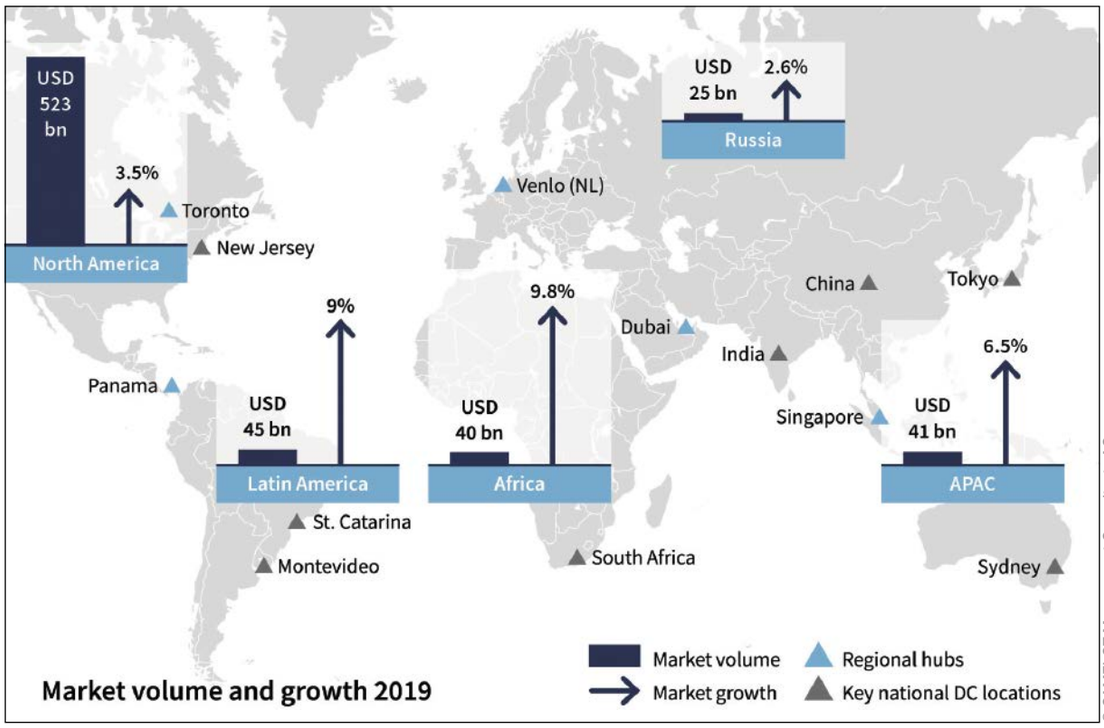
Despite these promising developments, pharma distribution is still a major challenge, involving diverse region-specific market risks and issues. The US market faces high pricing of pharmaceuticals due to missing governmental price controls and limited access to lower priced medicine from abroad. Regions such as Latin America, Africa and Russia still struggle with geopolitical risks, corruption, and illicit medicine. The African continent, moreover, must cope with security issues, unstable political situations and approx. 30% of counterfeit products. Although these challenges are rather obvious, they indicate that a detailed analysis is inevitable for pharmaceutical companies before entering those markets.

Logistical Requirements and Network Distribution Structures

Alongside general market-specific challenges, additional aspects regarding the successful distribution of drugs to the end customers need to be carefully considered. One of the most important issues is the underlying and often fragmented distribution infrastructure, including the availability of sea- and airports, street networks, and suitable warehouses. This is especially important when considering the long distances that need to be covered even in domestic transportation for eample in the US, China or Russia. Therefore, advanced distribution networks are a prerequisite to offer next-day delivery, which is a common practice in pharmaceutical business.

When it comes to the underlying logistical infrastructure and the distribution networks, there are significant differences. While in mature markets like North America or parts of the APAC regions including Japan and Australia, the general distribution infrastructure is highly advanced, in other regions like Africa and APAC including India and Indonesia or even Russia, this is different. Fragmented streets, dilapidated airports or poor warehouse conditions are still present, which often hinders the efficient, safe and timely distribution of pharmaceuticals. Since the main infrastructure in such regions is centered around major cities, this issue is exacerbated in rural areas.

The maturity of the North American infrastructure is also reflected in the existing network distribution structures. The market is clearly dominated by three major wholesale distributors—McKesson, Cardinal Health and AmerisourceBergen—which all have immense distribution networks with dozens of warehouses and specialty facilities scattered throughout the country to accommodate nearly every pharmaceutical distribution need and to facilitate next-day delivery for the majority of their customers. From a geographical perspective, the most important pharmaceutical distribution hub is New Jersey.



Pharma market: volume and growth 2019

Outside most of North America and Europe, there are several regions that face major issues in their network distribution structures. For instance, the distribution in Africa is often managed by distributors and several subcontractors rather than logistics service providers. As such, pharma companies lose transparency of the processes and mechanisms in the market. Thus, when distributing into Africa, the preference should be to limit the dependency on national or sub-regional distributors. Today, it is often feasible to distribute via regional hubs in South Africa and Dubai making use as well of road transportation for further inland distribution as this has become more viable and secure in recent years.

In contrast to Africa, the distribution networks in Latin America are at least well developed around urbanized centers. However, coverage of rural regions remains a challenge, owing to large distances between different centers and difficult topologies. Factoring in the often volatile political situations, we have observed specialized national or local solutions and only limited capabilities and regional networks in Latin America. Thus, it is no surprise that the typical pharma logistics setup requires a local distribution center in almost each individual country combined with higher local inventory levels. Many pharma companies typically distribute their products directly from production to the local stock locations in the country, which leads to a high share of airfreight. Offering many flight connections and stable climate, Panama has gained a lot of traction over the past years as regional hub, and even Montevideo is experiencing growing popularity due to constraints and restrictions in Brazil.

Like in Africa, the distribution in Russia and large parts of Asia is strongly dependent on national and regional distributors, which compared to logistics service providers, are responsible not only for storage and transport but also for the commercialization of pharmaceuticals. In Russia, for instance, Ruls, Protek and Katren are the largest distributors, which account for more than 50% of the total Russian market. As a consequence, most of the Russian distributors own pharmacy chains or even have their own local production, which is likely to strengthen the vertical integration in the future.

Recent Developments and Outlook

The future of pharmaceutical logistics is expected to remain dynamic, challenging and loaded with procedural, technological, and operational innovations as logistics processes and structures adapt to growth and increased complexity. The Covid-19 pandemic, for instance, has shown how much the globalized world depends on the supply especially from China and how vulnerable the pharmaceutical supply chains still are. The shutdown of pharmaceutical manufacturing combined with the unavailability of transport capacity, has not only resulted in major disruptions in medical supplies like masks or surgical gloves, but also of basic medicine like headache remedy.

Business strategies around risk mitigation and improved supply chain resilience like “near-shoring”, “dual sourcing” and “right sizing” of inventory levels are now pursued where feasible and justifiable. Moving forward, it will be key to reduce the complexity as well as increase the flexibility and resilience of the global production and distribution setup, enhancing the view so far mostly focused on cost and service levels. With those business strategies in mind, pharma companies with digital twins of their production and distribution networks have the advantage of being able to identify and develop suitable alternatives.

This can be achieved using agile technical solutions that support the need for continuous analytics of the respective options and their impact even at a tactical level. We strongly believe that such business strategies are a game changer for the pharma industry and that digital twins will be essential in mastering the global production and distribution challenges, breaking down the barrier between network design and supply chain planning.

Andreas Gmür, Partner, Camelot Management Consultants AG, Munich, Germany / Basel, Switzerland

Thomas Schnur, Associate Partner, Camelot Management Consultants AG, Mannheim, Germany

agm@camelot-mc.com
www.camelot-mc.com
www.camelot-itlab.com

Container with New Opportunities

Originally engineered for the transport of chocolate, tank containers with agitators have discovered a wide range of uses. This type of container is becoming more and more popular not only in the food sector, but also for chemical applications. Their adaptability and mobility are the major strengths.

The adaptability of the tank container mainly results from its technical equipment: The tank vessel has a capacity of 24,000 liters, two agitators and an integrated heating and cooling system. An easy and smart handling of the technical devices is ensured via a multilingual touch panel, the PLC (programmable logic controller). This can be used to regulate the temperature values and control the agitators.

High safety standards guarantee the complete floor covering as well as handrails that can be opened on both sides and an air connection that can be operated from the floor. The agitators are installed vertically and each have two blades that are guided through Teflon sleeves. The cleaning takes place via specially integrated and optimally placed openings.

Wide Range of Use

It is precisely this adaptability of the tank container that opens the doors to ever new purposes and areas of use. Two installed flanges can be used for additional valves or sensors. This means that the tank container can also be integrated in future digitization projects, such as automated order processing. It is well equipped for viscous and sedimenting products that have to be stirred up before further processing.

In addition, various preliminary products can be mixed to form a new end product and filled into different containers, IBCs, drums or cans. Temperature-sensitive materials are warmed up and cooled. All of these processes can be combined and with an additional spill trough, the tank container also fulfills the legal requirements as a mobile storage container which can be integrated in manufacturing processes. It becomes an integral part of the production plant. Mobility as a container enables flexible use in other locations in order to get closer to suppliers, customers or outsourced production and logistics facilities, locally, regionally and globally.

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The adaptability of the tank container is mainly due to its technical equipment, e.g. vertically installed agitators with two blades that are guided through Teflon sleeves.

Applications for flammable substances required further development of this type of container for use in explosion-proof zones. Despite the more extensive design of the agitator control, this new tank container has a capacity of 21,000 liters and is approved for operation in up to ATEX Zone 1. A solution for mixing solvents has thus also been found.

Creative ideas in connection with new perspectives enable further applications for tank containers with agitators. (sa)

www.tws.de

Tune Your Warehouse

Boosting Intralogistics Efficiency in the Pharmaceutical Area

The changes in customer needs and market requirements have not only been changing because of the pandemic influences within the last year, but traditional business models were quickly considered outdated in the current environment. The ones who have an adaptable warehouse and distribution concept are now pleased to react flexibly to the future needs. But what happens to those who struggle with outdated technical equipment, old IT systems, or even both?

There is a way to solve this challenge if you combine technological and logical measures—even in areas with high regulatory constraints like in the pharma & life science industry! But what should you actually do if your warehouse no longer meets customer and market requirements?

Some of our clients in the last almost 50 years claimed that they needed a warehouse extension but did not have the budget for it. They did not believe that smaller steps would be able to help to improve their logistics situation.

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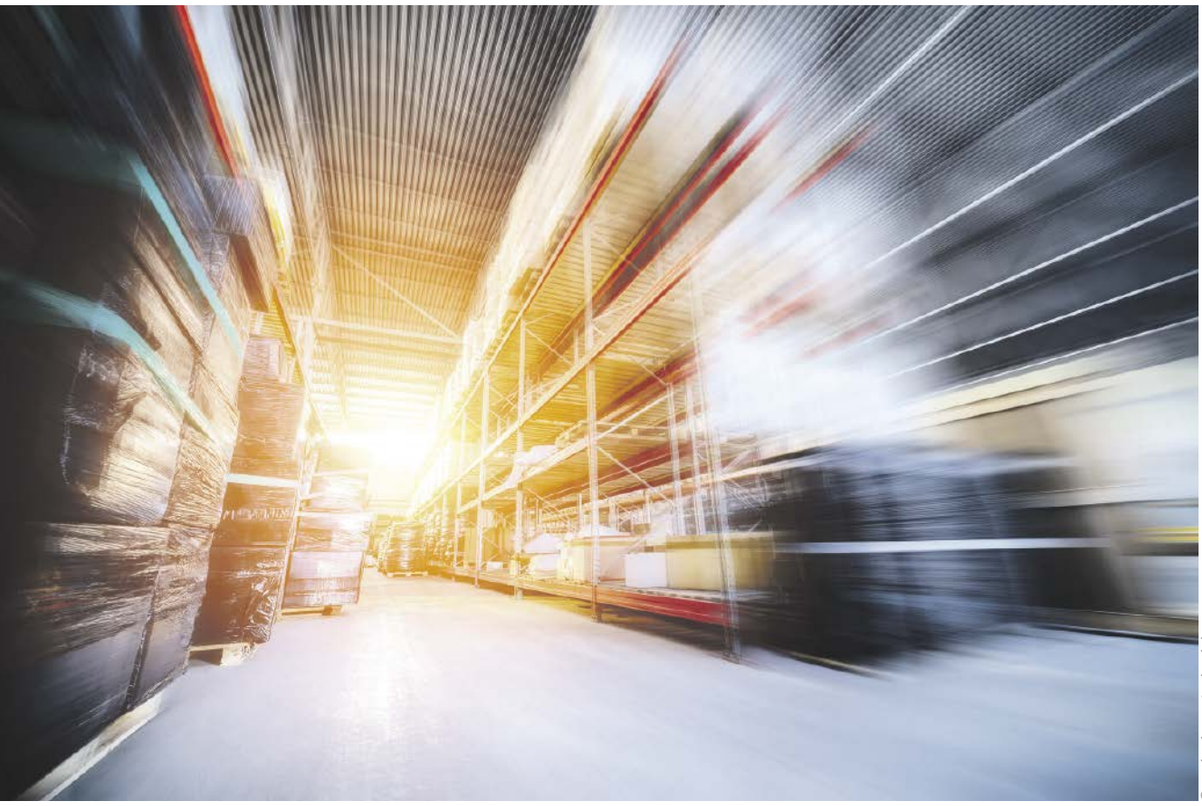
Achim Sponheimer, Miebach Consulting



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Very often the logic is: "If the warehouse reaches the capacity limit, intelligence can't make the pallets smaller, fewer of them, or the warehouse bigger, as we do not have the power to influence the stock level itself!" This is often followed by the opinion that additional intelligence, algorithms and logic only help to suggest rearrangements, but the potential is not real, as "the old technical equipment will not be ready for this technological leap". This view of the situation will become a self-fulfilling prophesy unless one starts looking at it in a more holistic way: It is not solely the planning, the logic, or the techniques, but the joint approach that is able to improve logistics significantly.

The first approach for reducing stock levels is not in the influence of the warehouse managers, but e.g., in changes of market demands, sourcing strategies, and internal alignments—especially for work in progress.

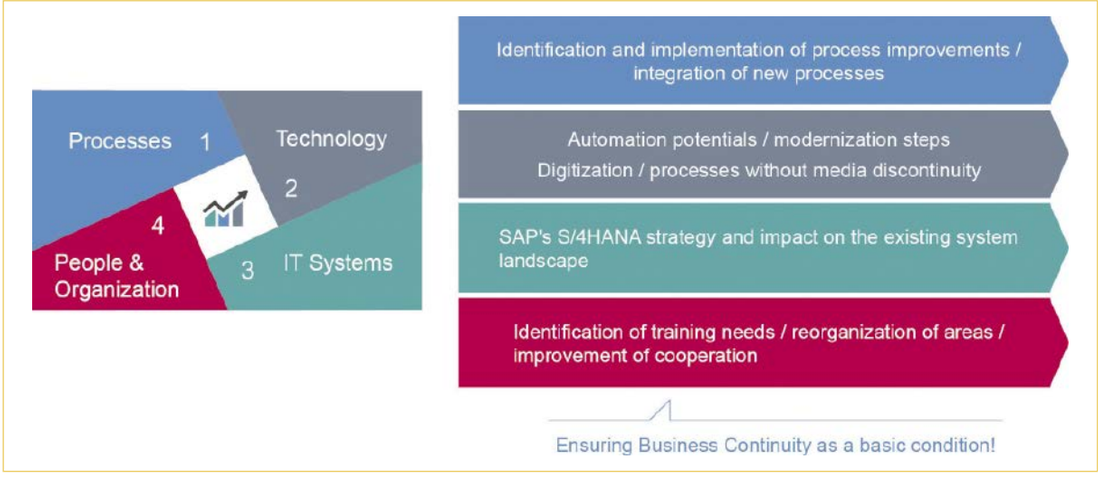

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Fig. 1: Holistic view on processes IT technology people

Implement Changes

The answer for optimization of these factors can be given by a resilient simulation study in a digital twin, where stock levels can be optimized in a multi-echelon approach, integrating the different levels of supply in the digital twin to prove how much the risk level changes and what kind of stock level is truly needed — instead of increasing stock levels based on the gut feeling of human planners.

But to implement the changes in daily work, the acceptance of staff (especially at the planning level) is needed first. In order to get this ac-

ceptance all processes should be aligned with a decent and integrated S&OP approach (Sales & Operations Planning), or better, with a full IBP integration (Integrated Business Planning). To learn this new way of working cannot be done overnight and requires proper change management. This does not mean to set up hasty training sessions shortly before going live after a decision has been made, but accompanying the whole process of change "with the people" and not "against the people", gaining acceptance and buy-in on the changes right from the conceptual level. Finally, more important than to teach the new processes is to make the staff to "unlearn" the old ones.

If these kinds of optimization potentials are utilized, the next step should lead to a retrofit and/or tuning of intralogistics automation. This part of retrofitting and tuning of the existing logistics center or the existing automation is a cost-optimal and efficient alternative to new construction. The optimization includes processes and existing IT solutions, space, warehouse technology as well as people & organization.

For the logistic optimization with a retrofit/tuning, the following issues could be addressed in questions like:

- **How can we get additional throughput?**

Some examples of how this can be done include: shortcuts in conveyors, partly automating heavily loaded bottlenecks, or HRC (human robot collaboration) in selected areas with the help of an AGV (automated guided vehicle), or even AMRs (autonomous mobile robots). The effectiveness should be confirmed beforehand by a simulation in a digital twin which avoids misinvestments.

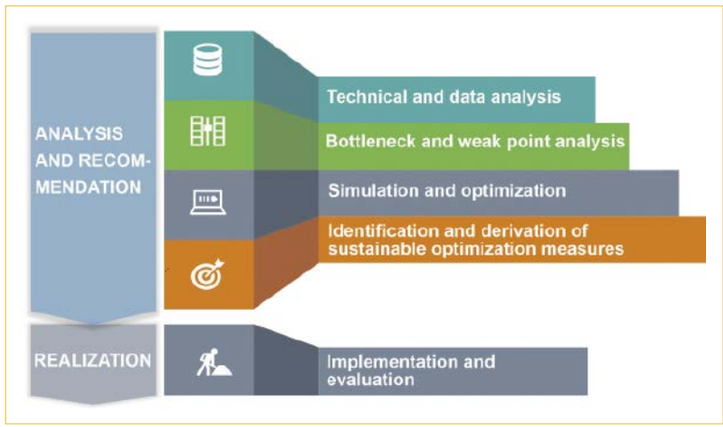

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Fig. 2: Structured and pragmatic approach from analysis to implementation

- **What are the typical quick wins to get additional capacity?**

Discussing or challenging the stock level with other departments regarding sourcing strategy, etc., should be the first step. If not fruitful, then the already mentioned Multi-Echelon Inventory Optimization (MEIO, again based on a digital twin) will help to confirm the results and convince the concerned colleagues that other parts of their network can act as a backup. But if all of the above mentioned does not help, then the physical modifications of warehouse and/or racking have to be considered, like changing the height of pallet locations to avoid "dead space", or even thinking of a higher-density storage technique (of course always depending on throughput demands).

- **Which systems and technologies need to be replaced to ensure the availability of the overall system, and which approach fits best to my goals?**

This question is not easily answered, especially regarding which kind of new technology to choose. The best answer is a clear: "it depends!" since the answer definitely demands a deeper analysis to fit to the specific needs of the situation.

Some of the new technical possibilities will bring benefits, especially when processes are supported by Cyber Physical Systems (CPS) for a smart relieve of people from manual workload. Workstations, workpieces and transport equipment are networked in such a way that they communicate with each other and prepare the next process step. Production planners monitor progress and only intervene in the event of deviations.

Previous steps in development of these systems were done by supporting elements like pick-by-technologies (pick by light, pick by voice or pick by vision using smart glasses). New possibilities are also offered by intelligent load carriers, which always know their stock and re-order independently if necessary.

Warehouse and production are connectable by internal transport. Autonomous forklifts allow automatic unloading of goods deliveries. AGV/AMR navigate independently optically or by laser. New generations of technologies are more easily adaptable then the ones before. Implementing an AGV (automated guided vehicle) was much more complicated than an AMR (autonomous mobile robot) which is not dependent on fixed routes, is a simpler installation and is able to reroute if unknown obstacles block its path.

- **How is the implementation carried out during operation and how can we make sure that transition goes smoothly?**

This question is one of the most crucial ones to be aware of before the implementation starts and while the transitional concept is developed. While there is no standard procedure, there is one common step: Simulate the changes in your digital twin before the implementation starts and confirm the feasibility with established service-levels in order to safeguard your investments and processes.

Successful optimization begins with a holistic view of processes, IT solutions, technologies and people & organization. Miebach uses simulation as the best way to quickly examine capacities and obstacles, weaknesses and potentials of these cost and value drivers. The simulation and data analysis tools support our clients in determining the optimal adaptation of your existing system and its effects on the overall network.

But all in all, a digital twin will become a central component of the ongoing digitization and optimization of processes. It continually presents a virtual copy of the logistics, the production system and the products. This means that order status, machine availability, stock levels, transport capacities, current position, processing status, quality defects and other information can be called up at any time. Changes to the real system can be realistically tested on the digital twin at any time in advance, and that ability will be a "must have".

Be sure to include internal experts or an external partner when planning or implementing your warehouse tuning and/or retrofit. An external partner should have experience supervising the entire retrofit and tuning process from design through go-live in multiple projects, as each is unique. Your goal is to improve your performance, and not beta-test a new technology for an integrator.

Achim Sponheimer, Partner & Head of Pharma, Miebach Consulting GmbH, Frankfurt am Main, Germany

www.miebach.com

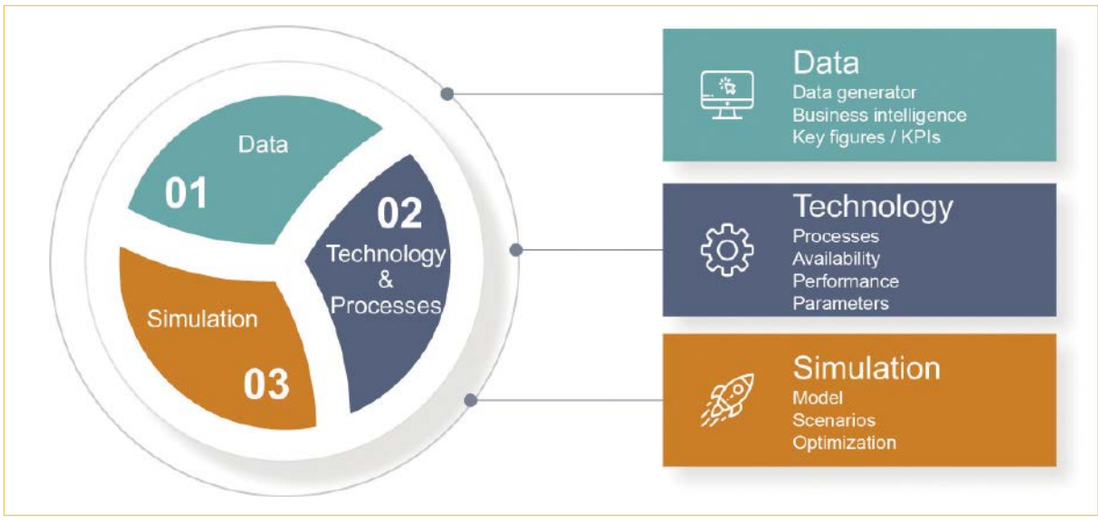

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Fig. 3: Methodical implementation in three areas to achieve the goals

And the Winners Are: Affix Labs, Caphenia and Senorics

Expert Jury Selects Three Start-ups as Winners of CHEManager Innovation Pitch 2020

The CHEManager Innovation Pitch, CHEManager's start-up support initiative, entered its third year in January. Last year, supported by our sponsors 5-HT Digital Hub, JMP, Plan-B, Flanders Investment & Trade and Heraeus, we presented 22 start-ups with their ideas—twice as many as the year before. But that wasn't the end of the 2020 cohort, as there were still the CHEManager Innovation Pitches of the Year to be selected.

At the end of January, a jury of experts selected in a virtual session three winners from these 22 start-ups from seven countries that had been given the opportunity to present themselves as part of the CHEManager Innovation Pitch initiative over the course of the past year. One winner was selected in each of the categories „Value to Society," „Value to Industry" and „Value to Sustainability".

The winner in the „Value to Society" category is Affix Labs. The start-up from Finland fought a neck-and-neck race with the German start-up MK2 Biotechnologies and ultimately won by a narrow margin.

In the „Value to Industry" category, Senorics came out on top ahead of Holo-Light from Austria and Hafnium Labs from Denmark.

And Caphenia won the „Value to Sustainability" category just ahead of IVOC-X and Ineratec from Germany and Cellugy from Portugal, which were tied for second place.

The expert jury consisted of the following members: Andrea Gruß, (CHEManager), Ann-Kathrin Kaufmann (Biocampus Straubing), Tine Schaerlaekens (Catalisti/Flanders Investment & Trade), Holger Bengs (BCNP Consultants), Martin Demel (SAS Institute/JMP), Matthias Hoerteis (Heraeus).

The experts particularly emphasized the diversity of the ideas implemented by the 22 start-ups, which are not only relevant to industry but also to society. CHEManager took account of this diversity in advance by awarding prizes in three different categories. (rk)

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Publisher
Wiley-VCH GmbH
Boschstr. 12, 69469 Weinheim, Germany
Tel.: +49 6201 606 0

General Managers
Sabine Haag
Dr Guido F. Herrmann

Publishing Director
Dr. Heiko Baumgartner

Product Management + Managing Editor
Dr. Michael Reubold
Tel.: +49 6201 606 745
michael.reubold@wiley.com

Editor in Chief
Dr. Ralf Kempf
Tel.: +49 6201 606 755
ralf.kempf@wiley.com

Freelancer
Sonja Andres
Dede Williams
Elaine Burridge

Media Consultants
Thorsten Kritzer
Tel.: +49 6201 606 730
thorsten.kritzer@wiley.com

Jan Käppler
Tel.: +49 6201 606 522
jan.kaeppler@wiley.com

Production Managers
Jörg Stenger
Melanie Radtke (Advertising)
Oliver Haja (Layout)
Ramona Scheirich (Litho)

Team Assistants
Bettina Wagenhals
Tel.: +49 6201 606 764
bettina.wagenhals@wiley.com

Lisa Colavito
Tel.: +49 6201 606 316
lisa.colavito@wiley.com

Beate Zimmermann
Tel.: +49 6201 606 316
beate.zimmermann@wiley.com

Wiley Reader Service
65341 Eltville
Tel.: +49 6123 9238 246
Fax: +49 6123 9238 244
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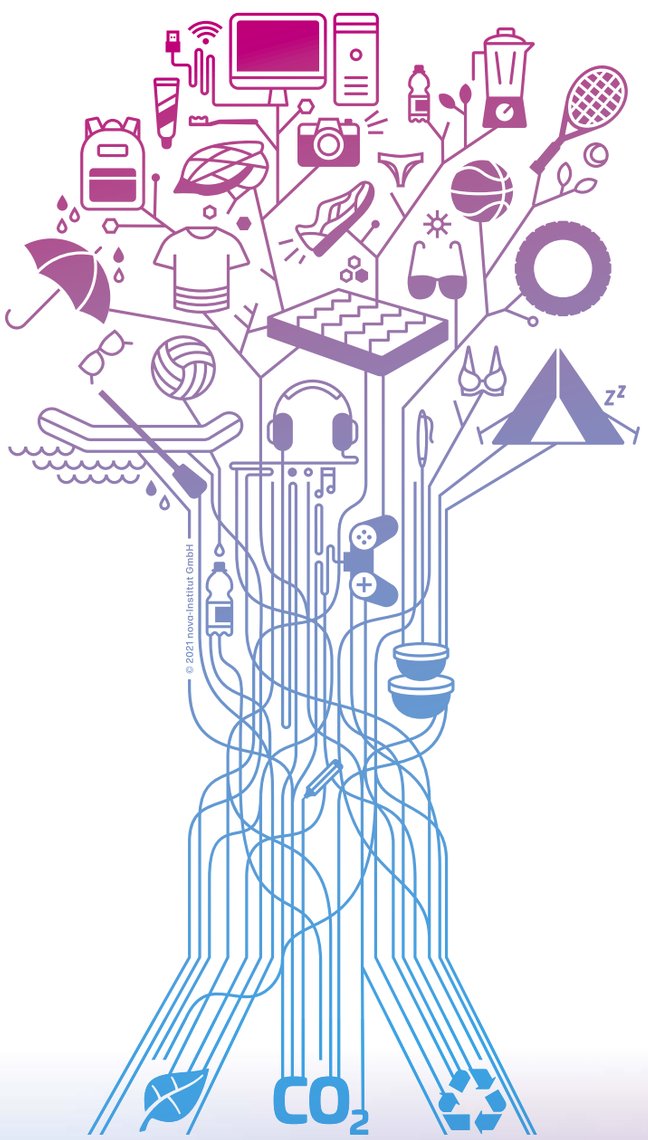

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