

# CHEMManager

## EUROPE



### Markets and Companies

What will the chemical industry look like in 2050?

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THE NEWSPAPER FOR THE  
CHEMICAL AND  
LIFE SCIENCE MARKETS

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The growing popularity of bio-based chemicals.

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#### People

Mark Costa will take over the reigns as Eastman president immediately and as CEO on Jan. 1, 2014. He will be replacing Jim Rogers, who will serve as board chairman.

Kenneth Lane has taken over as president of BASF's catalysts division in New Jersey. He replaced Frank A. Bozich.

Dr. Thilo Kaltenbach has joined Arthur D. Little's pharma and healthcare practice. He previously worked for PwC.

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## Sorting Out Winners From Losers

Distribution Offers Opportunities for Chemical Producers as a Potential Source of Top-line Growth

### New Markets, New Approaches

Opportunity still abounds for chemical distributors to win more business, as chemical producers look to them to provide ever more sophisticated and differentiated services. The chemical industry used to drive growth by inventing breakthrough molecules and new products, which companies were able to develop into large sales and profit generators. However, the ability to drive growth from new molecules per se seems to be trailing off, yielding increasingly marginal and incremental growth rather than the breakthroughs seen in previous decades.

In comparison, the customer interface, new approaches to customers in mature and emerging markets, as well as integration of end-to-end distribution and marketing capabilities, are likely to offer a richer seam of opportunity based on two main growth drivers: emerging markets and new approaches to customers.

The shift in economic growth to emerging markets has led to demand growth across all chemical product categories. The demand for chemicals tends to increase at a rate slightly above gross domestic product (GDP) because the greater use of chemicals drives industrial productivity and the performance of end-products. As a result, gross trade (that is, the sum of exports and imports) in chemicals has grown on average by 10% a year between 2000 and 2011.

In particular, high growth markets exhibit correspondingly high trade growth rates. For example, gross trade in chemicals in China grew by more than 13%, with imports expanding by 16% and exports by close to 14% each year.

On a customer level, the definition of distribution and supply chain offerings and their integration with marketing can create innovative propositions, point of sale interactions or two-way customer dialogues. Speed and precise timing of delivery, additional information including digital support and customized interactions are increasingly important buying criteria for customers and are therefore critical sources of growth for chemicals manufacturers.

#### Building A Competitive Advantage

Leading chemicals manufacturers are increasing their emphasis on differentiated services and go-to-market propositions as a way to build a competitive advantage. This is in contrast to the default position



Götz Erhardt, Managing Director, Resources Industry Group, Accenture

of simply turning to third-party distributors.

Third-party distributors have responded to the opportunities presented in new markets by accelerating their growth through acquisitions in emerging markets, and by building global sourcing and distribution capabilities.

As industries in emerging markets tend to be more fragmented with a greater number of smaller companies compared with the more mature and consolidated industries in developed markets, creating the right distribution capabilities can be a challenge. To date, chemicals manufacturers have pursued a mixed approach that combines their own and third-party distributor resources. However, to capture the full potential for growth from distribution activities, chemical manufacturers need to address some key challenges.

A number of sizeable barriers prevent chemical businesses from seizing the growth opportunities that distribution presents. But few, if any of them, are imposed by external constraints.

At the highest level, there is a lack of senior management attention to distribution's potential. The prevailing perception is that distribution is a cost to be managed, rather than a decisive growth driver.

This is typically linked to a static view of markets, customer industries and customers and a reactive approach to emerging growth areas.

Last but not least on the operational level, the lack of management attention leads to gaps in operating models, typically caused by a lack of process optimization and of undifferentiated services.

In response, we see a clear trend developing whereby leading chemicals manufacturers will begin to address these barriers, and in doing so, start to realize the potential of distribution to deliver growth.

Chemical manufacturers still largely treat distribution as a cost to be managed rather than a potential source of top-line growth. On the other hand, leading third-party distributors pursue growth strategies comprising organic investments and acquisitions. But, by far, the largest proportion of revenues and customer interactions are handled directly by chemicals manufacturers.

While third-party distributors have grown their market share over the past few years, it is still the case that 90% of distribution is managed in-house. Chemical majors have significant global investments in storage, logistics, marketing and sales. But they need to change the way they think about their distribution activities and exploit these assets more effectively.

**There is a lack of senior management attention to distribution's potential.**

Today's typical management approach to smaller customers and products is often to transfer them to a third-party distributor owing to their perceived lack of profitability. In doing so they may be missing valuable opportunities to interact effectively, shape new product and service propositions and get closer to their customers to generate value.

#### Shifting Models For Growth

The root cause of insufficient profitability is often the lack of detailed attention paid to process optimization and system support. It is noticeable that leading companies such as Germany's BASF and U.S.-based Dow Chemical have invested in process and system optimizations

to enable better multichannel management and the provision of profitable offerings for small customers and small products.

That means, for example, focusing on the speed and precision of delivery, optimizing complexity of products and bundles and offering customers efficient delivery volumes. Delivery and offering capabilities like these will also become increasingly important as emerging markets are becoming more and more important for growth.

The shift in demand growth from developed to emerging markets requires distribution capabilities to compete for new business opportunities in those territories. Very often, chemicals manufacturers use third-party distributors to enter these markets, as their distribution, marketing and sales capabilities are not

sufficiently optimized to support a market entry by in-house resources. However, this approach may act to slow down the development of the required business territory and customer intelligence, as developing management attention and two-way customer interactions need to go through an additional interface between third-party distributors and chemicals manufacturers.

#### Acting On Market Opportunities

More agile, flexible and responsive operating models are also a prerequisite for reacting quickly to market changes and resulting new opportunities. For example, rising oil prices increase the use of oil field chemicals to squeeze out incremental oil volumes from existing wells

and open up growth opportunities for oil field chemical providers. To capture these benefits requires both market intelligence and the ability to respond to opportunities rapidly, along with the operational ability to assemble and deliver the right formulations and product portfolios.

Achieving that agility involves a combination of information and intelligence as well as process excellence to address new opportunities quickly and on a global level. In that way, chemical makers will be able to respond to opportunities with capabilities to ship the right product to the right customer at the right time.

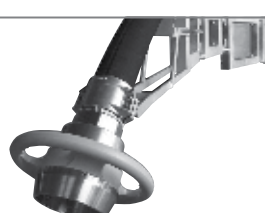
#### Determining Winners And Losers

Driving value from distribution requires a change from a cost-focused to a growth-driven view of distribution and the implementation of agile operating models, typically with a cross-functional alignment of marketing and supply chain. Shaping the required organizational interfaces and processes are decisive to accelerate growth and move beyond the traditional functional silos in, for example, marketing, distribution and supply chain.

Identifying how to respond to customer needs and having the capabilities in place across the supply chain will become ever more important, particularly in emerging markets. The small- and medium-sized businesses in those markets today could well be the large and highly profitable customers of tomorrow.

Chemical businesses need to assess the optimal route and timing to building their distribution assets and personnel for those markets in order to capture the growth they undoubtedly represent. As they do so, it will be their ability to implement efficient and customer-focused distribution that will increasingly differentiate the winners from the losers.

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## Dow Suffers New Setback in Urethanes Price Fixing Case, Pockets Kuwaiti Cash

A U.S. federal court in Kansas has upheld the \$400 million verdict against Dow Chemical for conspiring to fix prices for urethane chemicals MDI and TDI and simultaneously tripled the fine to \$1.2 billion. Judge John W. Lungstrum cited anti-trust procedures in the Sherman antitrust Act as the basis for tripling the penalty proposed by a jury in February.

An attorney for the U.S. chemical giant said the company will appeal the ruling, as it believes the statistical formula used to calculate the penalty was flawed. Dow has always denied the allegations pertaining to the period 1999-2004. Other implicated chemical producers, also denying any wrongdoing, settled out of court. Bayer MaterialScience accepted a fine of \$55.3 million, BASF paid \$51 million and Huntsman \$33m. LyondellBasell, in Chapter 11 bankruptcy protection at the time of the proceedings, was released.

The charges were sought by customers who alleged that their

suppliers met secretly to discuss prices and markets. Some of these foamers subsequently were sued by their own customers on price-fixing charges.

In other news, Dow has accepted a \$2.19 payment from Petrochemical Industries Company of Kuwait (PIC), ending its protracted dispute with the Middle East company over the failed joint venture K-Dow. The payment is less than the \$2.48 billion awarded by the international court of arbitration of the International Chamber of Commerce (ICC). In early May, Dow May agreed to forego interest in exchange for PIC's promise not to take retaliatory or punitive actions.

The planned JV was cancelled by Kuwaiti authorities three days before its intended start-up on 1 January 2009. Dow successfully argued that it had relied on a \$7.5 billion contribution to the proposed new company to fund its acquisition of Rohm & Haas. (dw)

## Logistics JV Links German and UAE Firm

German chemical logistics firm Talke and RSA Logistics of Dubai, United Arab Emirates, have founded a joint venture to build and operate a state-of-the-art logistics facility in Dubai Logistics City. The JV, to be called RSA-Talke, will have capability to handle and store hazardous materials in a new terminal offering 19,000 pallet spaces and expected to

be in operation by the first quarter of 2014.

"The production as well as the import and export of speciality chemicals is gaining importance in the Gulf region," said Richard Heathe, director Middle East & Asia at RSA-Talke.

## Bayer Integrates Teva Animal Health Portfolio

Bayer HealthCare has begun marketing products of the former Teva Animal Health, acquired at the beginning of 2013, in the U.S. market under its own name. The addition of more than 75 products complementary to the German group's portfolio will enable a presence in most major therapeutic areas, the Bayer sub-group said. Over the next 12-18 months, additional product from the former Teva DVM line will enter the market through the veterinary channel.

"The rapid introduction of the widely recognized and respected DVM brands shows how the acquisition fits well with our strategic goals to strengthen and broaden our range of animal care solutions



**Ian Spinks**  
President and General Manager, Bayer Health-Care Animal Health

for companion animals in the U.S. market," said Ian Spinks, president and general manager, Bayer Health-Care's Animal Health division.

Since the acquisition in January, Bayer's focus has been on re-mediating brands while maintaining quality, and re-introducing the most needed products back into the market," added marketing manager David Van Brunt. (dw)

## Drug Industry CEOs Plotting More Carve-outs

A new generation of drug industry chief executives is stepping up plans to divesting slower-growing and maturing operations, thus opening up new opportunities for deal makers, participants in a recent health summit organized by Reuters.

"The mindset has changed with a new generation of CEOs, Ercument Tokat, partner at investment banking and advisory firm Centerview Partners, told the summit, adding that "investors love the fact that they are thinking creatively, thinking shareholder-friendly." In the past, Tokat said, there was a lot of revenue protection. The new attitude is said to be reflected in a willingness to consider whether other companies

may be better owners for certain assets. Recent attention has focused on Pfizer, which has already spun out its animal health operations into Zoetis, sold its infant nutrition business to Nestle and set up a unit for older off-patent drugs that could be sold in future. In April, GlaxoSmithKline announced plans to bundle many of its drugs into a new unit in a move that the company said would give it "optionality" on a potential future spin-off. Johnson & Johnson is considering selling its diagnostics business or turning it into a stand-alone company, while Sanofi also is reported to be weighing similar strategic options for the company's portfolio of older drugs. (dw)

## Bayer MaterialScience to Quit Carbon Nanotubes Research

Bayer MaterialScience (BMS) has announced plans to stop work on carbon nanotubes (CNT) and refocus R&D activities on fields linked more closely to its core portfolio. The company said it had not yet precisely determined how to use the know-how gained. However, much of the findings were already shared with external partners in the Innovation Alliance Carbon Nanotubes, which is based at Düsseldorf, Germany, and has about 90 members.

While BMS still sees "huge potential" for carbon nanotubes, CEO Patrick Thomas said applications that once looked interesting from a technical standpoint are either "currently very fragmented or have few overlaps" with the high tech plastics producer's portfolio. Thus, "ground-breaking applications for the mass

market relating to our own portfolio and therefore comprehensive commercialization are not likely in the foreseeable future."

Nevertheless, Thomas said the research has provided an important basis for a possible later use of CNT, such as in the optimization of lithium ion batteries. "We are currently in contact with potential interested parties regarding the specific application of the know-how generated," he said. The alliance has focused in particular on methods for scaling up production processes and the development of new generations of catalysts and new types of products.

BMS said all of its 30 employees working in CNTs will transfer to other "suitable" positions within the group. (dw)

## German Merck Adds €100 Million to Venture Capital Fund

Germany's Merck KGaA has added €100 million to its strategic corporate venture capital fund MS Ventures, originally established in March 2009 with €40 million in funding for emerging biotech companies. The company said its venture capital fund from the outset has been "an important component" of its Merck Serono division's window to the companies developing next-generation platforms and products. The additional commitment will allow MS Ventures to "significantly expand" its investment activity.

Leveraging the respective capabilities of companies receiving seed funding and Merck's internal organization "enables us to facilitate development of innovative drugs with a greater level of clinical and commercial differentiation," said Roel Bultuis, head of MS Ventures. Along with the €100 million strategic fund, MS Ventures also manages the €100 million Merck Serono Israel Bioincubator Fund as well as portfolio companies funded through the €30 million Entrepreneur Partnership Program established to support spin-offs from Merck Serono. (dw)



## German Chemical, Plastics Producers: Modest Expectations for 2013 Growth

For Germany's chemical producers, 2013 began without the hoped-for improvement in business, but at least there was no further deterioration, the industry association Verband der Chemischen Industrie said in its report on the first quarter. Production decreased by 0.7% year-on-year. Excluding pharmaceuticals, the setback was 1.8%, as drug makers saw a more than 2% rise in output.

Industry-wide sales of German chemical producers rose by 0.5% to €45.8 billion, with selling prices up 1% against the strong Q1 2012 level. As in previous periods, foreign demand was the motor of sales; only detergents and personal care products saw improvement in Germany. Capacity utilization rates averaged 84%. Employment across the industry receded by 0.5%.

Despite the current sluggishness, chemical producers are confident that business overall will remain stable, especially as capacities are being



Josef Ertl  
President, Plastics Europe  
Deutschland

operated at full run. VCI noted that economic research institutes see a positive picture on the whole for the German chemical industry, despite the weakness in some European customer markets. Interest rates are low and access to credit easy. Moreover, German producers are competitive, and the robust labor market should boost consumer spending.

The industry association said exports should profit from the improving economy, primarily in emerging markets of China, India and Brazil. For full year 2013, it is maintaining its earlier forecast of 1.5% growth in chemical production, a 0.5% increase in producer selling prices of 0.5% and a 2% rise in sales to €190 billion.

### Plastics Industry Concerned About Competitiveness

The German plastics industry also expects modest growth in 2013 after a challenging 2012 in which polymer production sank by 3.4% to 19.5 million tons and the fourth

**When cheap energy and raw materials improve business conditions in the U.S., they deteriorate in other economic regions.**

quarter was especially dismal. At a press conference in Frankfurt, PlasticsEurope Deutschland, German arm of the European association of plastics manufacturers, said that despite further stagnation in the first months production could rise by about 1.5% in the full year.

In 2012, sales of all types of plastics made in Germany declined by 0.5% to €25.1 billion on the back of a 2% decline in home sales to €10.9

billion and a 0.8% decrease in foreign sales to €14.2 billion. Selling prices rose by 2.9% as feedstock cost increases could mostly be passed on. Employment in the plastics industry shrank by 1.8%. Capacity utilization rates were described as "acceptable."

Important German customer markets for plastics lost momentum in 2012, led by E&E with a business deterioration of 3.5%. The construction sector weakened by 1.7% and the automotive sector by 0.4%. Nevertheless the German plastics grouping's newly elected president, Josef Ertl (CEO of PVC manufacturer Vinnolit), noted that the German economy fared far better than the EU 27 generally.

German plastics exports in 2012 shrank by 0.5% to 12 million t worth €22.5 billion and import volumes by 0.4% to 8.3 million t worth €14.6 billion. This generated an export surplus of 3.7 million tons or €7.9 billion. Most of the trade volume was with the EU 27.

In their respective reports, German and chemical and plastics producers alike complained of an adverse political climate in their home market. VCI president Karl-Ludwig Kley (CEO of Merck KGaA) called on the government in Berlin to contribute to improving the competitiveness of industry rather than burdening it with increased regulation or financial responsibility for supporting renewable energy development.

There is growing concern in the German plastics industry about a perceived lack of competitiveness on international markets, Plastics Europe Deutschland said. In particular, producers see themselves

at a disadvantage against U.S. companies with access to inexpensive shale gas-based feedstock.

"When cheap energy and raw materials improve business conditions in the U.S., they deteriorate in other economic regions," said Ertl, while hinting that member companies could be forgiven for looking to the U.S. to build new plants. Germany should at least make exploration of domestic shale gas reserves possible, he said, while underlining that plastics producers, too, believe they have contributed enough cash to renewable energy.

Days before the cabinet of Chancellor Angela Merkel was due to vote on creating a legal framework for shale gas exploration on May 15, the vote was shelved when even members of Merkel's own Christian Democratic party indicated they would not support the practice. (dw)

## International Oil Giants Quit Polish Shale Gas Exploration

Amid the euphoria over U.S. shale gas reserves, Poland's ambitions of becoming a major European player have been dealt another blow. Two North American energy groups, Talisman Energy of Canada and Marathon Oil of the U.S., have announced plans to pull out of exploration in the country, citing other priorities. Talisman's cooperation partner, Ireland-based San Leon Energy, will take over the Canadian group's assets and equipment and continue exploration.

While saying that Talisman is encouraged by preliminary drilling results, Paul Warwick, executive vice president Europe-Atlantic, remarked that the company "needs to focus on what is important to our shareholders." In 2010, the Canadian player and its Irish partner signed a farm-in agreement for three blocks in the Baltic Basin. To date, they have drilled one vertical well in each block.

Marathon said it was quitting the Polish hydraulic fracturing, or

fracking, sector following "unsuccessful attempts to find commercial levels of hydrocarbon." Compatriot Exxon quit Poland in 2012, saying that exploration results were disappointing.

While currently focusing mainly on Polish shale gas reserves, San Leon, which cooperates with United Oilfield Services of Warsaw and U.S. oilfield giant Halliburton, manages substantial oil and gas projects in Albania, Morocco, Spain, Ireland, France, Italy, Romania, Slovakia and Germany in addition to Poland. The Irish company has an option to frack up to six wells in Poland.

To date, the Polish government is said to have issued more than 100 shale gas exploration licenses and drilled more than 40 test wells. However, no substantial output is expected before 2015, if then. Warsaw has had to correct figures for estimated shale gas reserves downward by 10% against its earlier estimate of 5.3 trillion m<sup>3</sup>. Rather than 300 years, reserves are now

thought to be sufficient only for a few decades.

The international oil companies are said to be unhappy about the red tape that must be cut through to do business in Poland, the absence of pertinent tax legislation and the fact that authorities require that state-owned companies such as energy company PPK Orlen, participate in exploration, despite having no experience.

Elsewhere in Europe, Germany is looking more unattractive than ever as a playground for firms interested in fracking. Just days before the cabinet of Chancellor Angela Merkel was due to draw up a legal framework for exploration, the matter was shelved indefinitely as it appeared the bill would not gain the support of even Merkel's own Christian Democrat party. (dw)

## FDA May Update Food Additive Rules

The U.S. Food and Drug Administration (FDA) has come under increasing consumer pressure to update regulations governing food additives amid growing concerns about chemical contamination of food containers and water bottles. The rules have not been revised for 50 years, at which time the agency created a list of products to be labeled "generally recognized as safe" (GRAS).

Under existing regulations, food additives producers can have their products confirmed as safe by the FDA or by hired consultants or even can declare them safe based on their own re-



search. Although the government watchdog has the option to challenge such declaration, the agency itself says this is rarely done.

According to research by the Pew Charitable Trusts' food additives project, which is conducting a three-year investigation into food additive regulation, 1,000 chemicals have been self-affirmed by industry as GRAS without notice to the FDA. The issue has gained currency through the ongoing controversy over bisphenol A (BPA), the chemical used to produce polycarbonate and epoxy resins used in can liners. (dw)

## EU To Go Ahead With Restriction of Neonicotinoids

The European Commission (EC) is pressing ahead with plans to severely restrict the use of neonicotinoid pesticides, despite an inconclusive stance among member states. The crop protection products are thought by a number of independent groups to be among the crucial factors in the decimation of honeybee populations, not only in Europe. The U.S.-based Organic Consumers Association claims that the phenomenon known as Colony Collapse Disorder has claimed 5.7 million hives worldwide, valued at \$1.61 billion, over the past seven years.

Europe's action is the world's first continent-wide suspension imposed on widely used insecticides and is considered a major victory for environmental campaigners such as Friends of the Earth. In the U.S., by contrast, a comprehensive scientific report released by the Department

of Agriculture (USDA) and the Environmental Protection Agency (EPA) rejected environmentalist calls for action. It identified the parasitic varroa mite as the main culprit, without letting pesticides off the hook entirely.

In March, the Commission's proposed two-year ban on use of the three most widely used active ingredients — imidacloprid and clothianidin made by agrochemical giants Bayer CropScience of Germany and thiamethoxam made by Switzerland's Syngenta — failed to reach a qualified majority. A second vote at the end of April also was inconclusive, with 15 states in favor, eight opposed and four abstaining. The UK and Germany, both previously abstaining, changed their votes, with the former switching to opposition and the latter voting in favor. The lack of a consensus freed the EC to act on its own.

The two-year suspension that will apply from December 2013 — five months later than initially proposed by the Commission — covers use of the three chemicals for seed treatment, soil application and foliar treatment on plants and cereals attractive to bees including corn, oil seed rape, apples, carrots and strawberries. Exceptions will be made for winter cereals and crops grown in greenhouses or in open-air fields after flowering. At the latest in two years, the newest scientific information will be considered and conditions of approval for neonicotinoids reviewed.

In announcing the suspension, Health and Consumer Commissioner Tonio Borg said the proposal was based on a number of unacceptable risks to bee health identified in an EC-commissioned study by the European Food Safety Authority (EFSA). The agency itself stopped short of recommending any action, however.

Syngenta and Bayer, which attribute the declining bee numbers to habitat loss and diseases carried by parasites such as the Varroa mite, stand to lose millions of euros in sales revenues due to the suspension, and the Swiss player accused the Commission of ignoring evidence. While Borg estimated that pollination by honeybees is worth €22 billion to European agriculture annually, the two pesticide producers, who had proposed an alternate plan, said that the move could cost the EU economy as much as €4.5 billion per year in lost crop yields. (dw)

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**In Numbers**

**5.7 million**  
hives destroyed by Colony Collapse Disorder worldwide

**\$1.61 billion**  
in losses over the last 7 years were the result

**2 year**  
restriction on neonicotinoid pesticides starts in December

**€4.5 billion**  
in crop-yield losses per year projected by Syngenta, Bayer



# Long-term Trends

## Demographic Shifts and Growing GDPs Bode Well for the Industry

**Major Changes** – During the next decades the world is poised to witness a period with the longest positive transformation in human history. With more than 9 to 10 billion people depending on the scenarios and an economy with an estimated GDP of \$280 trillion, the world will have the potential to host one of the largest, wealthiest, wisest and healthiest societies in human history. The world GDP is expected to quadruple from its 2010 levels, while China and India will not only become the world's largest economies, but also the largest chemical and pharmaceutical markets. The world average life expectancy will increase from 67 year in 2010 to 75 by 2050, with millions of people having the potential to live well above 100 to 120 years, especially in the most advanced economies.

Large improvements in GDP per capita and science will also enable the creation of new large megacities, and the world urbanization ratio in the BRIC economies will double in the next decades. The need also to address climate change — with an unprecedented carbon productivity of 90% — and resource scarcity, like water, energy and food, will also create massive business opportunities as well as formidable challenges for our society and industry. Information technology and computational progress will also have the potential to accelerate and change most of the aspects of our life, the way we work, live and communicate.

In this first in a three-part series, Rafael Cayuela Valencia, author of the book *The Future of the Chemical Industry by 2050*, takes an in-depth look at how these megatrends will change the industry landscape.

### An Industry in Growing Mode

During the next decades, the broad chemical industry is poised to quadruple in size from \$3.9 trillion sales in 2010 to \$18.7 trillion by 2050. According to an adjusted business-as-usual scenario (BAU), the chemical side of the industry is expected to grow from \$3.1 to \$14.9 trillion,



Rafael Cayuela Valencia  
global product and  
marketing director, Styron

while the pharmaceutical industry is expected to grow from \$875 into \$3.9 trillion during this period.

The world annual per capita consumption of pharmaceuticals is expected to grow from \$128 in 2010 to \$427 by 2050. On the chemical side, the world per capita demand is expected to grow from \$456 in 2010 to \$1631 by 2050; a figure that is equivalent to the chemical per capita demand in the U.S. in 2010.

Under this scenario, chemical demand will grow strongly in all regions — especially in the BRIC and REST economies. China and India would become the largest chemical market in the world with \$4,048 and \$2,903 billion in chemical sales annually — almost larger than the current size of the chemical industry in 2010. Also, China and India will become the second and fourth largest pharmaceutical markets in the world respectively, with more \$752 and \$56 billion dollars sales each, and a combined market higher than



the current size of the world pharmaceutical industry (fig. 1).

This massive growth, especially in the BRIC and REST economies, will trigger a large amount of organic and inorganic growth, growth that will trigger a spring of large and cross continental M&A activity from the BRIC and REST economies into the advanced economies.

### A Shift In Leadership

In 2010, eight of the world's top 10 chemical companies were from advanced economies; only one was from BRIC (Sinopec) and one from REST (SABIC). A similar situation could be seen in pharmaceuticals: again, eight of the world's top 10 were from advanced economies; the remaining two were from REST economies (Novartis and Roche). Considering that by 2050, the BRIC alone will host 51% of the world chemical market and 37% of the pharmaceutical one, it is to be expected that leading companies from the BRIC and REST will find themselves among the top companies in the world.

At the same time, the Indian chemical industry is expected to become the fastest growing market in the world. India with just \$63 per capita of chemical demand and \$11 per capita of pharmaceutical demand in 2010, it is expected to have a formidable growth potential in the decades to come. This becomes particularly clear when considering the fact that its GDP per capita could multiply by more than 15 times by 2050.

### The Era of Mega Companies

In a world market three to four times bigger than in 2010, it is likely that large multinational chemical companies will become formidable in size. We can expect much higher governmental presence and public scrutiny, high levels of transparency due to social networks and the clear need to address climate change and resource scarcity. Royal Dutch Shell defines this as the need of our world to become more resilient, and the chemical industry will be called into action and will be at the forefront on the solution.

In 2007, among the top 100 largest economies in the world, 47 were large corporations. Due to globalization, multinationals has tended to grow much faster than countries, even the fastest ones. Keeping this in mind, it is completely plausible that of the large chemical companies like BASF or Dow could eventually report annual sales upwards of \$150-250 billion dollars. Such mega companies will have to find new ways to relate to their different stakeholders, governments, international organizations, NGOs and society.

Again, the pressure will be higher than ever for these companies to enable emission and energy reductions. How will the industry operate with these kinds of players on the field? How will these companies adjust to the new market realities? The chemical industry has been traditionally highly exposed to societal scrutiny, but ever-expanding

companies combined with ongoing resource scarcity will lead to an even higher level of public attention; with that comes more responsibilities and obligations for the industry.

### On the Petrochemical and Polymers Side

Global petrochemical and polymer demand is expected to see massive growth in the next decades. It is currently one of the most significant industry segments, making up 37% of the chemical industry (including pharmaceuticals) in 2010. Some scenarios project ethylene demand to grow a whopping 400% from the current 120 million tons to 500 million tons by 2050. The 2010 discrepancies in per capita ethylene demand — 3 kilograms in India and 10kg in China compared to 44 kilograms in Europe and 70 kilograms in the U.S. — present a tremendous growth opportunity for global demand.

According to the BAU scenario, the chemical industry is expected to add more than new 500 world-class steam crackers (800 kilo tons of ethylene capacity) around the world by 2050 — excluding the regular replacement of all old crackers — representing a tremendous investment and growth opportunity for the industry. Interestingly, this growth will impact all three economic areas (advanced, BRIC and REST) as well as most of the individual countries, excluding Japan. In moments of economic crisis and desperation, even Europe 27 is expected to add more than 10 crackers by 2050 (fig. 2).

In this transition, China could become the largest ethylene market during the next decades, 2020–2030,

while India could surpass Europe by 2030–2040 and U.S. by 2040–2050.

### Global Growth and Massive Transformation

The chemical industry is poised to enjoy a period of formidable growth, led by BRIC and REST economies. Advanced economies will keep growing although this might be geared toward specialty products. During this period, the industry will face a massive transformation not only into its markets, players and products, but climate change will also drive a technological revolution from its products as from its feedstock. It's a bright future for the companies and markets that are able to take the lead on facing upcoming challenges.

During this transition, millions of people will be freed from poverty forever, the world GDP per capita will triple from 2010 levels to \$30,675, the highest world average GDP per capita in our history. This will enable the creation of the largest middle class population in our history — 50% of the world population. Meanwhile, the BRIC economies will see their GDP per capita multiply even more, with China and India at the front with 800% to 600% increases, respectively.

The industry will find itself having to address many challenging and conflicting issues — such as massive growth in demand while enabling emissions reduction in other industries. At the same time, the industry will be involved in massive transition, changing its feedstock (to maximize shale gas), its markets (from the advanced to BRIC economies), major players and even its technologies and way to work (from operational focus towards innovation, convergence and collaboration) while reducing its own energy and emissions.

The industry is facing probably its largest challenge and deepest transformation but also an enormous business opportunity. The challenge will be enormous, but the rewards will be equally impressive and our obligations undeniable.

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Rank	Country	Industry	% Growth
1	India	Chemical	3,816
2	India	Pharma	3,409
3	China	Pharma	1,905
4	China	Chemical	431
5	Russia	Pharma	609
6	Brazil	Pharma	527
7	Russia	Chemical	401
8	Brazil	Chemical	372
9	USA	Pharma	189
10	USA	Chemical	164
11	Canada	Pharma	140
12	EU-27	Pharma	132
13	Canada	Chemical	111
14	EU-27	Chemical	105
15	Japan	Pharma	61
16	Japan	Chemical	38

Fig. 1: Growth Ranking in % 2010-2050, Adjusted BAU scenario 2050

## The Future of Chemicals Series

- June: Long-term Trends
- July: Technological Changes
- August: Climate Change and Call to Action: An interview with the author

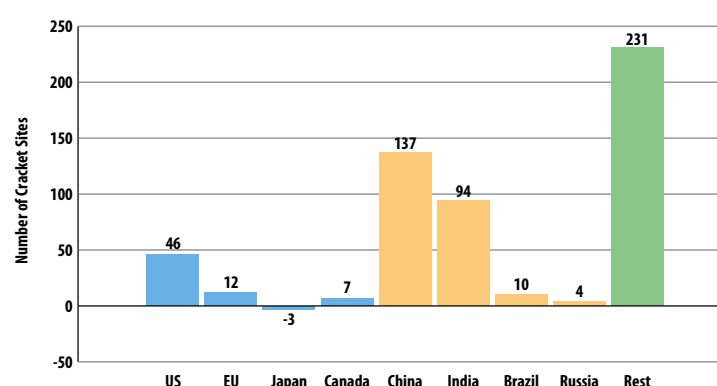
## Terminology

For the purposes of this article, the world has been segmented into three major areas:

- Advanced: U.S., Canada, EU-27 and Japan
- BRIC: Brazil, Russia, India and China
- REST: All other countries

### Additional Steam Crackers by 2050

(Capacity of 800 KT per Annum)



Source: Rafael Cayuela Valencia, *The Future of the Chemical Industry by 2050* © CHEManager Europe

## Want more? Check out the book.

Discussing the technological supremacy of the chemical industry and how it will adopt a leading position to solve some of the largest global challenges humans have even seen, this book details how the industry will address climate change, aging populations, resource scarcity, globality, networks speed, pandemics, and massive growth and demand.

### The Future of the Chemical Industry by 2050

Rafael Cayuela Valencia  
Hardcover, 332 pages  
June 2013, Wiley-VCH  
Price: €59  
ISBN: 978-3-527-33257-1



## Ineos-Solvay PVC Merger Would Help Consolidate European Market

The oversupplied European PVC market looks set to make an important move toward consolidation with the planned merger of the Solvay and Ineos businesses. In early May, the two companies signed a letter of intent to form a 50:50 joint venture that would have pro forma annual sales of around €4.3 billion and recurring EBITDA (REBITDA) of around €257

million. No timetable was given for the start-up of what would be Europe's largest PVC producer, which would employ 5,560 people in nine countries and be back-integrated into caustic soda and vinyl chloride monomer. It would have capacity to produce around 300,000 t of polymer annually, about half the current market volume.

Through its Solvin joint venture with BASF, Solvay plans to contribute its vinyls activities as well as chlorine businesses including five membrane electrolysis plants spread over seven integrated sites in Europe. Ineos would contribute its Kerling subsidiary, Europe's largest PVC producer with chlorvinyls and related businesses including three large-scale

state-of-the-art membrane electrolysis units based at 10 sites in seven countries.

The prospective partners have not announced plans to close any of production facilities. The deal's terms would allow the former British company now based in Switzerland to acquire Solvay's stake in the joint venture during a three- to

six-year period for a sum based on a mid-cycle REBITDA multiple of 5.5x. The Belgian company, which is not back-integrated into ethylene, for some time has been looking for ways of ending its PVC engagement. As part of the deal it would receive a €250 million up-front payment from Ineos, which it plans to invest in specialty businesses such as polymers

for the oil and gas sector, water and healthcare sectors as well as skin and haircare products. The latter company has been struggling with feedstock issues and previously announced plans to build a European terminal at Antwerp, Belgium, to import U.S.-produced shale gas-derived ethane. (dw)



# An Annual Cult Classic

## How One Man Turned the Jersey Shore into a Pharma Networking Hotspot

### Beach Means Business

When Billy Joel once sang about spending his weekend on the Jersey Shore, he most likely wasn't thinking about the pharma, chemical and biotech industries' best and brightest coming together to discuss the latest trends in API development. But for many in the industry, the ocean town of Long Branch has become more synonymous with valuable networking and riveting discussions than building sand castles and sizzling on the beach. The Pharma ChemOutsourcing conference, which focuses on the entire spectrum of drug development, has become one of the most important industry gatherings of its kind. The show's creator and organizer, Mark Alexay, sets the bar high in terms of attendees and speakers. "ChemOutsourcing is only as good as its last show," he said in an interview with CHEManager Europe's Brandi Schuster. "I have to shoot for the stars every year or suffer the consequences." Of course, Alexay knows that the allure of the beach can't be completely ignored; through barbecues on the beach and casino nights, he makes sure attendees can enjoy the sand and surf at the end of each conference day.



Mark Alexay, President, ChemOutsourcing



**CHEManager Europe: Organizing any conference is daunting in its own right, but you started the ChemOutsourcing on your own in 2007. How often did you get called crazy?**

**M. Alexay:** Crazy, never. Not yet, anyway. But the path has been a very unconventional since I'm neither a chemist nor industry insider.

I'm a complete outsider, in fact. As an undergraduate, I studied liberal arts and spent a semester abroad in Bogota, Colombia. Being a college student in a foreign country was a game-changer in that it gave me a very different perspective on everything, and after graduate school, I got an offer from Pfizer to work in Colombia. Two years later, I returned to the U.S. and began organizing shows for a New York City-based conference company. When that company was sold to investors 10 years later, I was forced to reinvent myself. So, I put up the ChemOutsourcing website, sent out some emails to my contacts, and the rest is history.

**What made you so confident that your idea would be a success?**

**Mark Alexay:** From the get-go, my goal was to offer a chemistry event that had never existed before: One that was content focused and aimed at the buyers rather than the suppliers of chemistry services. I took some inspiration from the Field of Dreams line, "If you build it, he will come": I knew if I could institute a high-end show that became an annual cult classic for pharmaceutical company chemists, then the suppliers would come, too.

**Once all of your planning was in place, how difficult was it to sit back and watch it unfold?**

**M. Alexay:** I was patient about letting the show develop on its own timeline. Since the show is mine, not the subsidiary of some larger corporate entity, I could afford to give it the necessary time without the tyranny of short term profit considerations driving my decision-making. I just needed to make sure the bills were paid. There has never been the need to seek external capital or paid consultants who might lead me astray. My clients are my bosses. Though I will always fear failure, which is a

strong motivator, I am confident of my capability to develop the event and respond effectively to challenges that come my way. I just need to ask questions and listen to my clients. I want this to be their event.

**You pride yourself on hand-picking conference attendees and speakers; how does this mesh with making ChemOutsourcing economically viable?**

**M. Alexay:** The strength of these one-on-one relationships over the years has enabled the show to be successful. It's all about relationships, delivering on promises, and being honest with people. The custom chemistry space is a large one and if the show grows and consequently gets better, then that would make me happy. If it doesn't, that's fine, too. My goal is for every pharmaceutical chemist in the world to attend every year because it's that good. Of course this is impossible to accomplish, but by setting the bar that high, it helps me focus on quality. A tradeshow is a very perishable, delicate product — I don't get a second chance to fix disasters.

**Do you have any plans to spin-off the show or to build up a similar conference elsewhere in the world?**

**M. Alexay:** No. That would spell the death of ChemOutsourcing. Like I said, the show is a perishable asset, and anything that draws people away from it or otherwise compromises its quality would be its doom. It's hard enough for people to justify three days away from the office as it is. The show hinges on attendee confidence in my ability to deliver a worthwhile show. It takes a whole year to make sure it comes off as expected.

**Working so closely with industry insiders must give you a unique view of trends in pharmaceutical outsourcing.**

**M. Alexay:** I love to talk about the industry and as the only non-chemist, I have a broader perspective. Outsourcing is about the efficiencies of globalization, expense, people, and the challenge of drug discovery. It's evident that it's going to take the whole world to discover the next generation of blockbuster drugs. These are intellectually stimulating topics.

Big Pharma has consolidated and faltered over the past 15 years. Though drug discovery and chemical synthesis really are "rocket science," the continued commercial viability of the industry hinges on constant, breakthrough innovation. That's a tall order. But as challenging as it is, I think humans are capable of continuous, dramatic innovation. It's the history of our species. The connections forged through outsourcing are the way new ideas are being hatched. We couldn't be successful without it.

**What do you expect to be some hot-button topics at this year's show?**

**M. Alexay:** The topics change over the years just because there are practically an infinite number of things to talk about both commercially and scientifically. But in general, people love to talk about supplier-customer relationships. It's almost like gossip, but in a good way. People love to talk about other people or at least listen in on those kinds of conversations. Talk about the future of drug development and broader themes, like the industry, are hot buttons, too.

The topics should be discussion-provoking, controversial, and fun — it's not just information, but also the way people feel when they leave the sessions to meet their colleagues. I have to set the right tone.

**Do you have any plans to further enhance the intellectual offerings at the ChemOutsourcing?**

**M. Alexay:** I hope to add a purely scientific track to complement ChemOutsourcing that would enable scientists to talk about drug discovery and related technologies in a way helps advance the field. Maybe drug product, too, on the commercial end. There are so many related areas that I'd have no excuse for not trying new things. I just need to keep taking risks and striving for excellence. I'm lucky to be able to do this and appreciate the privilege — and the responsibility that comes with it.

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# Mission (Im)possible?

– How the Chemicals Industry is Moving to Satisfy Increasingly Differentiated Customer Demand –

**Adaptation** – In chemicals, to an extent not seen in almost any other industry, increasingly differentiated customer demand is running up against a relatively inflexible supply chain. Studies show that this dilemma will intensify in the future. While European chemicals companies have done a good job of adapting their business models to various customer segments, they still need higher flexibility on the different steps of the supply chain.

Two trends, running counter to each other, can be observed in the European chemicals industry. On the one hand, customer demand has long been becoming increasingly differentiated, resulting in higher complexity. On the other hand, companies are still striving to achieve cost advantages in a difficult market environment with scale effects in their supply chains.

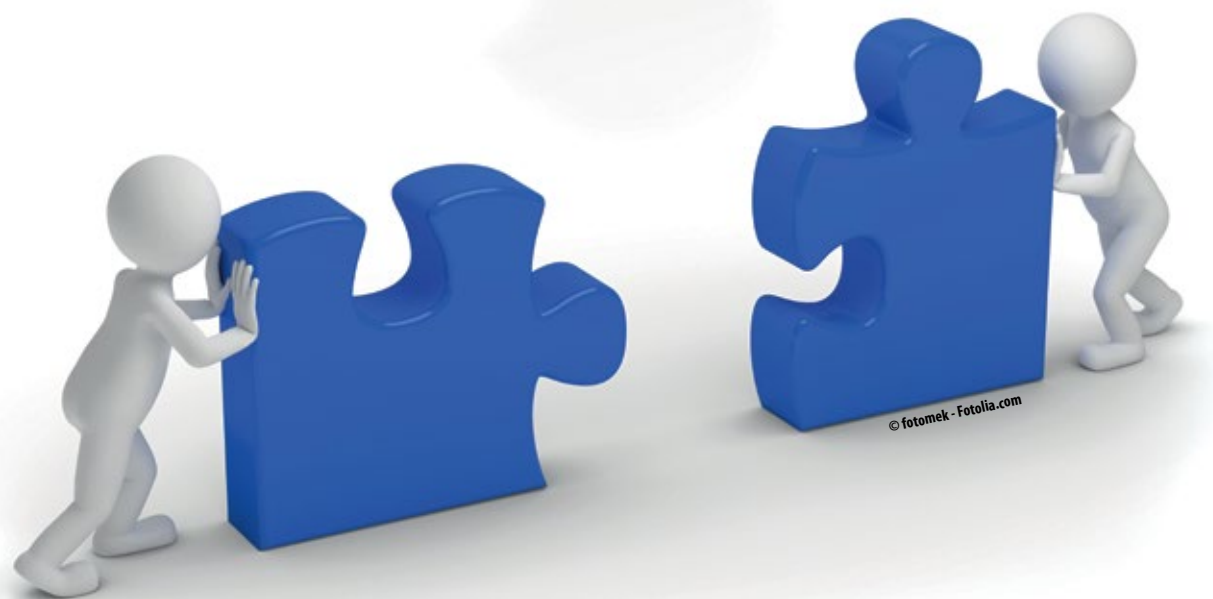
The dilemma is clear: How to satisfy differentiated customer demand with a high-scale supply chain? Below, we describe approaches to solving this dilemma. First, however, it is important to define the market environment and goals of possible initiatives to address the described dilemma (fig. 1).

## Pursue One Goal, but Don't Neglect the Other

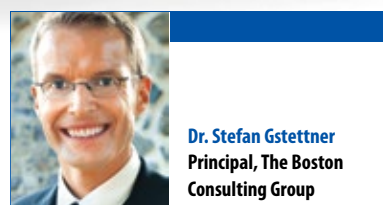
Two approaches have proven effective in solving dilemmas like this: Reducing unnecessary complexity and improving agility. But if a company does one without neglecting the other, true competitive advantage can be achieved with supply chain management — when the reduction of complexity and the improvement of agility are complementary.

### Approach 1: Reduction of Complexity

The biggest challenge in the management of supply chain complexity is distinguishing between valuable and unnecessary complexity. Therefore, upon starting a course of complexity reduction, a company must analyze which product and service features are perceived by customers as valuable and which they consider unnecessary or do not even notice. At the same time, the company must determine which products and ser-



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vices in the supply chain are the sources of the most value-impairing complexity.

In the "handshake approach," these two perspectives are combined and visualized, such as in a heat map. This allows the company to identify the largest unnecessary drivers of complexity.

### Approach 2: Improvement of Agility

Improving agility means taking specific action to increase the flexibility and speed of the supply chain. A supply chain focused purely on efficiency is often lacking on these two counts.

When the agility of the supply chain needs to be improved, all units are analyzed for the degree to which they support the sustainable realization of higher flexibility and speed for the fulfillment of customer demand. In particular, this includes supply chain transparency, length, and design, the quality of demand forecasting, planning processes, make-or-buy decisions, and inventory management.

Whether one approach or the other seems more important — that is, if the desired basic optimization of supply chain performance can be better achieved by the reduction of complexity or by the improvement of agility — or whether the two approaches can be applied in a complementary manner ("pursue one goal, but don't neglect the other"),

can often be decided with a direct comparison of possible measures.

Concrete decisions must often be made in regard to the following questions:

Does it make more sense to take a product group from the market (to reduce complexity) or to outsource its production (to improve agility)?

- Is product diversity the reason for weak delivery performance (a hallmark of complexity) or does it stem more from low-quality, undifferentiated demand forecasting (a lack of agility)?
- Are delivery times too long because production facilities have to deal with frequent capacity bottlenecks (complexity) or because suitable supply chain points for decoupling have not been defined (insufficient agility)?

### Identification of an Ideal Set of Measures

The approach developed by The Boston Consulting Group and proven in our daily work with clients is comprised of three steps and helps to identify an ideal set of measures for optimizing supply chain performance.

In step 1, the market is assessed for the exact capture of customer needs. In step 2, the company's agility and level of complexity are determined. Where does the company currently stand in regard to these two aspects, and where does it want to stand? In step 3, staggered measures are defined for short-, medium,

and long-term value improvement at the company (fig. 2).

### Measurable Improvement Proven

Agility and complexity initiatives affect the same performance metrics, but at different times. The advantage: Measures that will quickly allow the overall program to finance itself can be initiated first ("fund the journey") and structural measures tackled later.

The procedure developed by BCG brings measurable improvement in three areas:

- Direct cost reduction — such as with higher production capacity utilization and thus the avoidance of capital expenditures (CAPEX); with higher scale effects in procurement from product simplification; or with lower production errors from more effective planning processes
- The release of tied capital on the strategic and operative levels — with possibilities for network consolidation arising from freed capacities and inventory reduction
- Growth from the positive effects of more efficient use of sales capacity, and lower time to market from improved agility.

Of course, the scope of improvement depends on the starting situation at the respective company. Many companies have already achieved good ratings in key ratios such as capacity utilization (e.g., OEE) or inventory range (DIO). Nevertheless, in most cases, significant improvement is still possible.

On this topic, BCG's projects for its clients regularly achieve production cost (COGS) reductions of 3–5%, and — despite already good inventory management — a further 15–20% reduction of relevant tied capital.

These numbers make clear that European chemicals companies, in striving to prevail with successful business models in an increasingly differentiated and vertically integrated market, need the right balance between complexity reduction and improved agility. Only with these two complementary approaches can the supply chain be reinvented and significant value added sustainably achieved: when flexible customers meet a flexible supply chain.

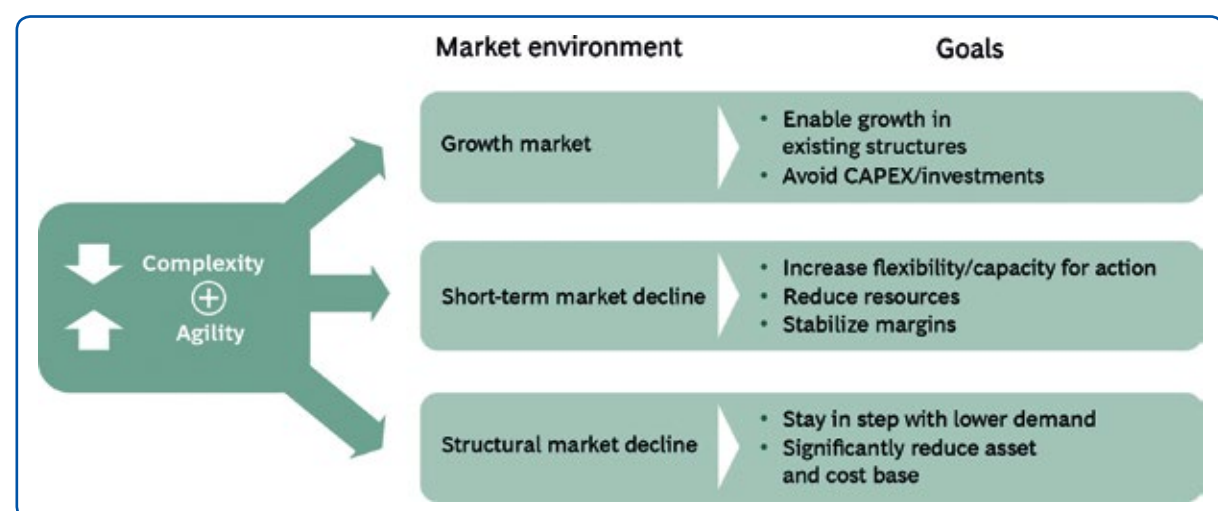


Fig. 1: Market environment and goals in complexity and agility management.

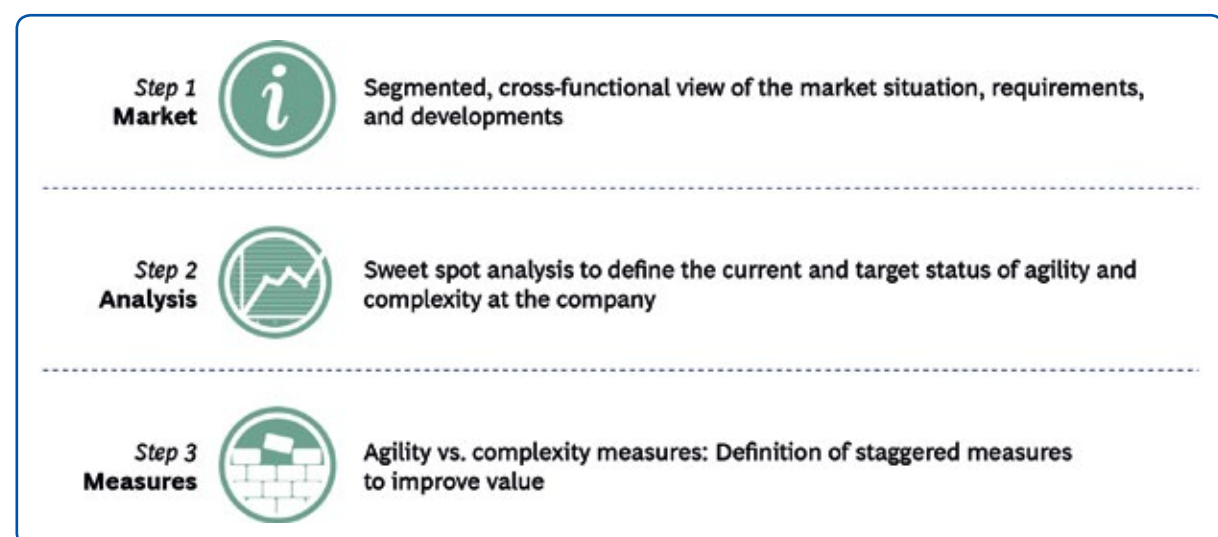


Fig. 2: Three-step procedure for the optimization of complexity and agility.

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## SALES & PROFITS

**Lanxess Off to a Weak Start** After a weak start to 2013, German speciality chemicals producer Lanxess is forecasting improvement in the second half year; however, EBITDA pre-exceptionals is likely to be below €1 billion, said CEO Axel Heitmann. In the first quarter, EBITDA pre-exceptionals fell by almost 53% to €174 million, and the EBITDA margin plummeted from 15.5% to 8.3%. The company attributed the decline mainly to lower yields from business with the rubber processing and construction sectors, but said the results represent "a generally poor business climate worldwide."

**Merck Set to Achieve 2014 Goals in 2013** Following a successful start to 2013, German chemicals and pharmaceuticals producer Merck KGaA is aiming to achieve its goals for 2014 a year ahead of plan. In the first quarter, the company reported a 4% increase in sales to €2.7 billion and a rise in EBITDA pre-exceptions to €801 million, which it attributed to organic growth, a better product mix and a more efficient cost structure. All four divisions contributed to growth, said CEO Karl-Ludwig Kley. He said full-year EBITDA pre-exceptionals "should exceed €3 billion."

**Evonik: Start to the Year Is Moderate** Group sales at chemical producer Evonik declined 4% in Q1 2013 to €3.3 billion, reflecting the divestment of two small businesses in 2012. The 10% decrease in adjusted EBITDA to €589 million is blamed mainly on lower selling prices and higher raw material costs for some product groups. The adjusted EBITDA margin receded slightly to 18.1% from 19.3%. In a "challenging economic environment," the German group's start to 2013 is described as "moderate," compared with the strong 2012 quarter, but CEO Klaus Engel said business should pick up "perceptibly" in the second half year, due to expected global economy recovery and the start-up of new production capacities.

**Borealis Sees Sharp Earnings Drop in Q1** Austrian petrochemicals and fertilizer producer Borealis blames in particular lower volume sales and earnings of its Middle East joint venture Bourouge, as well as routine maintenance and softness in the European polyolefins business for the 56% deterioration of its net profit to €61m in this year's Q1. Quarterly sales fell 5% year-on-year to €1.9 bn. Despite the setback, overall income from the polyolefins business exceeded expectations, said CEO Mark Garrett. The base chemicals business continued to bring "good results," confirming the company's expansion strategy, he added. While expanding, Borealis will "further optimise" its European operations.

**Solvay Sees Quarterly Earnings Fall** Belgian specialty chemicals producer Solvay saw recurring EBITDA (REBITDA) fall 12% year-on-year to €454m in Q1 2013, as net sales declined 3% to €3 billion. The segments Consumers Chemicals and Advanced Materials were outperformers with REBITDA up 10% and 3%, respectively, despite the absence of last year's favorable pricing conditions. Europe's economic slowdown conditions impacted all company activities, said CEO Jean-Pierre Clamadiou, warning that "we do not observe any significant improvement in the macroeconomic and business environment" in 2013. Nevertheless, he said Solvay is confident of improving full-year REBITDA before special items.

**Clariant Posts Growth in Q1 2013** Swiss specialty chemicals company Clariant reported 2% growth in Q1 2013 sales from continuing operations to Sfr. 1.5 billion, with improvement in organic primarily due to higher volumes. EBITDA pre-exceptionals from continuing operations fell 1% to Sfr 209 million and the EBITDA margin to 13.7% from 13.9%. Clariant said the business environment remained "basically unchanged" Q4 2012. For 2013, it expects a "persisting soft macroeconomic environment," with growth in emerging markets solid and no significant growth impulses in Europe and North America. Management has confirmed its 2015 targets of an EBITDA margin of above 17% and a return on invested capital (ROIC) above the peer-group average.



## PHARMA NEWS

**Lower U.S. Health Spending Persists Beyond the Recession** Slower growth in the pace of U.S. healthcare spending reflects a fundamental change in the use of medical services that could save the country nearly \$800 billion in the next decade, according to two new studies. The research disputes the claim that a slowdown in the rise of spending over the past few years was mostly due to a weak economy. Instead, the studies conclude, "a host of fundamental changes" drove the majority of the slowdown, including fewer expensive new imaging technologies and new drugs, along with the expiration of patents on many costly medicines.

**Sanofi Fined in Plavix Generics Dispute** The French competition authority has fined drug maker Sanofi €40.6 million for discouraging generic competition to its Plavix blood thinner. The decision follows a complaint filed in 2010 by Teva Sante, a French unit of Israel-based Teva Pharmaceutical Industries, against Sanofi's communication practices towards health professionals. Sanofi's communication "created a doubt over the quality and the safety of generics, without any proven basis, as nothing could demonstrate that Plavix generics were less safe than the original drug, the competition authority said in. Sanofi has denied the charges.



# Operational Excellence

## Seeking a Sustainable Structure in European Refining and Petrochemicals

### Shifts In Global Competition

The European refining and petrochemicals industry faces significant structural challenges. A declining demand for many refinery products and petrochemicals in Western Europe and, additionally, an overcapacity in many petrochemical products has created a structural cost pressure on often-underutilized assets.

Although typically fully depreciated, well-maintained and run, and often integrated into a larger product, logistics and energy network, these assets are often subscale when it comes to competing with resource-advantaged, world-scale assets in the Middle East and, soon, in the United States, thanks to America's current shale gas and oil boom, and corresponding petrochemical investments.

In refining, European capacities have been reduced from 840 million barrels per year in 2007 to 650 million in 2012, reflecting the increasing fuel efficiency in transportation, continued general energy savings and new alternative (non-oil) energy sources for heating. This trend is likely to continue with a further 1% to 2% annual decline in demand,



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managing director,  
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at least for the next five years. In petrochemicals, the capacities for naphtha crackers and for the derivatives from that cracking, especially polymers, have not been reduced in line with the demand reduction and increasing imports of petrochemicals into Western Europe.

As a consequence of those demand and supply trends, profitability in the integrated refining-petrochemicals industry, as measured by return on average capital employed (ROACE), has declined significantly over the past five years (fig. 1).

In Western Europe, the average profitability level of refining and petrochemicals is only at 6% ROACE. This is less than half the global average and less than a third of the American profitability level. If the Western European companies do not react, the profitability levels in refining and petrochemicals stay structurally low and do not earn a proper return over the cost of capital. It is necessary to define a roadmap to bring profitability levels in Western European refining and pet-



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director, AlixPartners

rochemicals back to a healthy and sustainable level. AlixPartners have identified three levers to achieve that goal, which could structurally double profitability levels from 6% to 12% ROACE (fig. 2).

- Performance excellence – 1.5% cost savings and increased reliability/availability
- Integration of refining and petrochemicals – 2% product, logistics and energy integration, sourcing synergies, and other scale and scope effects at co-located sites
- Structural transformation – 2.5% structural effects through focusing on attractive product-market segments and appropriate pricing, restructuring or transformation of the business and operating model and asset footprint

### 1) Performance Excellence

In refineries, but especially in petrochemicals and plastics, many cost-cutting and performance improvement initiatives have been undertaken in order to improve operational excellence. However, from our project experience, there are approximately 1.5% points of additional performance potential in existing structures.

Performance excellence should rest on three pillars:

- HSE performance: Ensure compliance and minimize risks and authorities requirements. The main challenges are organizational efficiency and cultural change: Getting every employee in each of his or her daily actions and decisions to understand the risks, report issues to the relevant party and ensure action is taken.
- Ability to operate at the desired capacity: Ensure equipment delivers the proper product within the proper specs when the margins are available. Margins fluctuate a lot, and flexibility of production decisions to capture pockets of margins should not be blocked by unplanned slowdowns or stops. The organization should be able to manage on a daily, weekly, monthly, quarterly basis problem-solving and performance enhancement combining in most cases process, maintenance and operation teams.

Cost management (fig. 3): Energy and cost reduction are the results of top-down and bottom-up actions. Obviously, capital expenditures (CAPEX) allocation is key to these two topics but is not sufficient. On the energy side, faster vapor-leak control, operating procedures, start-up procedures, etc. can influence energy costs by several percentage-points, pro or con. On the cost side, the bulk of the challenge is operations staffing and maintenance costs. Ownership of the equipment status, first level maintenance by operations team, proper start-up procedure and adequate priority management on a daily basis can strongly influence maintenance costs. For the logistics costs, restructuring the logistics function and empowering it to manage supply and costs is critical. On the variable cost side, classical sourcing challenging incumbents should be organized including capitalizing on new projects/new constructions to challenge current contracts.

In essence, there are often too many — partly conflicting — initiatives launched from the top, which are not properly prioritized and implemented at a working level. Increasing the number of initiatives further is the wrong way; empowering local people to define specific master

plans to optimize their local performance is the right thing to do. Empowerment of supervisors and middle management is key to success.

A well-balanced approach is crucial. Overly ambitious, unilateral cost reductions, which do not take into account unwanted "ripple effects" on other costs, harm the overall profitability.

### 2) Refining And Petrochemicals Integration

Refining, naphtha cracker operations and polymers are typically run as independent profit centers, which has created more transparency in performance evaluation and entrepreneurial ownership. There is, however, a limit of what performance excellence within those in-

dividual businesses can contribute to the overall performance. Especially in co-located refining-petrochemical sites there are synergies between those businesses, which can unlock additional performance and thus value potential. The obvious exchange of products between refineries and petrochemical plants offers product, logistics and energy synergies, which can be captured between the different units. This is naphtha, ethane, LPG, propylene, fuel oil and BTX from the refinery to the petrochemical plant and hydrogen, low sulfur fuel oil and pyrolysis gasoline in the other direction. Besides, there is an additional synergy potential by bundling similar

### 3) Structural Transformation

services, especially in maintenance, inspection and CAPEX projects.

Besides those operational excellence activities within the current business, there is a need to think about a structural transformation to make the refining and petrochemicals business sustainable. A focus on long-term attractive product-market segments is an important lever. For a refiner the chemical markets gain in importance. Naphtha crackers achieve their integrated product margin more and more via higher C4+ derivatives and petrochemicals and polymer players have to rethink, if they should serve all product-application markets in all regions, or if

they should focus on those segments where they can differentiate and add more value than their peers. Pricing along the value chain is an additional lever, which often offers an additional performance potential.

However, without an adaptation of the asset footprint those effects are helpful, but not sufficient to achieve a profitable and sustainable situation. Decisions on temporary shutdowns, mothballing, restructuring and redefinition of activities are additionally needed. With the further deteriorating market-competitive environment and with the decreasing restructuring costs and at least some legislative EU-support for

industrial reuse (tank farm, bio refinery, etc.) it is recommended to revise those alternative restructuring or turnaround options. Besides operatorship there is also an option to decide on best ownership. Minority positions might be given up, as other players — especially from the Middle East and Eastern Europe — are looking for market entry opportunities into Western Europe.

By pulling all three levers, it could be possible to double the average Western European profitability on capital employed within the next three years. Most important, these kinds of improvements are necessary to achieve a sustainable business model for the refining and petrochemicals industry in Western Europe.

Authors: Dr. Wolfgang Falter, managing director and Florent Maisonneuve, director, AlixPartners

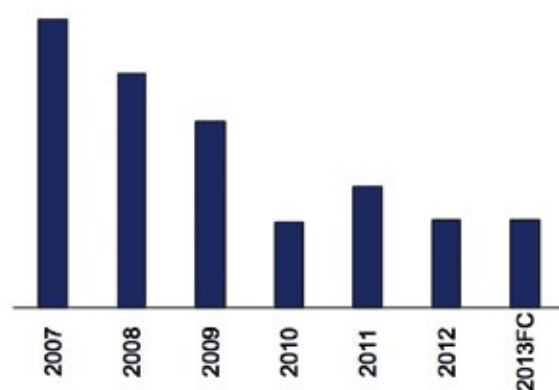
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Fig. 1: Profitability trend in the integrated refining-petrochemicals industry (2007-2013)

ROACE = Net Operating Profit / Avg. Capital Employed [€B and %]

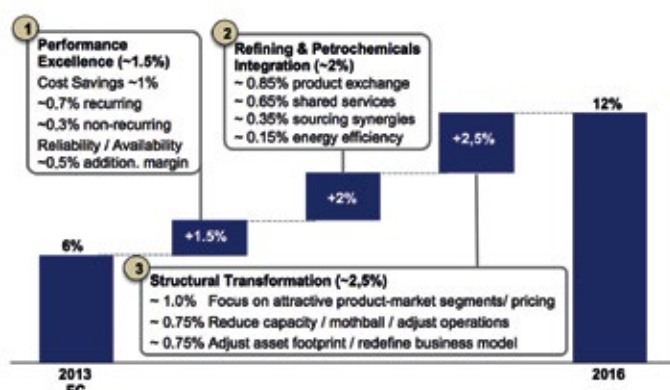


Note: estimations 2013 Forecast for refining & petrochemicals assets in Western Europe: Capital Employed in Western Europe 235 billion and Net Income 14.5 billion EUR (6.2% ROACE), EUR 155 and 8 billion by Western European players (5.2% ROACE) and EUR 80 and 6.5 billion (8.1% ROACE) by non-European players  
Source: Annual Reports, AlixPartners

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Fig. 2: Strategic 3-lever approach to increase profitability levels in Western European refining and petrochemicals industry.

ROACE for Refining Chemicals [Net Operating Profit / Avg. Capital Employed]

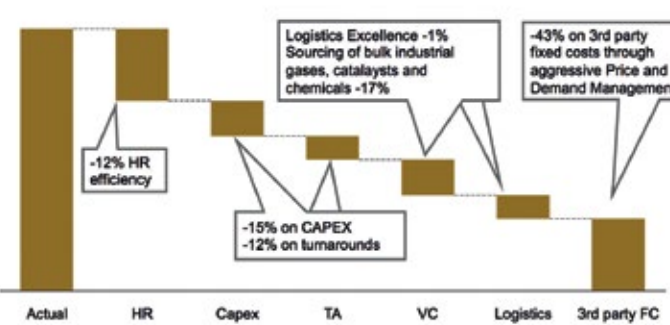


Source: AlixPartners experience in European refining & petrochemicals

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Fig. 3: Cost management

Assumed Cost Structure and Cost Saving Targets FY 2016 [%]



Costs without energy, feedstock and some off-sites. FC = Fixed Cash Costs, VC = Variable Costs, TA = Turnarounds  
Source: AlixPartners experience in European refining & petrochemicals

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# New Approach to Sustainable Innovation

Protecting Human Health and the Environment without Compromising on Performance and Efficiency

**Specialty Chemicals** – Clariant has announced a new approach to sustainable innovation. The EcoTain life cycle and label is driven by the specialty chemical company's commitment to protect human, environmental and ecological health without compromising on performance and efficiency. EcoTain represents Clariant's approach to sustainability at the product level and is being systematically rolled out throughout the company. Michael Reibold asked Silvia Ziebold, global marketing manager at Clariant's Business Unit Industrial and Consumer Specialties (ICS), Clariant



Silvia Ziebold, global marketing manager, Business Unit Industrial and Consumer Specialties (ICS), Clariant

**CHEManager Europe: The chemical industry is seeing a growing trend of eco-awareness among consumers and a strong demand for more natural, sustainable products. How does Clariant approach sustainability?**

**S. Ziebold:** Sustainability at Clariant is an integral part of the corporate strategy, and with the introduction of the new Clariant brand in 2012, "Performance, People, Planet" even became the company's core brand values. This reflects how important we consider sustainability to be. Clariant has not limited itself to compliance with legal requirements, but goes far beyond, participating in various voluntary sustainability programs — including the duties imposed by the Responsible Care Global Charter and the Global Product Strategy. Clariant has set clear, qualitative sustainability goals to match our strategic alignment, such as further increasing our system safety, improving our products through continuous research, running more efficient programs for employee qualification and stepping up communication with our stakeholders. At the product level, our EcoTain concept shows how corporate sustainability goals are "translated" into very concrete products and customer solutions.

**How does the EcoTain approach support the development of specialty chemicals?**

**S. Ziebold:** EcoTain represents a systematic approach to sustainable innovation by providing a tangible

means of understanding the ecological, economic and social impact of Clariant's products over the entire value chain. Within the framework of a four-step life cycle, EcoTain integrates the principles and ethics of sustainability into business activities according to measurable criteria. The four steps are: sustainable design, responsible process, safe and efficient use, and eco-integration.

Every EcoTain product fulfills the EcoTain requirements over its entire life cycle. The EcoTain claim "sustainable excellence at every step" is a promise that every product carrying the EcoTain label delivers advantages and benefits at each of its four life cycle steps.

**Our objective is to improve the innovation success rate and generate additional growth.**

**Clariant products serve various applications from personal and home care to crop protection and even aviation. Is the EcoTain concept suitable for the full array of these end-applications?**

**S. Ziebold:** Yes, that was one of the key requirements when we developed EcoTain. The objective was to create a concept that provides customer value and is easy to understand, but is still flexible and can be applied to products for different end-markets.

It took us some time to come up with the right concept due to the complexity of the market requirements and the different connotations of "sustainability." In our

analysis, we considered different market segments, different regions, different customer types, and all other market influencers — such as ecolabel certifier and regulatory authorities.

The final result is simple but smart. EcoTain is based on a life-cycle idea, focusing on the product development, manufacturing, consumption and disposal. This is common for all market segments — it doesn't matter if they are consumer- or industrial-driven.

**Can you explain in more detail how this concept works and what it means?**

**S. Ziebold:** It means, there are certain sustainability criteria or aspects that are relevant for all of our customers. For example, that products are based on safer ingredients or even contain renewable raw materials, that products help our customers to reduce handling efforts at their site or to increase the efficiency in the end formulation, and that products have a better environmental profile and are biodegradable. We have defined around 20 general criteria.

We also consider market-specific requirements in addition to this. For instance, the use of raw materials that are non-animal based or free of gene-modified organisms is relevant for personal care, but not for paint and coatings where the substance of concern is APEO — short for alkylphenol ethoxylates. When speaking about ecolabels, in personal care we

offer ingredients that are Ecocert certified and in paints and coatings our products are compatible with the Blue Angel or the EU Ecoflower requirements. For each market segment we have defined additional four to five business-specific criteria.

By doing so, we are able to offer sustainable products for different market segments that help our customers to gain a valuable competitive advantage.

**How does EcoTain support your customers toward achieving their targets for sustainability?**

**S. Ziebold:** EcoTain products are safer products and suitable for safer ap-



plication systems. They are more efficient in the end formulation or more convenient. Most of them are based on renewable feedstocks, are compatible with ecolabels from external certifiers or have a reduced carbon footprint. And EcoTain products can be used to replace substances that have been banned by the authorities or substances facing criticism that are likely to be banned in the future.

Two concrete examples that help our customers to achieve their sustainability targets are Hostacerin SFO, an emulsifier — based on 100% renewable raw material — for cosmetic creams and lotions, and our recycling concept for aircraft deicing fluids, such as our Safewing MPI 1938 ECO that helps to cut down CO<sub>2</sub> emission tremendously.

**When we observe the life cycle of a specialty chemical product, where or when does EcoTain enter the development process?**

**S. Ziebold:** Focus on research and development and innovation is one of the key pillars of our corporate strategy. Our objective is to improve the innovation success rate and generate additional growth of 1-2% by launching innovative products.

Already at the very early stage of a product development, the business unit Industrial and Consumer Specialties considers all internal and external requirements ranging from chemical composition, technical product properties, and production capabilities to sustainability aspects. We have a very structured approach to handle new projects and from the initial project idea to the final commercial phase we process our "checklist" from stage to stage. By doing so, we ensure we deliver innovative solutions that bring added value to our customers' formulations and that have a high potential of sustainable, i.e. long-term, business success.

EcoTain is being systematically rolled out throughout the company. Crop Protection and Paints and Coatings were the first business lines to bring their most sustainable products under the EcoTain umbrella; further business lines will follow. New sustainable ingredients are also currently in the innovation pipeline and will soon be launched under the EcoTain label.

**Does the EcoTain approach accompany the product throughout the manufacturing process from its application all the way until its disposal?**

**S. Ziebold:** A holistic approach expressed in a four-phase life cycle, EcoTain provides a means of assessing and understanding the ecological, economic and social impact of Clariant's products and business activities over the entire value chain. From the initial chemical design all the way through the product life cycle to recycling and waste disposal, EcoTain supports sustainable technologies and processes for safer chemical products.

For a product to be awarded the EcoTain label by Clariant, it should present benefits at every phase of its life cycle. And naturally it is Clariant's aim to ensure that the maximum number of criteria is met in order to live up to our goal of sustainable innovation.

**Can you give us examples of products that have been developed according to the EcoTain approach?**

**S. Ziebold:** Two examples of different market segments — personal care, and paints and coatings — may illustrate the flexibility of the EcoTain approach: First, Vitipure products are used in cosmetics, especially in skin care formulations such as anti-aging creams. Second, Dispersogen MT200 is a nonionic, surfactant-based dispersing agent for use in water-borne colorants.

**Do you have to compromise the product performance in order to meet the EcoTain standards?**

**S. Ziebold:** No, quite the contrary! Product performance and increased formulation efficiency are essential parts of the EcoTain concept and its products. EcoTain's aim is to create "sustainable business" — i.e., long-lasting business success — with sustainable products. Therefore EcoTain is a combination of efficiency and sustainability and it provides our customers with balanced cost-performance solutions. This means increased efficiency by performance boosting and/or multifunctional products and cost reductions by saving resources and higher efficiency in technology, manufacturing.

**Read the complete interview online:**

[www.chemanager-online.com/en/tags/sustainability](http://www.chemanager-online.com/en/tags/sustainability)

## Delving Deeper into Value Chain Collaboration

**Top Management Survey** – The previous edition of C3X found that the European chemical industry can generate additional sales of up to €25 billion if it is able to better exploit the benefits of supplier-customer collaboration across value chains. In the seventh edition of their top management panel survey entitled "Chemical Customer Connectivity Index" (C3X), A.T. Kearney, CHEManager Europe and the Westfälische Wilhelms-Universität Münster will now delve deeper into this topic. The survey will look at how collaboration can change a company's approach to innovation and the benefits this can generate. It will also contain a special section on structural relocation within the value chain. The survey is available at [www.chemanager-europe.com/C3X](http://www.chemanager-europe.com/C3X).

Starting May 31, the top management panel survey is entering the next round and will once again look at the issues at the top of the agenda of chemical companies and their customers. This seventh edition of C3X will continue to exam-

ine the opportunities that can arise from collaboration and will look into what has changed over the past 12 months with regard to increased collaboration. It will explore how collaboration can change a company's approach to innovation and what benefits this can generate. Are there benefits from increasing open innovation that outweigh the benefits of original, patent-protected research? How willing are suppliers and customers to share information on requirements to make sure they have better targeted innovation available?



Dr. Tobias Lewé  
partner in the Chemicals  
and Oil Practice,  
A.T. Kearney

Furthermore, C3X will look at the consequences of structural relocation within the chemical industry. The relevance of this topic is being fueled by the increasing utilization of new energy sources, such as unconventional gas and oil sands. The shale gas development in the US is playing a particularly important role in this context. As Dr. Tobias Lewé, Partner in the Chemicals and Oil Practice at A.T. Kearney, explains, "Many European chemical companies are putting their North America strategy to the test, looking for answers to two strategic questions: first, on how shale gas will affect their positioning and second, how they can benefit from this development." In this special section, the survey will address aspects such as: Is manufacturing coming back to the U.S.? In which geographies and countries do companies plan to invest

in manufacturing capacity? What can companies do to remain competitive in light of these trends?

Apart from these two special sections, the survey will continue with the standard set of questions on customer requirements and customer interface priorities. It will also once again deal with the cyclical outlook and cast a light on the consequences of the ongoing financial instability in Europe.

Between now and June 28th, executives of chemical companies as well as executives from customer industries, such as the automotive, pharmaceuticals, construction, paper, and consumer goods industries, can sign up to the top management panel and take part in the survey. By doing so, they can make a significant contribution toward improving both parties' understanding of the issues that are crucial at the interface between the chemical and the customer industries. Answering the questions of this survey will take no longer than 10 to 15 minutes. All information will be treated in strict confidence and only anonymous data will be included in the overall evaluation. As an in-

centive, participants will receive the results of the survey in an exclusively edited form. The results will also be published in the September issue of CHEManager Europe.

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### Join the C3X Panel

Until June 28th, executives of chemical companies as well as executives from customer industries can sign up to the top management panel at:  
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## In The Heart of Munich

This Year's Chemspec Billed to Be Largest Ever

**Networking** – This year marks the 28th anniversary of the Chemspec Europe, and the show has come a long way from its humble beginnings in a Manchester hotel in 1986. Considered to be one of Europe's main events for the fine and speciality chemicals market, the Chemspec Europe is expected to attract over 400 exhibitors and more than 5,000 visitors in Munich June 5-6. CHEManager Europe spoke with Steve Diprose, vice president at Quartz Business Media, which owns the Chemspec brand about what visitors can expect this year.



Steve Diprose, vice president, Quartz Business Media

**CHEManager Europe: This June, Chemspec Europe takes place in Munich, Germany. Have you further developed or refined the concept of Chemspec Europe?**

**S. Diprose:** It has become evident in recent years that in order to continue attracting visitors and exhibitors, we needed to evolve from a simple trade exhibition to an event where people could not only network, but also enjoy a learning experience as well.

**How have you integrated this learning experience into the show?**

**S. Diprose:** We now work with a number of industry and academic partners to host a number of lecture theatres featuring a wide range of subjects — from regulatory to pharma outsourcing to flow chemistry to a career clinic and many others beyond. In total, there are 12 conferences/seminars nearly all of which are free to attend.

**What kind of an effect is the location having on exhibitor and attendee registration numbers? Have you experienced differences of locations in terms of the appeal of a city or the proximity to regional markets?**

**S. Diprose:** Being an international event, we look at a number of factors to decide where to host Chemspec Europe. Key considerations include proximity to a local industry; destination appeal; good facilities and transport infrastructure. All of these factors have a bearing on the

profile of the audience; although, interestingly, our total trade attendance tends not to vary by more than 10% at around 5,000 visitors from 60 countries. We do generally see an upsurge of visitors from the host country, and Germany is normally the most popular country across our exhibitor base. Munich 2013 will be the largest Chemspec Europe on record and certainly has the highest level conferences and seminars. I guess that proves that point as Munich really fits all the criteria as an ideal conference location.

**How have the needs of exhibitors changed?**

**S. Diprose:** Fundamentally, the needs of our exhibitors have remained fairly constant: They wish to have face-to-face meetings with existing and potential new clients. What they recognize and have helped us to evolve via our advisory panel is the current offering of Chemspec's transformation from a standard trade exhibition to an industry event and international meeting point. For example, destination venues, content subjects and networking opportunities have all been passed and approved by the panel.

**Specialty chemicals cover a broad range of segments or applications. What are the most important market segments covered by Chemspec Europe exhibitors? Do you have plans to increase the importance of different market segments?**

**S. Diprose:** The beauty of Chemspec is its coverage right across the

spectrum of fine and speciality chemicals, with markets such as pharma, agro, personal care, water treatment and many others. When new market opportunities come on stream — generally we learn about these from our exhibitors — we look to acquire new data and encourage new visitors from these markets.

**Specialty chemicals producers have aligned their strategies along megatrends such as sustainability, urbanization, mobility or health. Has Chemspec Europe also implemented these megatrends into its concept?**

**S. Diprose:** We are aware of these trends, and indeed a number of our exhibiting companies and visitors are participants. However, at this time, it is difficult to understand how we could implement these in to Chemspec given our broad client range — from mom and pop outfits to the major corporates.

**In particular, do you see a growing importance of green chemistry concepts in exhibitors' product or market strategies?**

**S. Diprose:** Indeed we do, and not just at our European show. Chemspec's India and Asia shows will also include green chemistry seminars on the show floor

**After two years, there was no Chemspec USA held this year. What are your plans for going forward with that show?**

**S. Diprose:** It would be fair to say that we were unsuccessful in attracting the visitor levels we wished for at Chemspec USA. The reasons are unclear to me; in the two years we had the event in Philadelphia, we had an excellent line-up of content and speakers and should have attracted greater numbers. To have continued with the same strategy would not have been good practice towards our exhibitors for whom attending a trade show is a significant cost. It is our responsibility to ensure that they receive a return on their investment as much as possible. We are continuing to watch that market; if we feel there to be a genuine opportunity for a successful event in the future we will not hesitate to try again.

**This year, Quartz is launching the ChemExpo Africa. Who are you**



**looking to attract to that show? What role do you see Africa playing in the future of the specialty chemicals industry?**

**S. Diprose:** With the absence of a broad-based chemical show in Southern Africa, we felt there was an opportunity to expand our offering beyond our traditional fine and speciality chemicals and serve markets such as petrochemical; explosives; laboratory and test equipment; formulation technologies; packaging; etc.

We therefore created a new brand ChemExpo Africa, which reflects our expansion beyond our traditional roots. My understanding from some of our major clients and local trade associations is that Africa is set for expansion both economically and in the chemicals market. Launching at this time, we definitely feel that we will be well placed to take advantage of that growth. We have already experienced tremendous support from local companies, trade associations such as Chemicals and Allied Industries Association

(CAIA). The South African government has described ChemExpo Africa as a wonderful opportunity to display the South Africa chemical industry on the global map. Internationally strong interest has been shown from China, India and Europe.

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### Where will this summer take you?

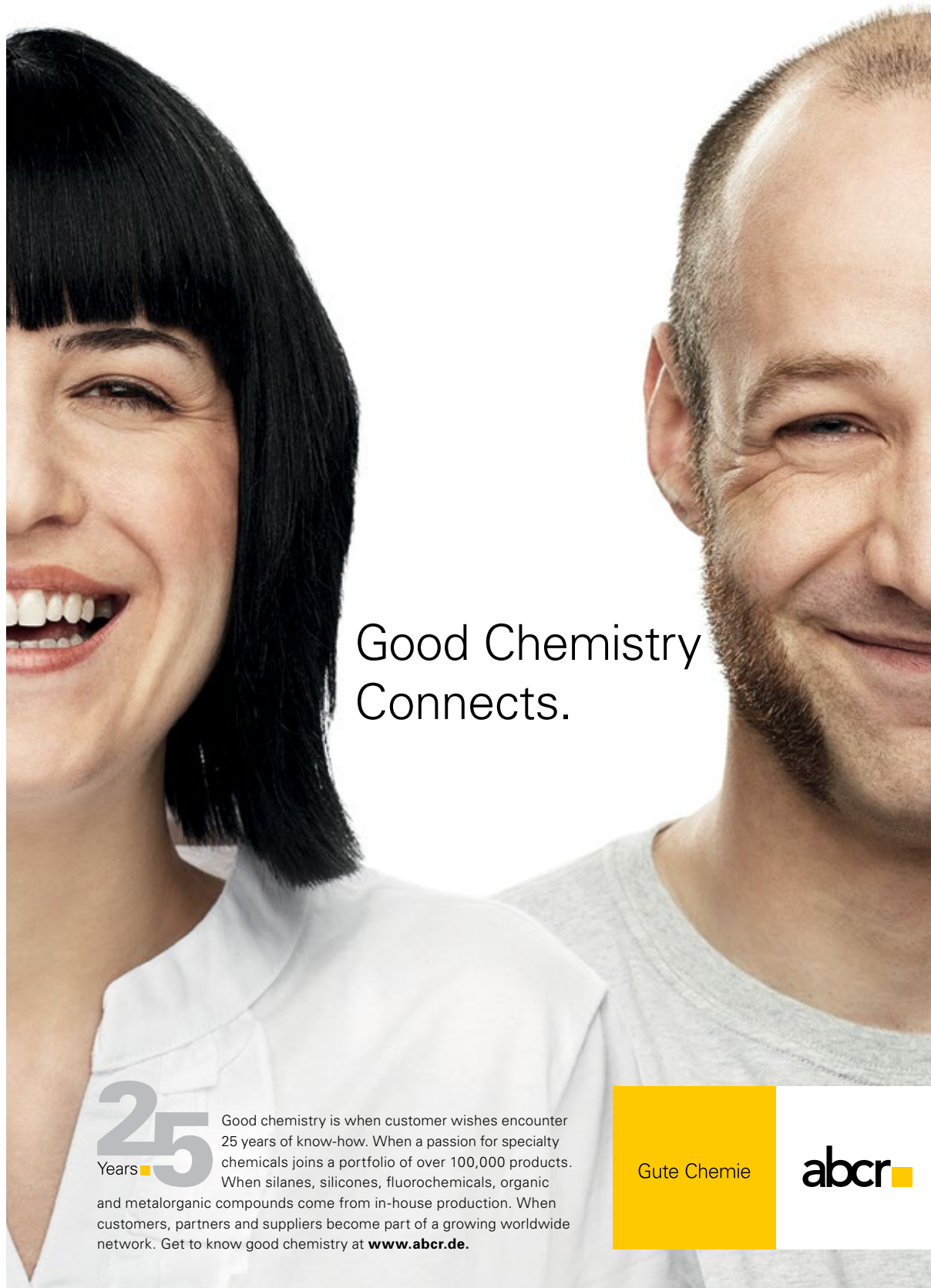
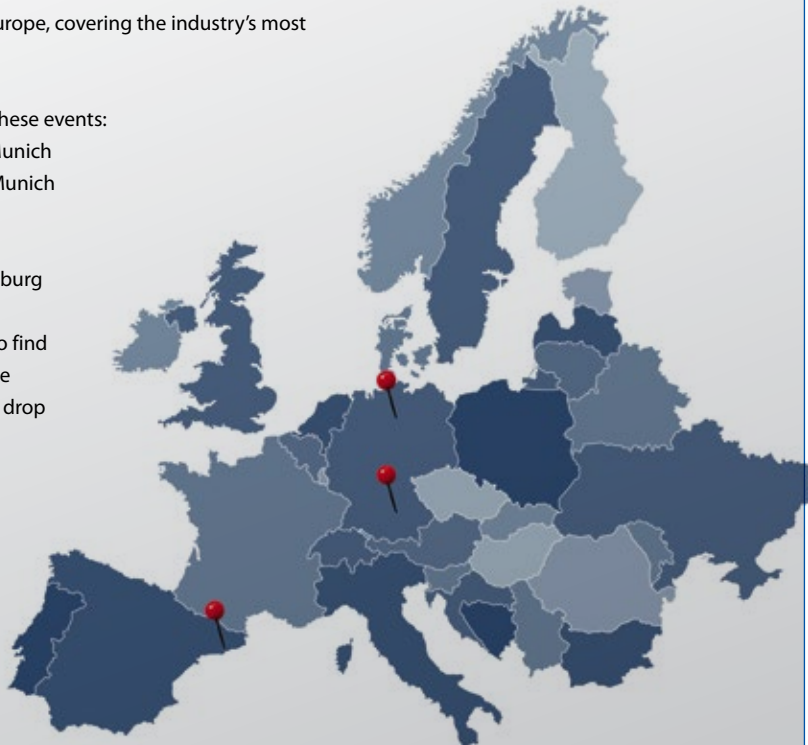
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We are looking forward to seeing you at these events:

- June 4-7:** Transport Logistic 2013, Munich
- June 5-6:** Chemspec Europe 2013, Munich
- June 10-12:** CESIO 2013, Barcelona
- June 11-13:** LOPE-C 2013, Munich
- June 17-19:** FECC Congress 2013, Hamburg

Do you have a story to tell? Or just want to find out more about what CHEManager Europe and CHEManager have to offer? Then just drop us a line — we'd love to hear from you.

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# Bio-Based Chemicals

A Wealth of Opportunities for Economy and Environment

**Ready To Buy** – Biomass as a resource for chemicals and plastics is on the rise. Drivers may differ — while some regions are looking for ways to commercialize their abundant biomass, others are driven by high oil prices or by climate concerns — but the interest is increasing globally.

“The interest for biomass as a resource for chemicals and plastics is increasing globally.”



for throwaway packaging such as beverage cups and plastic food packaging trays. Because of a lack in infrastructure, however, it is currently incinerated. One disadvantage of PLA is its low melting point, which makes it unsuitable for items that are exposed to heat.

Biotechnology and chemical techniques are used in combination to make the lactide polyester. Sugar or starch is fermented to make lactic acid, and a chemical dimerization process is then used to produce lactide. Finally, ring-opening polymerization is performed on the lactide monomer.

An entirely different approach is used for the production of bio-based polyethylene (PE). PE is not biodegradable, but established recycling paths exist, at least in Europe. By making the platform chemical ethylene from renewables, the existing value-added chains starting from the production of different plastics and continuing right through to the end-of-life scenarios can be utilized.

The production of bio-based ethanol is well established in China. As China's ethylene production is currently lower than the demand, the conversion of ethanol to PE might be economically feasible.

The higher degree of functionalization (alcohol and acid groups) of bio-based monomers compared with fossil feedstock can be exploited in a variety of plastics applications. To cite some examples, bio-based dicarboxylic acids (succinic acid) and polyols (castor oil, 1,3-propanediol) are used in bio-based polyesters. Polyols are also used in polyurethane. Dehydration of lactic acid produces acrylic acid, a monomer of polyacrylic acid.

#### Bio-Based Lubricants

Biolubricants are not the same as bio-based lubricants. They include

all lubricants that are readily biodegradable regardless of whether they are bio-based, mineral-based, made with recycled oil or synthetic.

In contrast to mineral-based lubricants, bio-based lubricants are generally made from vegetable oil. Depending on requirements, they are used either in their native state (natural ester) or they are chemically modified (synthetic ester). The range of applications for bio-based lubricants covers the entire spectrum of conventional lubricants.

Because of their long service life, low toxicity and fast biodegradability, bio-based lubricants are particularly attractive for environmentally sensitive applications. By nature, bio-based lubricants provide better lubrication than comparable mineral-based products.

#### Bio-Based Solvents

In a study, the Fraunhofer Institute for Systems and Innovation Research (ISI), Germany, estimated that the global solvents market is around 19.7 million mt/year. At least 12.5% of the total market volume could be produced from biomass, but the current figure is only 1.5%. Production of most solvents is based largely on fossil feedstock. Due to sustainability and environmental protection considerations, the spectrum is expected to shift toward bio-based solvents. The list of new bio-based solvents includes things like fatty acid methyl esters, which are also used in biodiesel, and esters of lactic acid with methanol (methyl lactate) or ethanol (ethyl lactate) as well as natural substances such as D-limonene, which is obtained from the rind of citrus fruits.

Another trend is to replace conventional organic solvents with biogenic solvents. Conversion of bio-based succinic acid or furfural (a byproduct of the cellulose industry) to tetrahydrofuran (THF) is one example.

#### Bio-Based Surfactants

Bio-based surfactants are produced by microbial fermentation or enzyme-catalyzed reactions. Surfactants normally contain both hydrophobic and hydrophilic groups. In the case of bio-based surfactants, at least one of these groups is made from renewable resources.

The bio-based hydrophobic group is usually made from coconut oil or palm kernel oil. A hydrophilic group is normally made from carbohydrates such as sorbitol, sucrose or glucose. The use of animal fat has significantly decreased.

In contrast, the market for bio-based surfactants is expanding. Due to their good biodegradability and low to zero toxicity, they are used in specific applications by the paint, cosmetic, textile, agricultural, food and pharmaceutical industries. The mining and ore processing industry uses them as an emulsifier to facilitate oil production and for biological cleanup of contaminated sites.

#### Integrated Biorefineries

The most promising approach for a widespread use of biomass for the production of chemicals is the integrated biorefinery. The Association of German Engineers (VDI) Technology Center has conducted a study to assess the extent to which biomass and its maximum utilization in biorefineries will replace conventional oil-based production techniques. The study provides information on bio-based production methodologies for 26 precursors (platform chemicals). There are strong indications that production is being migrated to bio-based techniques on eleven of these precursors.

Biotransformation of biomass in living cells or biocatalysis using isolated enzymes or enzyme systems is widespread in the white biotech industry. A very wide range of microorganisms is used for biotransformation, the most common ones being yeast, *Escherichia coli* and *Corynebacterium glutamicum*. A variety of hexoses (C6 sugar) such as glucose and fructose serves as precursors that can, for example, be isolated from the biomass through hydrolytic pretreatment. A different methodology is needed for lignocellulose, however, to separate the non-fermentable lignin from the sugar. Currently, lignocellulosic biomass passes through a mechanical or chemical pretreatment process using acids, phenol derivatives or hot steam and, to an increasing extent, hydrolytic-catalytic pretreatment with cellulases. Hemicellulose recovered from the lignocellulose has a high pentose content (C5 sugar), for example xylose, and particular microorganisms are needed to break these substances down.

#### Technical Hurdles and Solutions for Biomass Processing

To roll out competitive, cost-effective bio-based production on an industrial scale, a number of technical hurdles will have to be overcome.

The challenges begin with handling aspects that are closely related to the very nature of biomass. Large quantities have to be harvested, transported and processed. The sheer volumes are not the only a challenge for industry. Diversity is another issue that needs to be addressed. The term biomass extends beyond dry bulk solids such as corn and wood chips to include high-viscosity liquids like sewage sludge and liquid manure. Given this level of diversity, different techniques are needed to move the biomass to the intended destination.

Logistics is not the only area that calls for special solutions. Biomass has to be stored between delivery and industrial processing. Spontaneous ignition has been a recurring problem with wood chips. Chemical oxidation reactions are the largest exothermic factor in the overall process, but physical processes may also play a role. For example, water adsorption on the surface of relatively dry solids also raises the temperature when adsorption heat is released.

Following conversion, the products are normally highly diluted, often in the form of complex product mixtures that contain constituents that are very similar to each other. The products also contain various residues and waste products. Fermentation solutions, cell cultures and plant extracts are typical examples.

Product purification to meet chemical standards is a big challenge, too. Large amounts of aqueous solution are normally involved, and the product often still has to be isolated from the organism. Extracting the product from a fermentation broth can often account for 80% of production costs, making it a major cost factor in biotech production. The list of additional technological hurdles includes the development of new specific catalysts and biocatalysts.

Product inhibition during fermentation can be another problem if high product concentrations are not conducive to the organisms involved. Innovative approaches such as in-situ product isolation or low-pH process design can provide the answer.

Upscaling from the lab environment can also cause problems. Bio-based processing needs to be combined with conventional chemical techniques. Hybrid chemical production is essential, particularly during the early stages of development. Intensive work is underway in the U.S. and China on polybutylene succinate. The process combines biological fermentation with chemical hydrogenation.

The transformation of the raw material base is a global question. The current hurdles and technological challenges require creativity and ongoing R&D efforts.

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For instance, China's 12th Five-Year Plan identifies biotechnology as one of seven "Strategic Emerging Industries." Besides a strong focus on biopharmaceuticals, this also includes bio manufacturing. There definitely is a market: According to a survey released by DuPont in December, the acceptance of bio-based products with Chinese consumers is even larger than in North America. In the survey, more than three-quarters of the urban consumers interviewed said they would "definitely or likely buy bio-based products." Currently, available consumer products include detergents with enzymes and cosmetics ingredients. The capacity for bioplastics production is soaring. But biomass has much more to offer.

#### Two Distinct Approaches

In principle, there are two approaches toward the production of bio-based chemicals. Many of today's large-scale bio-based products are based on the first approach: To use the high functionality of natural molecules in specific products with only moderate chemical modification. Typical examples include biopharmaceuticals, bio-based polymers and products from fats and oils. The second approach, which takes more effort but might eventually revolutionize the chemical industry, is the concept of integrated biorefineries. Similar to a petrochemical refinery, biorefineries convert biomass to produce a series of chemical raw materials and fuel products. The ul-

time goal is to use the whole plant instead of only parts and to obtain a wide range of potential products.

#### Bio-Based Polymers

Bioplastics are one of the strongest growing markets for bio-based products. Driven by the continuing demand for plastics in all kinds of applications and due to rising oil prices as well as environmental concerns, the share of bioplastics is expanding slowly but surely.

The first bio-based plastic was the thermoplastic polymer polyhydroxybutyrate (PHB), which is used by bacteria as energy storage. It was placed on the market in the 1990s under the trade name Biopol. In recent years however, the approach has been not to use biopolymers directly. Instead biotechnology or chemical techniques are employed to extract monomers from renewable feedstock to provide a basis for new (functional analogue) or traditional (structural analogue) polymers.

Currently the most popular functional analog bio-based plastic is polylactic acid (PLA). Industrial production of PLA got underway in 1994. Worldwide production capacity exceeded 110,000 mt/year in 2010. Production plants are located in the U.S., the Netherlands and China.

PLA has properties similar to those of conventional mass-produced thermoplastics and can be processed on existing production lines. Because it is compostable, PLA has considerable potential

ol (BDO) — due on stream in the second half of 2013 — BASF has licensed the technology of US bioplastics specialist Genomatica. The San Diego, California-based company's one-step fermentation process produces sugar as a basis for the renewable chemical, replacing the petrochemical building blocks

natural gas, butane, butadiene and propylene.

In addition to its newest European plant, BASF recently said it would build a 100,000 t/y renewable BDO complex in China in partnership with local producer Xinjiang Markor Chemical Industry. A facility for 50,000 t/y of polytetrahydrofuran

(PolyTHF) using BASF's proprietary technology will also be part of a production complex expected on stream in 2015.

Sanjeev Gandhi, president of BASF Intermediates, said the Genomatica BDO technology was chosen because "we consider it to be exceptionally advanced and reliable." The German

group is the world's largest producer of conventional BDO and derivatives, with annual capacities for 535,000 t.

Japanese chemicals and plastics producer Toray has used Genomatica's technology for bio-based 1,4 butanediol to develop a partially bio-based PBT at bench scale. The company said tests have confirmed

that the polymer made from renewable BDO has physical properties and formability equivalent to polymer made from the petroleum-derived material. Toray plans to build a commercial-scale production facility as soon as renewable BDO is available from one of the producers using a Genomatica license. (dw) ■



Sanjeev Gandhi  
President,  
BASF Intermediates

## BASF and Toray to Use Genomatica Technology for Renewable BDO

### Background

This article is based on a trend report developed by international experts and journalists on behalf of Dechema (Society for Chemical Engineering and Biotechnology), Germany, in preparation for AchemAsia 2013, 9th International Exhibition and Conference on Chemical Engineering and Biotechnology, which took place in Beijing May 13–16.

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# Solvent Recycling

## ESRG in Support of the EU Environmental Action Plan

### The Business Of Sustainability

In the business world and particularly the chemicals industry, much is talked of resource efficiency and sustainable development. Very recently the European Commission has proposed a new Environment Action Programme: "Living Well, Within the Limits of Our Planet" is designed to guide EU environment policy up to the year 2020.

Businesses, however, are probably more focused on managing tough times in a period of economic austerity and downturn, so are these challenges compatible and, politically, should the environment take a back seat? To that question the European Solvents Recycler Group (ESRG) answers certainly not. It has long advocated that the recycling of solvents makes a valuable contribution to resource efficiency and sustainable development.

#### Key Environmental Issues

In its seventh Environment Action Program, the European Commission identified a number of key environmental issues and the strength of the underlying problems associated with each issue. These broadly were broken down into three areas:

- Ecological and climate resilience
- Sustainable, low-carbon growth
- Human health and well-being

Particularly important to the chemicals industry under ecological resilience are air and water pollution

problems. Sustainable growth focuses on greenhouse gas emissions, resource use and waste generation/management, while human health works on managing chemicals.

In all three areas the recovery and recycling of solvents can readily lead to delivering a positive effect that is both well established and recognized in most sectors of the chemical industry. The benefits of recycling solvents include a high rate of recovery, in the order of at least 75%, meaning that the top up of a process depending on their use is meaningfully reduced to the order of 25% and below. So if all is well here, can we simply say so and forget the matter? ESRG says no and believes that a number of individually well-meaning pieces of EU legislation with principled objectives show that when combined they paradoxically can be counterproductive. To illustrate this, one should consider a number of recent pieces of legislation.

#### Legal Limitations

The revised Waste Framework Directive (rWFD) (2008/98EU) sets out to encourage reduced waste production and where it inevitably arises to manage it responsibly. To do this it sets out descriptions that outline what waste is, but this can easily lead to legal uncertainty with opinion at a detailed level very variable across the EU member states. Importantly, the question of whether a recovered material can cease to be a waste has recently benefited by the issue of good EU guidance

on the interpretation of key provisions of the rWFD, but it still means that for many chemical substances the competent authorities and their opinions vary. This is a critical point if recycled materials are to be freely traded across EU frontiers, for wastes and products are managed very differently.

The rWFD also has a key feature in that it sets out a waste hierarchy convention encouraging after prevention and reuse aspects, the recycling of materials that are then given a priority over energy recovery

(combustion) or other disposal options. Deviation is permitted but subject only to a process of Life Cycle Thinking. Undoubtedly highly laudable, but how can this be directed, and uniformly enforced by the member state competent authorities?

Few would dispute that EU chemical legislation has increased dramatically over the last decade and notably so with the arrival of REACH Regulation (1907/2006 EC). While in general terms wastes are not within the regulation (as to do so

would conflict with other law) when something stops being a waste and re-enters a new life cycle, the question needs to be asked: "Is REACH applicable?"

#### Guidance on Wastes and their Recovery

Assuming it is for many chemical substances, a key criterion is, "Has end of waste been established?"

ESRG together with other industry trade bodies formed the Recycling and Recovery Industry Chain (RRIC), which has lobbied the EU chemicals authority, the European Chemicals Agency (ECHA), to address issues along the supply chain. The latter have provided invaluable guidance on wastes and their recovery and set out special conditions for exemptions from substance re-registration. Nevertheless, many solvent recyclers are small or medium-sized enterprises dealing with recovered chemical streams that do not always fit the precise culture of REACH and classification, labeling and packaging (CLP). Hence a recycled resource can easily remain classed as a waste, or rejected by a potential user, and its value and utility lost.

More recently the Industrial Emissions Directive (IED) (2010/75EC) has brought together and expanded a number of existing directives, including the Integrated Pollution Prevention and Control, Waste Incineration, Solvent Emissions and Large Combustion Plants directives. Importantly, the IED underpins the delivery into practice of a wide range of environmental

policies including the waste hierarchy and the setting of pan-EU Best Available Techniques (BAT) principles that are then applied to operating practices and associated emissions. Ensuring that recovering solvents from waste remains a high priority in the concept of the IED therefore presents another challenge for ESRG.

While resource and sustainable objectives are soundly supported, ESRG stresses that legislators need to take on board the need for greater coherence between the technical and legal aspects of the individual statutes giving recycling a more robust opportunity to perform. It is also prerequisite that the 27 member states need to work harder on agreeing on both definitions and standards so that trade can become freer across the community and that resources are not wasted.

*Roger Creswell, Chemical Recycling Association (UK), board member, European Solvent Recycler Group (ESRG)*

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# Good For Business, Good For Society

## Industry Players Discuss the Influence of Sustainability

**Responsibility** – As the chemical industry evolves into the world's solution providers for modern global challenges, its obligation to adhere to sustainable principles and practices gains importance. The phrase "sustainable chemistry" is an elastic term and can mean different things for different companies. Brandi Schuster spoke to chemical companies to find out what their definition is — and what it explicitly means for their businesses.

*CHEManager Europe: What does "sustainable chemistry" mean for your company?*

**J. Krueger (Clariant):** For Clariant, sustainable chemistry is the design of chemical products, applications and processes that reduce or eliminate the use or generation of substances with hazardous potential and limited socio-economic benefit. Sustainable chemistry applies across the life cycle of a chemical product, including its design, manufacture, use and final disposal. This may involve reduced waste products, non-toxic components and improved efficiency. Sustainable chemistry is a highly-effective approach to pollution prevention while delivering on societal needs because it applies innovative scientific solutions to real-world environmental and demand situations. Sustainable chemistry is not limited to the use of renewable raw materials; likewise the production and processing of bio-based raw materials must not necessarily follow the principles of sustainable chemistry. The whole lifecycle of the product or application must be considered.

**D. Voeste (BASF):** At BASF, we look how chemistry can contribute to sustainable development. Sustainable development means the combination of long-term oriented economic success with environmental protection and social responsibility. We have set ambitious goals in all three areas for years. For example, we want to increase the energy efficiency of our company — defined as the amount of sales products in relation to the primary energy demand — worldwide by 35% by 2020. Of utmost importance for us is the reduction of work-related accidents by 80% by 2020 (baseline 2002). The contribution of chemistry to sustainable development also means for us that we look at the entire value chain for example in our corporate carbon footprint. Additionally, the use of our products avoids greenhouse gas emissions. In this way, we enable our customers to further reduce their carbon footprint. The key to succeed is the open dialog with stakeholders and business partners — transparency is essential for our business.

**W. Breuers (Lanxess):** At Lanxess, we believe that growth and entrepreneurial responsibility go hand in hand. Our approach to sustainable chemistry is simple: What's good for business is good for society. As an international specialty chemicals group, we bear a major responsibility toward people and the environment. Our entrepreneurial activities reflect this sense of responsibility. Safety, environmental protection, social responsibility, quality and commercial efficiency are all key corporate goals. We use our know-how and experience to develop sustainable products and technologies that are friendly to the climate and the environment in the long term, increase value-added and at the same time improve people's quality of life. Corporate responsibility is a central element of our core business. Our goal is to bring in line



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**Dr. Dirk Voeste, VP Sustainability Strategy, BASF**



**Dr. Werner Breuers, Member of Board of Management, Lanxess**



**Robert Dahinden, General Manager Business Unit Custom Manufacturing, CABB**



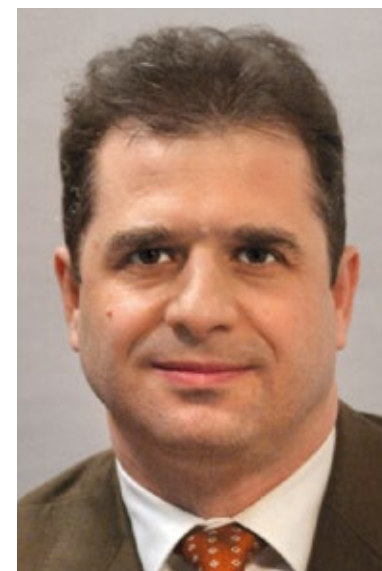
**Dr. Peter Seuffer-Wasserthal, Senior VP, Pharmaceuticals, Codexis**



**Dr. Thomas Jostmann, Head of Corporate Environment & Responsibility, Evonik Industries**



**Dr. Andreas Maier, Managing Director, WeylChem International**



**Michel Blanc, Sales Director Synthesis, Novasep**

economic, ecological and social aspects within our corporate strategy.

**R. Dahinden (CABB):** For us, it means following three guidelines: efficient, safe and environmentally benign production processes; protection of humans and environment; and the reduction and minimization of waste. The protection of human health and of the environment is of highest priority, together with the prevention of accidents. This is important for all areas within CABB. The efficient and safe production processes as well as the reduction of waste can be realized in many areas by our Verbund and recycling system. Not only the manufacturing of our own products benefits from a sustainable production but also our custom and toll manufacturing business. Moreover, many of our core technologies can be performed as continuous processes, which save energy and reduce waste, but is also safer and often leads to higher quality products. The reduction of solvents is another important topic, and in our continuous processes, we operate with a minimum of solvents.

**P. Seuffer-Wasserthal (Codexis):** Sustainable chemistry isn't just about minimizing the use and production of hazardous materials; it is looking at the whole process, the use of materials, the generation of waste, etc. As the only organization to win three Presidential Green Chemistry Challenge Awards from the U.S. Environmental Protection Agency, Codexis leads the way in developing enzymes with the ability to catalyze reactions under mild, neutral conditions, avoiding use of many organic solvents and with only little generation of by-products and waste. Through biocatalysis, we develop more sustainable chemistries that offer new or improved drug development and accelerated manufacturing processes, resulting in higher purity products, better yield and more efficient and cost-effective solutions.

**T. Jostmann (Evonik):** Sustainable chemistry means making an essential contribution to sustainable development with our products and customer solutions — with responsibility,

foresight and pragmatism. Evonik's specialty chemicals are "enablers," meaning that our products are a necessary factor for sustainable development. To give a few examples, our amino acids make the production of meat and fish more efficient and environmentally friendly. At the same time, our high-performance polymers reduce fuel consumption by decreasing the weight of cars and planes, while also opening up new application areas, such as uses in medical technology. There are many more examples, and they all show that sustainable chemistry is the key to a livable world for everyone.

**M. Blanc (Novasep):** The key to sustainable chemistry is to adapt manufacturing processes to limit as much as possible their impact on the environment while keeping them safe and efficient. We consider it our responsibility to promote sustainable processes as much as possible. Several aspects come in consideration in this domain but the main framework for good practices to implement is given by regulations, such as Reach or the local regulations where our production sites are located. We are strongly committed to complying with existing regulation.

**A. Maier (WeylChem):** As a modern custom manufacturing organization and fine chemicals producer, the initiative towards sustainable chemistry is a prerequisite for the successful application of our business model. As all resources are limited, the intelligent use of these is very important for us and our customers. We, as engineers and chemists, have to develop new techniques and reactions that allow the use of resources in the most efficient way. Not only do our customers expect this, but it is also part of our professional approach.

The term sustainable chemistry is used in many ways to describe the efforts of the industry to develop and apply chemistry that uses fewer raw materials while producing better and more affordable products and services. It also includes the use of safer and less hazardous reagents. It's important to transform this concept into practical measures and projects. We have also started to

put emphasis on the reuse of materials and provide such services to our customers. We have several new projects at Miteni's Trissino plant that will allow our customers to reuse valuable perfluorinated materials. Together with our customers we have developed recycling procedures and will provide services based on those processes via long term contracts. Besides the careful and intelligent use of raw materials, the efficient use of energy is the main focus of our efforts.

*What drives your company's sustainable chemistry endeavors?*

**J. Krueger (Clariant):** Sustainability is deeply anchored in Clariant's business strategy and goes far beyond legal compliance. With our recently launched EcoTain approach, we have developed a holistic process that honors Clariant's innovative products that meet sustainability criteria over their whole life cycle. In addition, we have initiated our "Sustainability@Clariant Portfolio Value Program" with an external partner. This tailored program involves all relevant stakeholders — customers and employees alike. It addresses the issue of sustainability in a comprehensive and forward-looking way. The program will further improve Clariant's sustainability efforts and raise it to the next level in areas such as product development, innovation and investment decisions and will influence our overall sustainability strategy. With the development of key performance indicators, we will set the basis to measure our sustainability performance.

**D. Voeste (BASF):** The Earth's resources are limited, so the growing world population and its rising needs are and will continue to be a global challenge. At the same time, these challenges open up many opportunities for the chemical industry. We see three areas in which innovations based on chemistry play a key role: resources, environment and climate, food as well as nutrition and quality of life. One example of how chemical innovations contribute to meeting the society's need is battery materials. As the population grows, so does the number of cars, especially

in cities. Electric vehicles will play an important role in future mobility concepts. Today, we are researching new battery technologies that will be able to reduce costs considerably and increase the range of electric vehicles. We aim to take a leading provider of system solutions on the market for battery materials and thereby act as an enabler for innovation and sustainability.

**W. Breuers (Lanxess):** We have established a globally integrated management system to breathe life into the concept of sustainable development in our everyday business. Our central management system provides the necessary global structures to ensure responsible commercial practices. With this toolbox, we have created a transparent framework of values and rules that unites management and employees worldwide. Our integrated management system is built on clearly defined responsibilities. In addition, all management systems are based on values and guidelines that provide a clear framework for the company's management and employees. We are committed to the established principles of the world's largest corporate social responsibility initiative, the United Nations Global Compact.

**R. Dahinden (CABB):** CABB is eager to constantly improve its manufacturing processes, may it be for the safety of processes, to protect humans and the environment, to improve the quality of products or the efficiency of processes in order to save energy or to minimize waste and emissions. This also means to operate in a more environmental friendly way, to design safer processes and also to be more efficient. Sustainability also means to maintain competitiveness as our customers are increasingly looking for a sustainable supply of their products. Sustainability drives innovation and vice versa: We have constructed a dedicated plant for Wolff-Kishner reactions, which has not at all been our core chemistry but which is a result of our broad experience with continuous processes.

**P. Seuffer-Wasserthal (Codexis):** We are driven by our customers' needs to

find new, economically viable and sustainable processes. That might mean developing enzymatic approaches to improve their existing processes for faster, greener manufacturing, including finding ways to increase productivity and quality, and reduce manufacturing costs and resources. Alternatively, it might mean helping customers screen and optimize candidate enzymes very rapidly for new drug development processes, using natural enzymes in place of non-renewable or harmful materials. Much of our own technology and product development has evolved through R&D that we've carried out for specific customer projects and can now be used for new projects, not just in the pharma and chemical industry.


**T. Jostmann (Evonik):** We want to create value for our shareholders, our customers, our employees and for society. Our products and solutions focus primarily on the megatrends of health, nutrition, resource efficiency and globalization. Our outlook and actions combine economic, ecological and social aspects as equivalent factors, which gradually brings us closer to our goals. Thus, we managed to reach our long-term environmental goals two years ahead of schedule. Our chemical business has reduced our specific energy-related greenhouse gas emissions, our specific drinking water consumption, and our specific product waste volume by 20% or more since 2004. We can't stop there, though. Sustainability only works as a comprehensive approach that includes our contribution to the sustainability of our customers, but also a sustainable supply chain. We have already created life cycle assessments for some of our products, which everyone better understand the ecological benefits of our products.

Evonik is also actively addressing the question of raw materials that may form the basis of our products in the next 20 years, with consideration for social and economic aspects.

**M. Blanc (Novasep):** Sustainability arises from our consideration of processes as a whole. In terms of manufacturing steps, process scale-up and optimization does a lot for sustainability. Indeed, it is essential to address environmental impact, safety or efficiency with care when a process is implemented at large scale. To be clear, the first driver for process optimization is the reduction of manufacturing costs but it mostly goes in the same direction as sustainability: maximizing efficiency, minimizing wastes and energy, shortening synthetic routes, etc. In many aspects, hazardous chemistry can be sustainable and safe, provided the hazardous substance or reaction have been properly studied and appropriate measures are implemented. Many other technologies are also being implemented at Novasep to optimize processes and promote sustainability.

**A. Maier (WeylChem):** Sustainability is an integral part of WeylChem's offer to its customers; it's of increasing importance in our industry. Our management teams are committed to this approach as can be seen in the examples outlined above. WeylChem is a member of AIME (Agrochemical & Intermediates Manufacturers in Europe) and we are committed to the voluntary guidelines outlined by this industry association. We are convinced that this approach ensures the durability and dependability of the WeylChem companies in the market place.

[Read the full interview here:](#)

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## Safe Solutions for Small Hazardous Goods

Europe-wide Express Service for Sending Samples and Value Added In-house Services

**Chemicals Logistics** – Flexibility, reliability and favourable transport rates — these are among the chemical industry's most important requirements towards transport service providers. TNT Express has developed an economical pan-European solution for a large chemical company that has high volumes of small sample shipments.

Chemicals logistics go beyond the 40-ton road tanker and silo trailers. Even the big players in the industry have tiny shipments for destinations across Europe every day — samples, for instance. These shipments are usually time critical, i.e., they need to reach their destination particularly fast and reliably at a certain time. And because such samples often contain varying types of hazardous goods, the transport service provider needs to be familiar with all the applicable legal regulations and to comply with them.

However, this type of consignment is often too small for the classic chemical logistics specialist, too urgent for the general cargo carrier, and too tricky to handle for the average parcel service. In consequence, many large chemicals



TNT Express makes it possible for chemical companies to react flexibly to their European customers' diverse requirements.

producers around the world entrust TNT Express with their shipments. The quality service provider offers a wide and convincing range of services that goes well beyond that of the classic providers. TNT Express is competent when it comes to hazardous goods and offers reliable

transport services for many hazardous goods classes at attractive rates — by road or air freight, as required. And in contrast to general cargo carrier, the express service provider does not charge a minimum fee even for very small shipments, and even caters for special

needs such as safe and reliable daily services to Europe (including Eastern Europe).

One example of how well the services are received by the market and in the industry: a global leader in the chemicals sector uses TNT Express for the distribution of its

sample shipments with destinations in 20 European countries. There are about 150 shipments a day, weighing about 20 kilograms each. The customer is one of the big players in the industry, which is why the number of shipments is so high. But the solution developed by TNT already would make economic sense starting at 50 shipments a day to eight different countries.

### Flexibility Even by Dealing with Hazardous Goods

10-20% of the total shipment volumes are hazardous goods. The carrier is capable of handling these materials, as the required know-how is readily available and processes are in place across the company. Drivers and staff are specifically trained for handling hazardous materials.

TNT Express makes it possible for companies in the chemicals sector to react flexibly to their European customers' diverse requirements, offering European transport services at competitive rates and with lead times of two to four days. If even faster delivery is required, clients can request their goods to be shipped by air — as a one-off or a standard service, even for some classes of hazardous goods.

In addition to the transportation, the express carrier also offers "all-

round services" upon request. Some large chemical companies already use these professional in-house services: TNT Express employees work at the customer site and take on coordination tasks such as attaching analysis certificates and delivery notes, consolidating shipments with several packing units or performing specific customer services such as an advance delivery notification.

For the client, these made-to-measure services are a proven competitive advantage: they lower the shipping costs for low-weight hazardous goods shipments and relieve the customer of many daily issues concerning the coordination of transports and logistics. In a nutshell: TNT Express is a perfect example for the "right-sizing" of low-weight hazardous goods transport services in the chemical industry.

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## Logical Logistics

CHEManager Gives a Series of Lectures at Transport Logistic 2013

**Brain Food** – The logistics fair transport logistic — which takes place June 4–7 in Munich — will now benefit from the strengths and expertise of CeMAT (organized by Deutsche Messe AG) in the field of intralogistics. The existing segment will thus be expanded and upgraded. CHEManager will contribute towards this presentation event by giving a series of three lectures on June 4.

### Results of a Recent Study into Chemical Logistics

In the first lecture of the series, Prof. Dr. Carsten Suntrop, CMC<sup>2</sup> and Competence Group Chemical Logistics, will present some of the key findings of a recent study into chemical logistics carried out by the German Logistics Association (BVL Bundesvereinigung Logistik). This study, which was carried out by the working group of the Scientific Advisory Board of the BVL, first of all clarifies the topic of chemical logistics in 2012. The aim of the study was to provide a practice-oriented and scientifically-based assessment for defining the chemical logistics market, proposing business models as well as recognizing current and future trends. In addition, development potentials for cooperation within the supply chain were identified.

The study is aimed at all players in the logistics value chain in the chemical industry for the purpose of improving the long-term competitiveness of the chemical sector in Germany. The following findings are presented in this lecture: macroeconomic data and facts on chemical logistics; supply chain characteristics; business models in the chemi-



**Kai-Uwe Tebbe**  
Vice President Chemical Logistics for Infraser Logistics



**Prof. Dr. Ludger Brüll**  
Vice President Supply Chain Engineering, Technical Consulting & Execution Systems at Bayer Technology Services



**Prof. Dr. Carsten Suntrop**  
CMC<sup>2</sup>

cal logistics sector; development potentials for chemical logistics; and trends in chemical logistics. A decisive factor in carrying out this study was to look at the findings from different perspectives, namely from the perspective of freight-forwarding, site logistics, logistics services and site management.

### Secure Logistics in Chemical Parks

The second in the series of lectures is based on the research entitled: "Site Logistics: Safe and Optimal Logistics in Chemical Parks" by authors Prof. Dr. Ludger Brüll, Hans-Joachim Fornfeist and Martin Kembügler; this lecture will be presented by Prof. Dr. Ludger Brüll, Vice President Supply Chain Engineering, Technical Consulting & Execution Systems at Bayer Technology Services.

A well elaborated "Logistics Site Master Plan" is one of the most important prerequisite for safe and economical operation in a larger pro-

duction facility or in a chemical park. This plan or concept must be both visionary and flexible to ensure the optimal operation over several decades. For this achievement a huge number of different aspects, boundary conditions and influencing parameters have to be investigated, to end up with a harmonized concept.

Examples for this are production related topics such as safety distances or potential expansion areas, requirements from authorities and regulations, logistical questions such as storage and loading facilities or 3PL concepts, or utilities related demands with respect to availability and/or redundancy of energies and other supplies, to mention only a few. Mathematical tools and approaches such as simulation and optimization can help to structure and analyze the large assortment of parameters and scenarios, graphical tools help to keep track of the concept. A couple of elaborated and realized applications from chemical parks all over the world will be used to demonstrate the professional development of these concepts.

### The Rhein-Main Chemical Logistics Hub

The next lecture entitled "Chemical Logistics in Industriepark Höchst: A Rhein Main based Chemical Logistics Hub as a Contribution to Green Logistics" presented by Kai-Uwe Tebbe, Vice President Chemical Logistics for Infraser Logistics, deals with green logistics as a holistic transformation of logistics strategies, structures, processes and systems within businesses and business networks to create environmentally-sound and resource-efficient logistics processes.

Continues Page 14 ▶

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# The Need for Advanced Infrastructure

## Future Challenges in Handling and Distribution of Pharmaceuticals around the Globe

**Logistics** – Globalization, outsourcing and a trend towards generics and biopharmaceuticals are some of the key factors shaping today's supply chains for the life sciences and healthcare industries. Logistic providers such as DHL offer special solutions to serve their customers in these industries. Dr. Sonja Andres asked Angelos Orfanos, President, Life Sciences and Healthcare, DHL Customer Solutions & Innovation, about performance requirements, the impact of stricter regulations and the influence of Emerging Markets.



Angelos Orfanos, DHL

**CHEManager Europe:** Mr. Orfanos, please tell us about your general product structure in the life science and healthcare market. What are the "key markets" for these products and what are their estimated volumes? Is DHL targeting some of these markets more than others?

**A. Orfanos:** Across all of our four operating business units under the DHL brand we have customised services and solutions for the Life Sciences and Healthcare market. DHL's core services are warehouse and order fulfilment as well as transportation management. Additionally we offer secondary packaging, hospital logistics, cold chain airfreight, cold chain road freight and clinical trial logistics — and we support the industry across the entire value chain.

Regarding what markets we service more than others: in terms of production the U.S. market and the Western European market continue to be the largest markets. They are forecasted to stay the largest markets until 2020. India has evolved into the third largest production site country and China, which was number ten a year ago, is projected to move up into the top five by the year 2020. China will grow significantly in terms of production particularly in active pharmaceutical ingredients.

In terms of consumption the US, Japan, Germany, France, and China make the top five today. Brazil, Russia, India, China, as well as Mexico and Turkey are the emerging markets. Those will be the markets of growth for the future as the traditional markets continue to stay strong. The industry is investing in those markets and so are we. That is where we see ourselves investing and developing services.

**What must be done to ensure a good performance in logistics to these markets?**

**A. Orfanos:** We take a look at the market place to define good performance. Life Sciences and Healthcare products are very different to, say, car tires or clothes. They demand a higher degree of quality. Performance is driven by not only on-time delivery and efficient supply, but also by handling those products, moving them around the world and storing them.

To meet those performance requirements we as the logistics provider for the Life Sciences and Healthcare industry provide our customers with the industry's most advanced infrastructure and network, impeccable service quality, innovation and simplicity of solutions as well as unsurpassed expertise and know-how.

**Have there been crucial changes in the basic conditions in the last years?**

**A. Orfanos:** We see three main key trends within the market. The first thing which changed the conditions in recent years is globalization. Manufacturers are moving to different sites around the world.

This shift in consumption and production is changing the logistics, as well as the supply chain of the industry. Therefore we invest in sector-specific expertise and infrastructure, like opening Life Sciences and Healthcare Competence Centers in key markets or multi customer sites.

Outsourcing is the second major shift. The whole supply chain is becoming more relevant. DHL has successfully implemented innovative products and supply chain solutions for hospital and clinical trial logistics as well as for the distribution of pharmaceutical and medical devices supporting this outsourcing trend.

The third trend for the next couple of years is one towards generics and biopharmaceuticals. This has a great impact on the requirements of the supply chain. A manufacturer

who is distributing a lower priced product is seeking more cost-effective ways to move it, while he is at the same time being challenged with maintaining the quality requirements needed to transport and to store that product. Those manufacturers might be in India, Korea, or China, which creates specific transportation, storage and compliance requirements.

Biopharmaceuticals represent a strong-growth segment of pharmaceuticals that have specific temperature requirements along the entire transport and storage chain, from better packaging, to better processes and capacities, up to better infrastructure. DHL can support these specific needs and the demands of our customers for example with our European cold chain less-than-truckload network.

**How do you judge new guidelines and regulations - like EU Guidelines for GDP - for the Life Science sector?**

**A. Orfanos:** As we speak, the European GDP guidelines are being re-written, based on significant input from the industry as well as from DHL. We participate and submit our thoughts, using our expertise to add input to the development of those guidelines. And we will see what we end up with in the next draft and whether there is further need for consultation. For sure, regulations for the storage and movement of Life Sciences products are becoming stricter.

From our perspective, trade barriers for Life Sciences products haven't changed globally across the sector — and I don't see that they will in the near future. I think the key drivers are going to be the regulations towards patient safety and product integrity, especially on things like counterfeiting and product condition. DHL has developed solutions along the regulations that have been made. They help our customers to continue to do their business and reach the markets with their products.

**More and more pharmaceuticals and medical products have to be stored and distributed at defined temperatures — is this a growing logistic challenge or even a problem these days?**

**A. Orfanos:** I would define it as a challenge rather than a problem, because the problem is solved. There are already solutions in the market place which help to move temperature-controlled products. The challenge is to do it cost effectively.

We see pharmaceuticals that need to be maintained with very precise temperature ranges. So it is challenging to move products to



the right place, in the right time, and in the perfect condition. We have worked on developing a disciplined cold chain process and procedures to secure that this kind of shipment meets the requirements of our customers.

**Looking at the cool chain — what are the obstacles? How shall supply chain management look like to ensure smooth processes?**

**A. Orfanos:** I see three major enablers. First of all you need infrastructure to enable the cold chain. Secondly, you need optimized processes and finally it is about people.

DHL has highly developed specialised services. Our DHL Airfreight Plus Pharma service, for example,

is a door-to-door overnight service across Europe, designed for end-to-end transportation for the Life Sciences industry. Our cold chain network is another product we have developed through our freight organization. "LTL Coldchain," for example, caters to the demand for having less-than-container load, less-than-truck load shipments that might go from one part of Europe to another.

All involved partners need to be in sync, and the infrastructure has to be able to enable the movement of these goods. Furthermore, people you need within the infrastructure are an important enabler — dedicated people who understand the business and the idiosyncrasies of handling this type of freight. You need the processes documented specific to products, regions, and services.

**What do you think about Emerging Markets in life science and healthcare — currently and in the future? Will this affect the supply chain substantially?**

**A. Orfanos:** Emerging markets are being looked upon by the major manufacturers as their growth areas. As Europe and America are single-digit growth environments for them, it is the emerging markets that present the larger growth opportunity as the consumer base grows there and as manufacturing and sourcing moves there as well. We definitely see emerging markets having a big impact on the industry. Cold chain logistics will be an inherent part of that trend.

We see huge growth areas in countries like China and India, where the population is becoming wealthier and consuming more, and manufacturers are opening local sites. This is going to change the balance of how pharmaceuticals are

consumed and medical devices are used and moved around the world. I think the challenge for us is going to be to adjust to that growth and provide the services that the customers need.

**From your perspective: What will be the main challenges in the future in handling and distribution of pharmaceuticals around the globe?**

**A. Orfanos:** Manufacturers are influenced by rising cost pressure, which is driving a certain change to globalization and creating an outsourcing trend. New locations need to be serviced with the right type of infrastructure to accommodate both the globalization and the outsourcing.

Another impact due to the cost pressure is increased market consolidation through mergers and acquisitions. We see co-manufacturing, co-marketing amongst different manufacturers in the industry. This results in consolidation and is changing the route to market. Regulatory conditions will continue to create challenges and opportunities to support the industry demand and the requirements.

We are going to see the big countries like China, India, along with Africa and Latin America as continents, with significant growth prospects. Other parts of the world will catch up and emerge in terms of consumption as well. All of this will influence the supply chain behavior of manufacturers. From my point of view, these are the main challenges as I look into the future of the pharmaceutical supply chain.

## Logical Logistics

Continued Page 13

The objective of "green" logistics is to create sustainable shareholder value by achieving a balance between economic and environmental efficiency. Practical examples are used to show that it is possible to efficiently couple green logistics together with economic efficiency.

At the Industriepark Höchst in Frankfurt am Main, Infraser Logistics operates a hub for bulk and packaged hazardous materials. Thanks to this hub, there is the potential to decisively optimize the logistics policies applied by companies operating in the chemical and pharmaceutical industries. The ideal situation is to network the logistics, handling and distribution of liquid and packaged hazardous materials via rail, road and waterway

modes of transport. This situation is achieved by means of a central tank farm, a fully automated high-bay warehouse and the tri-modal terminal in the industrial park.



The Rhein-Main chemical logistics hub also makes a contribution to reducing CO<sub>2</sub> emissions: a barge with a load capacity of up to 2,000 tons can replace around 80 trucks

with one single journey. In addition, the Industriepark Höchst, which is open 365 days a year around the clock, offers a significantly greater degree of flexibility: for bulk liquids and packaged dangerous goods that arrive in Europe via the ports of Amsterdam, Rotterdam and Antwerp, it is ideal as a central warehouse and the main transfer point.

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www.transportlogistic.de  
www.bayertechology.com  
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www.infraser-logistics.com



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## EVENTS

**CESIO 2013, June 10-13, Barcelona**

The CESIO Congress 2013 is organized on behalf of the European Committee of Organic Surfactants and their Intermediates (CESIO), a sector group of the European Chemical Industry Council (Cefic). The event combines a comprehensive scientific program with extensive business convention facilities. In 2013, the congress theme is: "Surfactants Today and Tomorrow - Mapping the Megatrends". The 9th World Surfactant Congress and Business Convention will offer a one-of-a-kind opportunity to meet the relevant actors of the global surfactant industry, its suppliers and customers and service companies, thus covering the entire surfactant value chain.

► [www.cesio-congress.eu](http://www.cesio-congress.eu)

**LOPE-C, June 11-13, Munich**

LOPE-C is the most comprehensive conference and exhibition dedicated to the field of organic and printed electronics. At the official annual conference of the OE-A (Organic and Printed Electronics Association) speakers from 28 countries will be giving over 180 individual presentations. Mass production of organic photovoltaics is among the topics in the Technical Conference. The high international relevance of "new electronics" is clearly reflected in the presentations at the Business Conference, such as "Market opportunities for printed electronics in China" or "Printed Electronics in Brazil — a rapidly growing market". The University of California, Berkeley (USA), is presenting new projects at the Scientific Conference.

► [www.lope-c.com](http://www.lope-c.com)

**28th EU PVSEC 2013, Sept.30-Oct.4, Paris**

The EU PVSEC is the largest international Conference for Photovoltaic research, technologies and applications, and at the same time one of the top international PV industry exhibitions. The renowned science-to-science, business-to-business and science-to-industry platform gathers the global PV community to conduct business, to network and to present and discuss the latest developments, innovations and state-of-the-art technologies in Photovoltaics. The 28th EU PVSEC 2013 at the Parc des Expositions Paris Nord Villepinte will attract key specialists from the entire PV industry value chain and related sectors.

► [www.photovoltaic-conference.com](http://www.photovoltaic-conference.com)

**Biotechnica 2013, Oct.8-10, Hanover**

In 2013, Europe's leading trade fair for biotechnology, the life sciences and laboratory equipment opens its doors for the 20th time. Biotechnica 2013 showcases the bio-economy, and its BiobasedWorld platform offers a meeting place for players in the bio sector. BiobasedWorld, which invites experts from all bio-economy fields to learn about new technical developments and locate cooperation partners, is organized jointly by Deutsche Messe and Dechema. "At BiobasedWorld, biomass suppliers, technology suppliers, manufacturers of bio-based products, process developers and scientists with market-ready ideas can all make contacts and develop ideas together" explains Dr. Kurt Wagemann, CEO of Dechema, the German Society for Chemical Engineering and Biotechnology.

► [www.biotechnica.de](http://www.biotechnica.de)

**Global Plastics Summit, Nov.4-6, Chicago**

A new plastics industry event will bring together plastics industry decision makers and technical experts to discuss global manufacturing trends, strategies and forecasts for North American and emerging markets. Organized by IHS Chemical and SPI, the U.S. plastics industry trade association the inaugural Global Plastics Summit over the course of three days will provide attendees with insights on the market outlook for key polymer and raw materials, technical and product development, innovations, challenges and opportunities in the dynamic plastics industry, which impacts plastic producers, converters, distributors and all related industry professionals.

► [www.GlobalPlasticsSummit.com](http://www.GlobalPlasticsSummit.com)

**Sustainable Oil and Gas 2013, Nov. 25-26, Edinburgh**

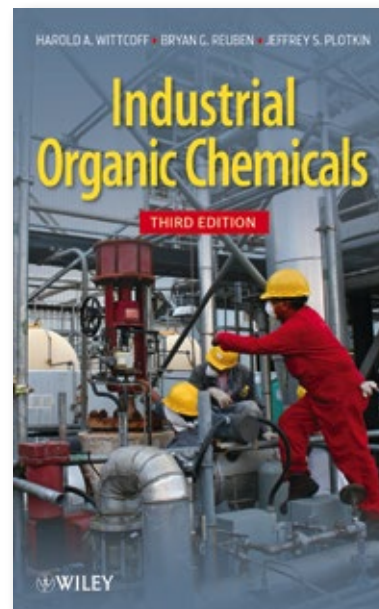
Scotland will host a new international symposium on the future of the oil and gas industry. The Sustainable Oil and Gas conference, which is being organized by the Institution of Chemical Engineers (IChemE) will cover every major aspect of the oil and gas industry with a particular focus on the challenges faced in Europe. The event will feature a mix of invited speakers, oral and poster presentations, and a trade exhibition of related products and services. Papers on key issues including shale gas, carbon management and the future of refining and petrochemicals in Europe are now being invited. The deadline for abstract submission is July 26.

► [www.icheme.org/sog2013](http://www.icheme.org/sog2013)

**Industrial Organic Chemicals**

The new edition offers an updated and expanded version of the previous editions. It explains how the majority of industrial organic chemicals and polymers are derived from seven major building blocks produced from petroleum and natural gas. The book goes on to describe the chemistry of these building block chemicals and their derivatives, and how they are manufactured. It gives their uses and economic importance, and explains associated environmental concerns. Additionally, it covers how polymers are made and industrial catalysis, two topics essential to understanding the organic chemical industry.

► Industrial Organic Chemicals  
Harold A. Wittcoff, Bryan G. Reuben, Jeffery S. Plotkin  
John Wiley & Sons  
Price: €129  
ISBN: 978-0-470-53743-5

**Metal-Catalyzed Reactions in Water**

Water is abundant in nature, non-toxic, non-flammable and renewable and could therefore be safer and economical for the chemical industry wherever it is used as a solvent. This book provides a comprehensive overview of developments in the use of water as a solvent for metal catalysis, illustrating the enormous potential of water in developing new catalytic transformations for fine chemicals and molecular materials synthesis. A group of international experts cover the most important metal catalyzed reactions in water and bring together cutting-edge results from recent literature with the first-hand knowledge gained by the chapter authors. This is a must-have book for scientists in academia and industry involved in the field of catalysis, greener organic synthetic methods, water soluble ligands and catalyst design, as well as for teachers and students interested in innovative and sustainable chemistry.

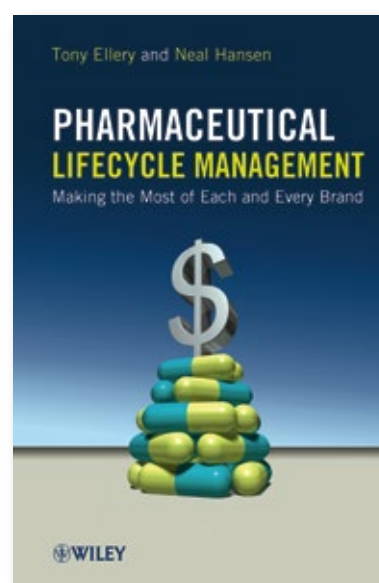


► Metal-Catalyzed Reactions in Water  
Pierre Dixneuf, Victorio Cadierno  
Wiley-VCH  
Price: €139  
ISBN: 978-3-527-33188-8

**Pharmaceutical Lifecycle Management**

This book systematically explains how LCM strategies can help the pharmaceutical industry maximize the value of its patented brands through effective drug development programs and brand management. The authors share their combined 50 years of experience in the industry, citing numerous recent examples and case histories, and demonstrating how different measures can be combined to create winning strategies. The text helps pharmaceutical professionals understand challenges facing the industry and the role LCM has in confronting them, and offers a look ahead to predict which LCM strategies will continue to be effective in the future.

► Pharmaceutical Lifecycle Management  
Tony Ellery, Neal Hansen  
John Wiley & Sons  
Price: €77.90  
ISBN: 978-0-470-48753-2



## PEOPLE



Mark Costa

**Mark J. Costa** has been appointed as Eastman Chemical's president effective immediately and chief executive officer effective Jan. 1. Costa, 46, currently the company's executive VP and head of the Additives & Functional Products and Advanced Materials segments succeeds James P. Rogers, who will continue to serve as chairman and CEO until Jan. 1. Rogers then will serve as executive chairman of the board. Costa, who also has responsibility for the company's corporate innovation organization has also been appointed as a director, effective immediately, to serve until the annual meeting in 2014. Since joining Eastman in 2006, he has held a number of executive positions. He has been instrumental in developing Eastman's growth strategies, has led Eastman's global supply chain and served as senior vice president of the Polymers Group.



Kenneth Lane

**Kenneth T. Lane**, currently senior vice president at Isocyanates Europe, became president of BASF's Catalysts division headquartered in Iselin, N.J., on June 1. He succeeds Frank A. Bozich, who has decided to leave the company. Lane holds a bachelor's degree in civil engineering from Clemson University, S.C. and a master's degree in management from the University of Alabama. He joined BASF in 2006 as director, Urethane Chemicals, Wyandotte, Mich., and moved to BASF's Belgium Coordination Center in Brussels to become senior VP, Strategic Marketing Polyurethanes, in 2009. From January 2013 he served as senior VP, Isocyanates Europe.

Zhengrong Liu  
© Kai Hedden

**Zhengrong Liu**, head of the Group Function Human Resources (HR) at Lanxess will leave the German specialty chemicals company as of June 30, at his own request. In his role, Liu has made significant contributions to the company's progress since its creation in 2004 with his global focus and innovative personnel management skills. **Gudrun Ihling**, currently head of the Global HR Business Partner Team, will succeed Liu as of July 1. The area of executive development within HR will still be headed by Miriam Muehlhoff.



Marten Booisma

**Marten Booisma** has been appointed as a new executive committee member of AkzoNobel. He is responsible for human resources and will officially take up the position of chief human resource officer on Oct. 1, succeeding Marjan Oudeman, who is leaving AkzoNobel to become president of Utrecht University. Booisma has been chief human resource officer at Royal Ahold since 2007. Booisma joined Royal Ahold in 1999 as director of Management Development Europe and prior to that worked for Unilever and Shell in various HR positions.

**Dr Thilo Kaltenbach** joined the Pharma and Healthcare Practice of global strategy consultant Arthur D. Little. He will join forces with Arthur D. Little's global Healthcare team and work with clients from the pharmaceutical industry, medical technology firms, health insurances and healthcare providers. In his last job at PWC Management Consulting Kaltenbach was mainly concerned with the development of growth strategies in emerging markets.

**Prof. Rafiqul Gani** of the Technical University of Denmark has been elected to succeed Prof. Richard Darton as president of the European Federation of Chemical Engineering (EFCE), from Jan. 1. Gani is currently the Federation's scientific vice president. Prof. Michael Considine has been elected as the Federation's executive vice president, also from Jan. 1, succeeding Dr. Wridzer Bakker of AkzoNobel. Considine is professor of process safety and loss prevention at the University of Sheffield, having joined the University in 2012 following a distinguished career in the international energy industry. EFCE is administered by the Institution of Chemical Engineers (IChemE) in conjunction with the German DECHEMA and the French Société Française de Génie des Procédés.

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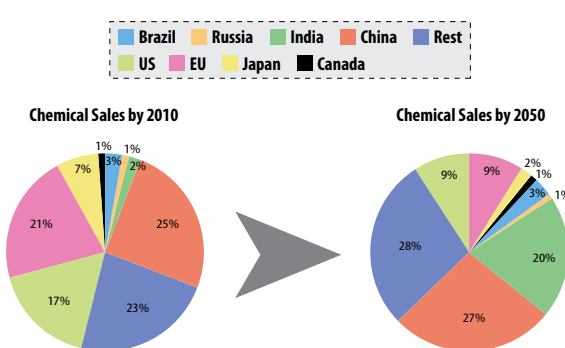
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## The Future of the Chemical Industry

### Development of Chemical Sales



Source: Future of the Chemical Industry by 2050  
by Rafael Caynela Valencia

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### Chemicals

In 2010, the largest chemical market was China, with 25% of the global sales and \$763 billion, followed by Europe with 21% (\$651 billion) and the U.S. with 17% (\$524 billion). The REST group was also significantly large with 23% of the global chemicals sales and almost \$720 billion. By 2050 and under the business-as-usual scenario (BAU) modified scenario several changes are expected.

The REST group will be the largest market for chemicals with 28% of the world, accounting for almost \$4.2 billion. China will be the largest single market, excluding the REST group, with 27% of the market \$4 billion market.

However Europe and the U.S. will see their global presence shrink in favor of India. The EU will move from being the fifth largest market in the world in 2010 to being the fifth largest when including the REST Group with just 9% of the market and \$1.3 billion. In a similar pattern, the U.S. will move from being the third largest chemical market to being the fourth when including the REST, with 9% of the total and \$1.3 billion. India is expected to become the second largest individual market after China, excluding the REST group, with 20% of the global chemicals sales, accounting for almost \$3 billion by 2050. In every scenario, India is expected to become the world's largest chemical market during the period 2030 to 2040, when it will surpass the EU and the U.S.; the U.S. is expected to pass Europe by 2040.

Brazil is expected to become the fifth largest chemical market in the world by 2030, after surpassing Japan. Brazil's chemical market will grow from \$100 billion in 2010 into \$477 billion by 2050. The Russian chemical market is also expected to surpass the Canadian chemical market during this decade. The Russian chemical market is expected to grow from \$42 billion in 2010 into \$208 billion by 2050.

### Pharmaceuticals

The pharmaceutical market is also expected to undergo a huge structural shift, with an unprecedented change of focus from the advanced economies into BRIC. Massive increases in market size will be the result of a combination of large populations and increases in per capita demand; however, there will still be large difference in per capita demand among the different countries and areas of our analysis.

In 2010, 75% of the world pharmaceutical sales were in the advanced economies, with the U.S. alone accounting for more than one third of the world pharmaceutical sales and EU-27 for another 28%.

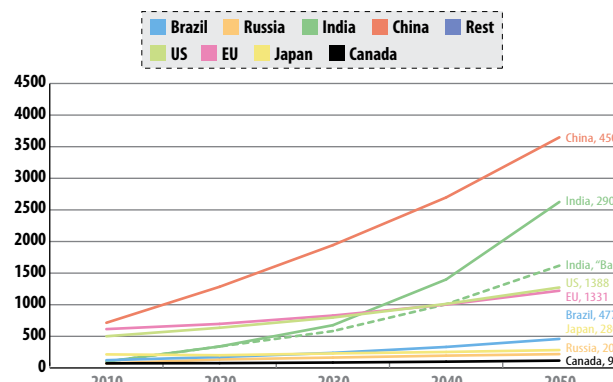
By 2050 and under the modified BAU scenario, several changes are expected. The U.S. is expected to remain as the largest pharmaceutical market in the world with 24%, and accounting for \$925 billion by 2050. In other words, the whole U.S. pharmaceutical market in 2050 will be as big as the world pharmaceutical market was in 2010.

China, with 19% of the world demand and \$752 billion, will be the second largest pharmaceutical market. Europe will follow with a 14% (\$566 billion) and India will take over fourth place with 12% of the world demand (\$456 billion). Japan, despite increasing the total size of its market by a staggering \$43 billion — from \$71 billion in 2010 to \$114 billion in 2050 — will lose its third position in the world pharmaceutical markets to China and India. (Excerpt from the Wiley book „The Future of the Chemical Industry by 2050“ by Rafael Cayuela Valencia)

For more details see the article on page 4

### Chemical industry

in billion \$US (2009 dollar)

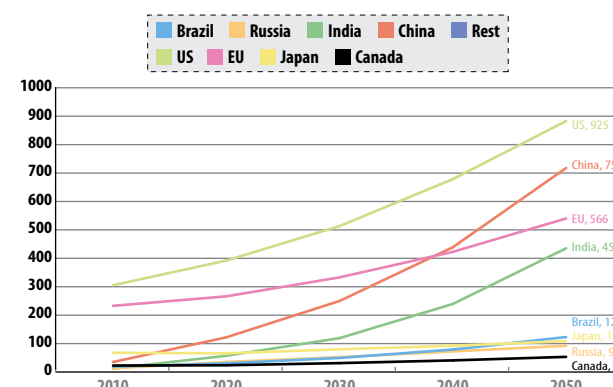


Source: Future of the Chemical Industry by 2050  
by Rafael Caynela Valencia

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### Pharmaceutical industry

in billion \$US (2009 dollar)



Source: Future of the Chemical Industry by 2050  
by Rafael Caynela Valencia

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**Origami Boat** - The Oru Kayak is a high-performance boat that folds out of a compact case. Its designer Anton Willis — inspired by origami — began creating this folding kayak after a move into a small San Francisco apartment forced his fiberglass kayak into storage. The full-size (12' long), and super light (25 lbs) Oru Kayak is engineered of a single sheet of double-layered plastic that is extremely tough and durable. The single seam is sealed with a watertight rubber gasket. Solid ribs offer strength and rigidity. On the water it's fast, stable and handles well. Folded and stowed in the case it can be stashed in a trunk, checked on a plane or even carried on a hike to remote waters. (Photo: www.orukayak.com)

## Breakthrough In Chiral Technology

Researchers at the University of Gothenburg have been able to produce one mirror image by using crystals with special properties; this can have a major impact on the production of pharmaceuticals.

The mirror image forms of chiral molecules have identical properties except when they interact with other chiral molecules. In all living organisms, only one of the two mirror image forms is used.

The mirror images can have different effects in our bodies where one can provide the desired effect while the other in the worst case can give rise to serious side effects.

“Today, all new pharmaceuticals must contain only the mirror image form with the desired effect. But when a chiral molecule is produced in a laboratory, equal amounts of the two mirror images are obtained,” said Susanne Olsson at the Department for Chemistry and Molecular Biology, University of Gothenburg.

To date, the active mirror image form has been produced by adding a mirror image form of another substance, but this requires that the substance be separated from the pharmaceutical. Being able to produce the desired mirror image form without having to add mirror image

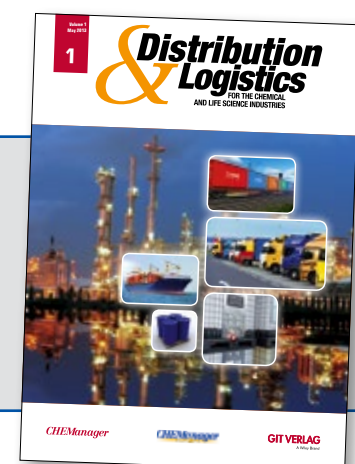
forms of some other substances is considered by some chemists to be impossible.

“But by using compounds where the mirror image molecules switch between being the right form and the left form, I have succeeded in getting all crystals to contain only the one mirror image,” Olsson said.

She believes that the method is industrially usable since crystallization is a process that is good for large-scale production.

## Supplement

This issue of CHEManager Europe contains the special supplement **Distribution & Logistics for the Chemical and Life Science Industries**. The new annual publication covers all relevant topics for chemical distribution and logistics services.



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**Publisher:**  
Wiley-VCH Verlag  
GmbH & Co. KGaA  
GIT VERLAG  
A Company of  
John Wiley & Sons, Inc.

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Commerzbank AG Darmstadt,  
Germany  
Account No. 01715501/00,  
Routing No. 50880050  
The current price list is valid  
from 1st October 2012

CHEManager Europe  
appears 10 times in 2012.  
Print run: 20,000  
(IVW Report  
Q1 2013: 19413 tvA)  
Eighth year 2012  
Subscriptions  
10 issues €85.70  
incl. postage  
single copy €13.80  
plus postage  
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Druckzentrum Rhein-Main  
GmbH & Co. KG  
Alexander-Fleming-Ring 2  
65248 Rüsselsheim

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Printed in Germany  
ISSN 1861-0404