



REACTION

Chemicals Magazine

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What do data and analytics and changes in the personal care industry mean for chemical companies today?

KPMG GLOBAL CHEMICALS INSTITUTE

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Introduction

Welcome to the July 2016 edition of Reaction Magazine. It's certainly been a tumultuous few months for the global economy, capped by the recent vote for 'Brexit' in the UK and the massive impact that has had on global stock and currency markets. While the long-term impacts remain unclear, the short-term impact is already driving volatility and uncertainty, both of which are likely to adversely impact business confidence and, consequently, investment.

We'll have more on Brexit in later editions, but in this edition, we bring you a focus on the key trends in the personal care market — one of the chemical industry's most important end markets — and look at how globalization and changing tastes for care products are providing massive opportunities for chemical producers. We also take a look at how chemical companies are deploying the latest data and analytics tools and techniques to gain business advantage.

As ever, KPMG's global chemicals and performance technologies team remains active in the industry and it was great to see so many familiar faces at our annual chemical industry roundtable in Düsseldorf recently.

We'll be back with our next edition in November with an outlook for the chemical industry in India along with the latest in our ongoing supply chain optimization series. If there are any other topics you would like us to cover in future editions of Reaction, please don't hesitate to contact us.



Mike Shannon

Global Chair

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Chemical suppliers

keep pace with global personal care markets

By **Alton Adams**

Chemical companies are working hard to satisfy the growing demand for ingredients that go into personal care products for the skin, hair, oral care, and other applications. As a large, rapidly expanding and increasingly diverse market, product ingredients represent special challenges for chemical companies. Today's consumers want more, they want quality and they want it now. But opportunities are evident as well, driven by a growing middle class in the East, an aging population in the West, and new markets such as men's grooming, halal beauty and bio-based skin care.







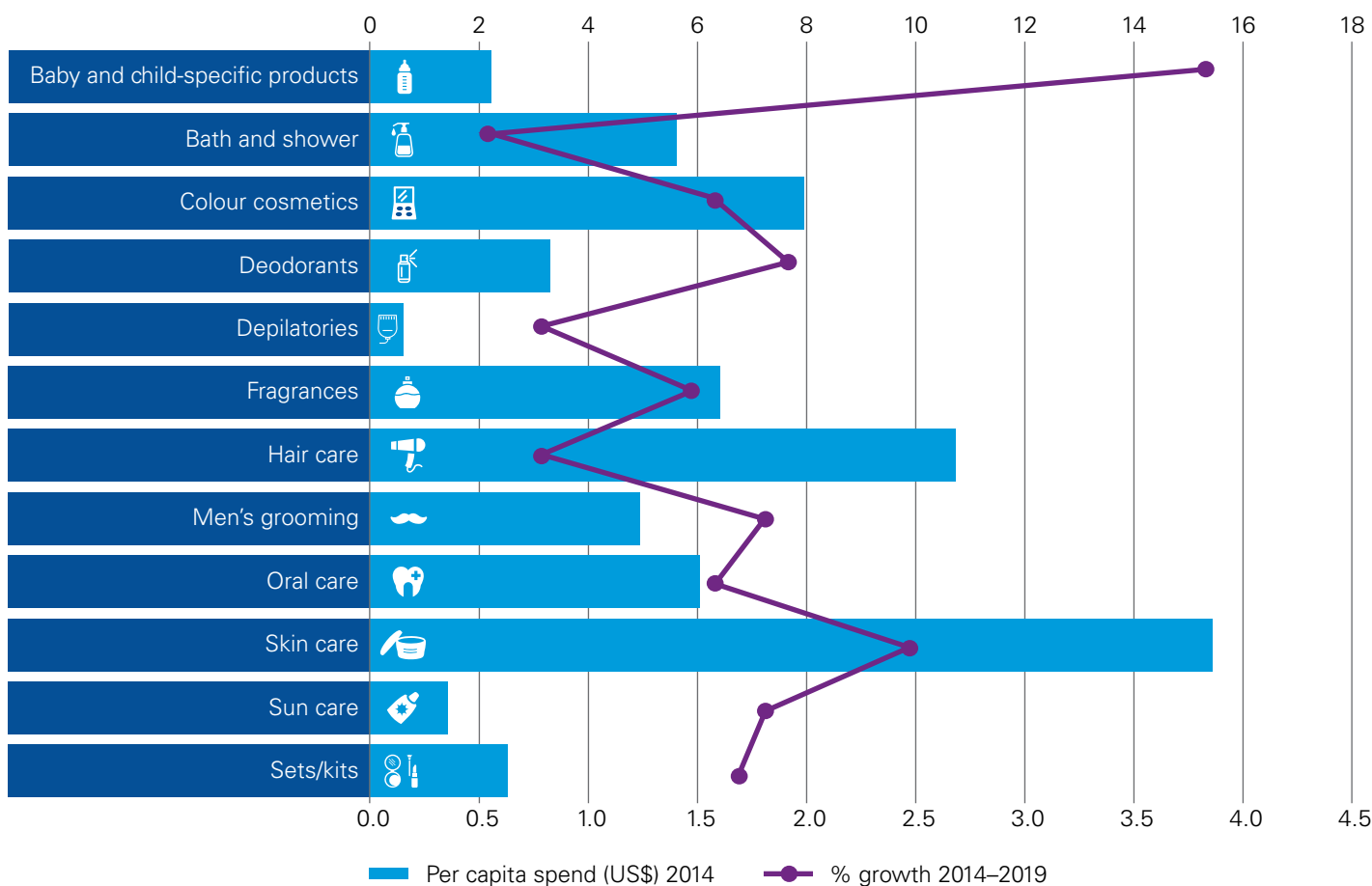
Better products for a 'better' you

In South Korea, consumers take up to a dozen steps in their daily skincare routine, while Chinese consumers prefer one-step products supplemented by sheet masks, sometimes twice daily. In Indonesia, scalp freshener products are popular with Islamic women wearing the jilbab.¹ In the US, men's grooming is one of the fastest-growing market segments in personal care.²

Clearly, personal care is an expanding, highly regionalized and increasingly diverse market. Product categories include toothpaste, fragrances, mouthwashes, hair care and dyeing products, cosmetics and products for nail care, bathing and shaving. The chemical ingredients for these products include surfactants, emulsifiers, polymers, emollients, cosmetic active ingredients, pigments, UV filters and thickeners, and protein compounds.³

The global market for personal care products is expected to increase between 3.5 and 4.5 percent over the next five years, with a total market value of US\$500 billion by 2020.⁴ The market for product ingredients will likely grow even faster over most of the same forecast period. Valued at US\$7.46 billion in 2014, the ingredients market is expected to reach US\$11.76 billion by 2023, representing a CAGR of 5.2 percent.⁵

Global per capita spending on beauty and personal care 2014 and growth 2014–2019 by category



Source: The Future of Beauty and Personal Care in the Globe and Asia Pacific, Euromonitor, 2015

¹ Examples from In-cosmetics trends presentations review 2015, In-cosmetics News, 27 May 2015, <http://news.in-cosmetics.com/2015/05/in-cosmetics-trends-presentations-review-2015/>

² Global Personal Care: Trends 2015, Lebermuth, <http://www.lebermuth.com/assets/1/7/GlobalTrends2015.pdf>

³ Personal Care Chemicals and Ingredients Market: Global Industry Analysis and Forecast to 2020, Persistence Market Research, <http://www.persistencemarketresearch.com/market-research/personal-care-chemicals-ingredients-market.asp>

⁴ Growth of global ingredients market outpaces personal care industry, Transparency Market Research, <http://www.transparencymarketresearch.com/pressrelease/organic-personal-care-products.htm>

⁵ Ibid.

Beauty and personal care is a US\$465 billion industry globally*



*Source: The Future of Beauty and Personal Care in the Globe and Asia Pacific, Euromonitor, 2015

**Source: <https://www.linkedin.com/pulse/how-consumers-shop-anti-aging-skin-care-market-trends-michelle-skelly>

Skin care is the major application for personal care products and accounts for a quarter of sales.⁶ The largest segment for ingredients is surfactants, agents that increase a liquid's wetting and spreading properties.⁷ On the basis of chemical properties, the active ingredients segment shows the strongest growth.⁸

Asia Pacific represents the largest share (29 percent) of the global personal care products market, with sales fueled mainly by population growth, urbanization and increased per capita spending power.⁹

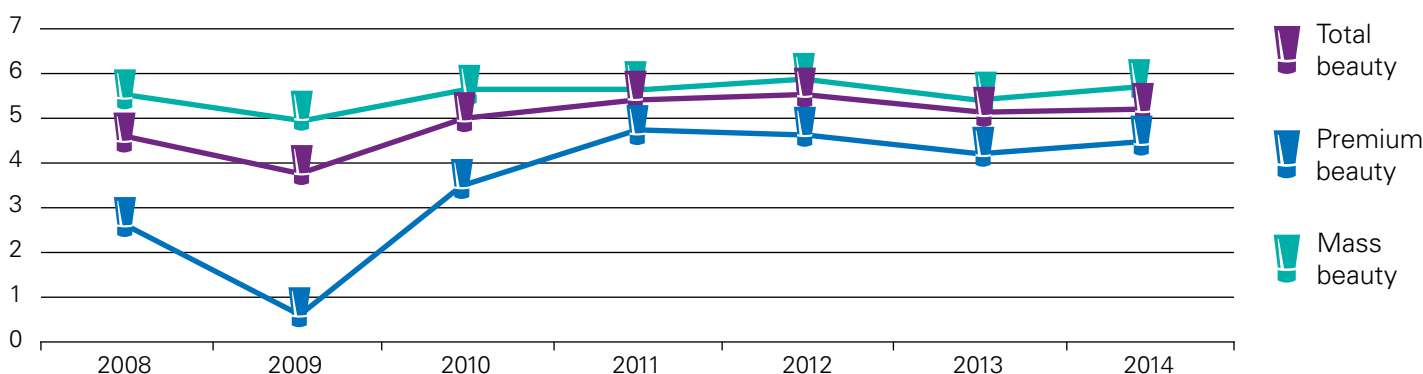
Europe occupies second place, followed by North America.¹⁰

In the US, a growing Hispanic population and rising demand for luxury personal care brands will support demand for cosmetic chemicals over the next five years.¹¹ In Europe, skin care and toiletries remain the most important product categories, followed by hair care and fragrances.¹² Across all developed economies, including Japan, the growing number of older consumers is driving more sales for anti-aging, anti-wrinkle and sun protection products.¹³

A sluggish economy in emerging markets, increased regulations in the West, and questions about product effectiveness have impeded sales over recent years. Yet personal care products represent a strong and resilient market. Granted, consumers buy less during an economic downturn, though exceptions have been noted (see page 9, The Lipstick Effect). However, after 2008, sales made a strong recovery and, equally significant, premium products gained a larger share of the total market (see chart: Total vs. premium vs. mass growth performance: 2008–2014).

Total vs. premium vs. mass growth performance: 2008–2014

% y-on-y growth



US\$64*

per person, annual per capita, spent on personal care products globally

5%*

value growth generated in 2014



29%*

represented by Asia Pacific in 2014

*Source: The Future of Beauty and Personal Care in the Globe and Asia Pacific.

⁶ The Future of Beauty and Personal Care in the Globe and Asia Pacific, Euromonitor International, November 2015, http://www.in-cosmeticsasia.com/RXUK/RXUK_In-CosmeticsAsia/2015/Documents/The%20Future%20of%20Beauty%20and%20Personal%20care%20in%20Asia.pdf?v=635857035004836758

⁷ Ibid.

⁸ Ibid.

⁹ Growth of global ingredients market outpaces personal care industry, op. cit.

¹⁰ Asia Pacific to Continue Personal Care Ingredients Market Dominance, Global Market to Reach US\$11.76 bn by 2023, press release, Europlat.org, <http://www.europlat.org/asia-pacific-to-continue-personal-care-ingredients-market-dominance-global-market-to-reach-us11-76-bn-by-2023.htm>

¹¹ US Cosmetic Chemicals Market to Grow due to Increasing Demand for Personal Care Products, TechSciResearch, <http://www.techsciresearch.com/news/186-us-cosmetic-chemicals-market-to-grow-due-to-increasing-demand-for-personal-care-products.html>

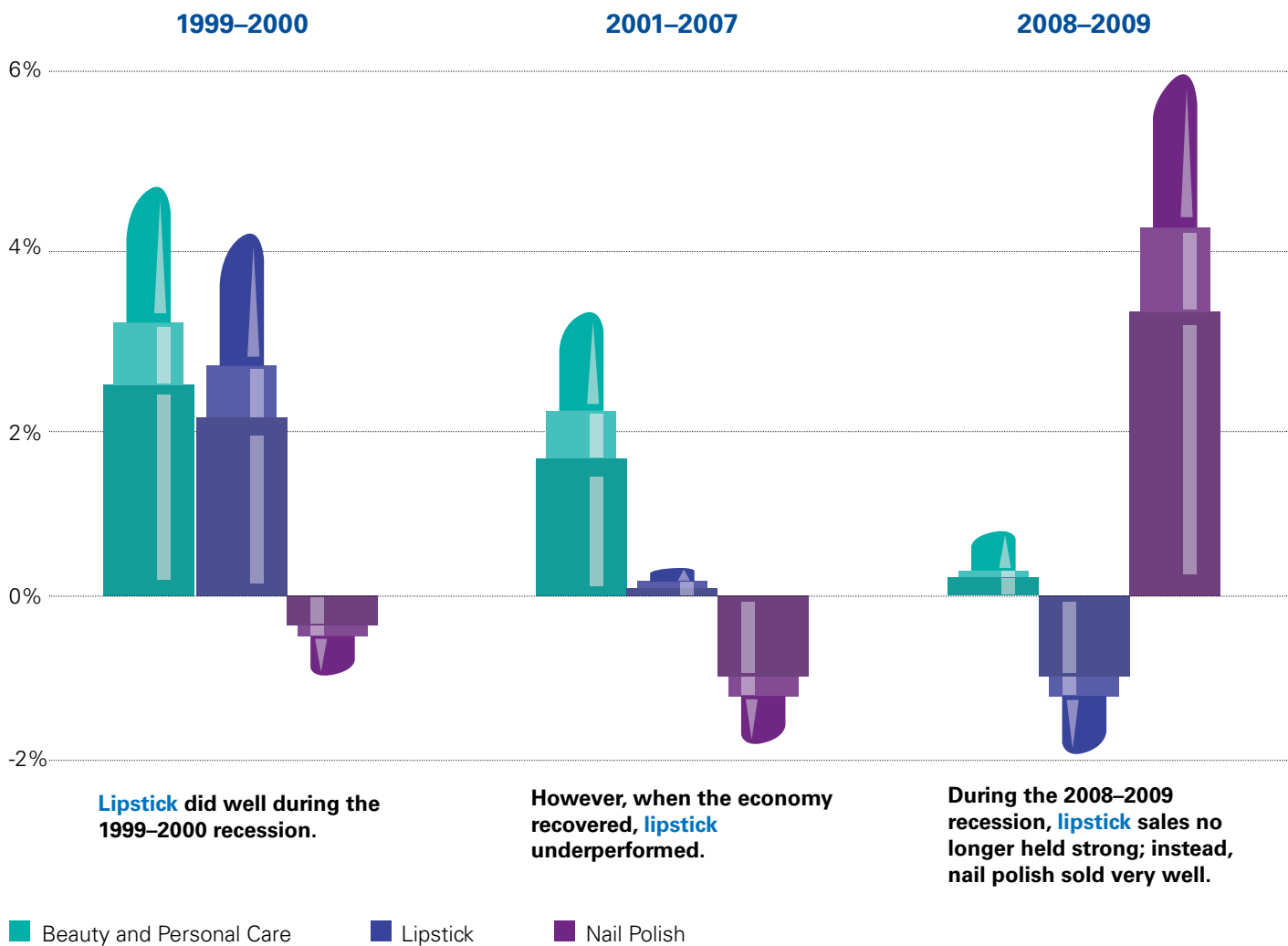
¹² The European cosmetics and personal care market shows signs of recovery, Premium Beauty News, 23 June 2015, <http://www.premiumbeautynews.com/en/the-european-cosmetics-and-8340>

¹³ Ibid.

The Lipstick Effect

The resilience of the personal care market depends partly on what is sometimes called the Lipstick Effect — the idea that during economic downturns consumers buy fewer and less costly goods in general but not for certain items such as lipstick or nail

polish. Psychologists disagree about the motivations behind these purchases but sales figures support the claim. L’Oréal, one of the world’s largest cosmetics companies, reported that during the global recession in 2008 their total sales grew by 5.3 percent.¹⁴



Source: Euromonitor, <http://blog.euromonitor.com/2013/11/redefining-the-lipstick-effect-examples-of-recession-proof-categories.html>

¹⁴ The Lipstick Effect: How Boom or Bust Effects Beauty, Psychology Today, 10 October 2015
<https://www.psychologytoday.com/blog/slightly-blightly/201510/the-lipstick-effect-how-boom-or-bust-effects-beauty>.
See also Lipstick, the Recession and Evolutionary Psychology, Scientific American, 27 June 2012,
<http://blogs.scientificamerican.com/guest-blog/lipstick-the-recession-and-evolutionary-psychology/>

Industry megatrends

 Consumers stay better informed about ingredients that may potentially harm them or the environment.

The global personal care industry is rapidly changing based on a number of megatrends, each one of which affects both manufacturers and the chemical companies that supply ingredients.

Better-informed consumers

Gone are the days when consumers purchased products solely in retail stores, prompted by messages from a relatively small number of media channels such as television commercials or print ads in newspapers and magazines. Even a manufacturer's website must compete for the attention of consumers who compare product reviews posted online and gather information from a multitude of sources. As a result, consumers stay better informed about ingredients that may potentially harm them or the environment. Because they know more, they are often more skeptical regarding claims made by product manufacturers, whether in advertising, packaging, websites or point-of-sale materials. Consumers are also demanding full transparency from manufacturers about their sourcing methods, product, ingredients and sustainability practices.

More products and shorter product lifecycles

In the past, we saw well-funded, heavily marketed products with a lifecycle that lasted years, if not decades. Consumers grew up with these 'familiar faces' and

became loyal customers. Today, products are replaced by new market introductions at a much faster rate. We also see what might be called 'tangential' products where, for example, a successful hand lotion is followed by several spin-off products that offer variations in functionality and fragrances.

Deflationary economics

Especially in developed economies, personal care product manufacturers can no longer expect a steady annual price increase of several percentage points to drive growth. Today, pure volume is a better determinant of growth. This means that manufacturers are more focused on margins that require tighter control over costs for ingredients — which is impacting chemical companies along the supply chain.

Regional demographics

A growing urban population, particularly in developing countries, is helping to fuel the growth in personal care products. As more people work in offices and retail environments, awareness of personal appearance and hygiene is increasing the use of these products. In Brazil, anti-aging functionality is less important than products for hair care. Anti-inflammatory products are strong in the US unlike other regions, and skin lightening creams are most popular in Asia.¹⁵

¹⁵ Personal care ingredients: Trends driving the market, COSSMA, http://www.cossma.com/fileadmin/all/cossma/Archiv/2015/10/COS1510_30_IngrEdInnov.pdf

The 'Asianification' of beauty

Growth in Asia Pacific constitutes a megatrend in itself for the personal care industry. This region dominates global markets, and with a billion new consumers buying an increasing amount and variety of products, this trend will only continue in the years ahead.¹⁶

Along with the traditional BRIC markets — Brazil, Russia, India and China — new markets are emerging in Pakistan, Morocco, Indonesia, Saudi Arabia, Vietnam and the United Arab Emirates. These countries have a relatively young population, an expanding urban middle class and sophisticated beauty habits, all of which support steady sales. Products in one market can quickly take off in another. Hair oil — which is big in Japan, India and Indonesia — is now finding growth in the Middle East.

Even with a cooling economy, China remains the largest Asian market for personal care products. Sales are expected to grow at 8 percent for the next five years. Greater disposable incomes and an increased number of products offering comfort, convenience and health also contribute to growth, with revenues estimated at US\$28.2 billion.¹⁷ The introduction of the

two-child policy is expected to provide a major boost to the forecast period performance of baby and child-specific products.¹⁸ The growing consciousness of personal well-being and grooming among urban middle-class consumers, along with demand for gender-specific products, will support markets for skin care, colour cosmetics, fragrances and men's grooming.

An increasingly important market segment in the Middle East and Asia is halal beauty — cosmetics, skin and hair care products created for Islamic women. Halal certification requires a strict adherence to the purity regulations according to Islam. These cover every part of the production process, including which raw materials can be used, how they are handled, how the product is manufactured and even how it is packaged. For example, in the manufacturing process that produces glycerol for soap, gas-based synthetic ethanol is allowed but not alcohol made from fermentation. Halal certifiers are not universally recognized, so brands must understand each target market. For example, Germany has five independent certifiers while Indonesia, Turkey and Iran have state-based systems.¹⁹

 Even with a cooling economy, China remains the largest Asian market for personal care products. Sales are expected to grow at 8 percent for the next five years.

¹⁶ 3 great forces changing China's consumer market, World Economic Forum,

<https://www.weforum.org/agenda/2016/01/3-great-forces-changing-chinas-consumer-market/>

¹⁷ Gentlemen Marketing Agency, <http://cosmeticschinaagency.com/2014-personal-beauty-care-market-china/>

¹⁸ Beauty and Personal Care in China, Euromonitor, April 2016,

<http://www.euromonitor.com/beauty-and-personal-care-in-china/report>

¹⁹ In-cosmetics trends presentations review 2015, op. cit.

What do men want?

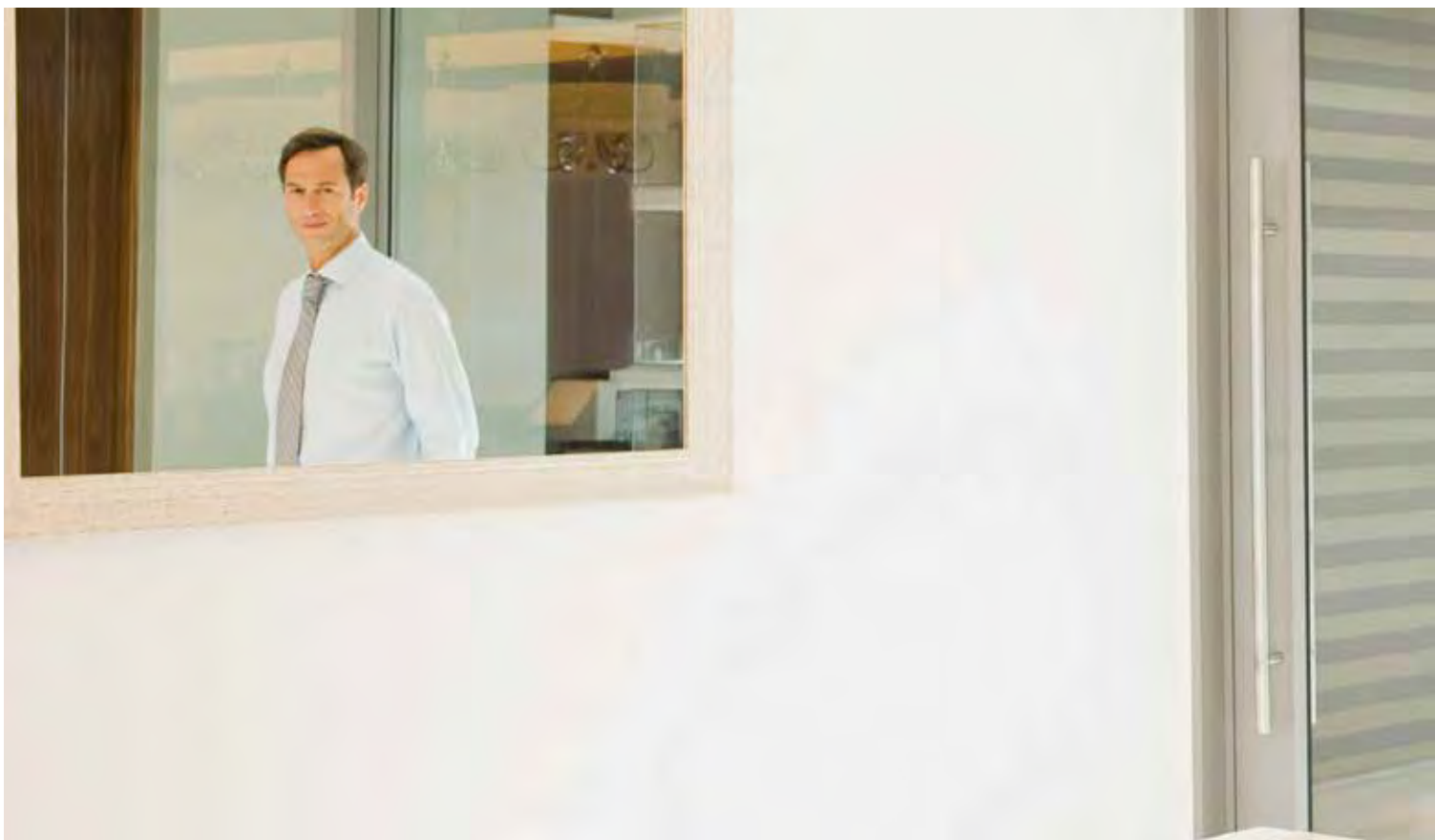
“52 percent of global male consumers consider their looks and appearance to be either important or very important, and 29 percent touch up their looks throughout the day.”

With products intended for half the world's population, men's grooming is a market segment with huge potential. Traditionally, men's grooming was treated by brands and retailers as an afterthought to women's beauty, but that is changing as men take more interest in their appearance. According to research, 52 percent of global male consumers consider their looks and appearance to be either important or very important, and 29 percent touch up their looks throughout the day.²⁰ This percentage rises to 39 percent in teenagers 15 to 17 years old, the future users of grooming products.²¹

Marketers have identified two user groups: men who use toiletries to help

maintain good personal hygiene, health and well-being, and a new breed of man who buys products designed specifically to improve their physical appearance.²² The latter includes blemish concealers, face bronzers, lip balm and even male fingernail polish. Anti-aging products are also becoming more popular with men in their 40s and 50s, mirroring a long-standing trend in the women's skin care category.

That said, men's grooming is still a work in progress for personal care marketers. In the US, 86 percent of men prefer their daily grooming routine to be as simple as possible.²³ Only 31 percent of men use facial skin care products, and some men use just hand cream or nothing



²⁰ Trends in the global men's grooming market, In-cosmetics, <http://news.in-cosmetics.com/2015/01/trends-in-the-global-mens-grooming-market/>

²¹ Ibid.

²² Ibid.

²³ Making Over the Men's Grooming Market, Mintel News, 8 October 2015, <http://www.mintel.com/blog/beauty-market-news/the-global-trends-making-over-the-mens-grooming-market>

at all on their faces. In Brazil, however, almost a third of men report that they are spending more time looking after their hair compared to six months ago.²⁴ Men in emerging markets are also twice as likely to apply hair oils, use hair fragrances and apply hair-loss treatment products.²⁵ Africa in particular has been identified as a high-growth market, with an exploding population, a fast-growing middle class, increasing urbanization and improved business regulation.

In the US and Europe, beards have become a growth segment in many regions, especially with the advent

of the 'lumberjack look' that is driving sales for products designed to clean, condition and style men's beards and moustaches. These products need to be formulated specifically for men's skin and hair physiology. Men's skin is generally more sensitive, more vascularized, ages differently, and is darker than that of women. Although thicker, it is weakened by constant shaving. Proper beard preparation is vital: the hair must be thoroughly moisturized to reduce the stress caused by the razor and avoid burn. Using products designed for women is rapidly becoming a thing of the past.



²⁴ Ibid.

²⁵ Men's Grooming Habits in Emerging and Developed Markets, Euromonitor, 22 July 2014, <http://blog.euromonitor.com/2014/07/mens-grooming-habits-in-emerging-and-developed-markets.html>



Organic and natural ingredients

According to recent reports, the global organic personal care market is growing at an annual rate of almost 10 percent, with expectations of a market valued at US\$15.98 billion by 2020.²⁶

Organic personal care products are made from plant-based ingredients such as almond, palm, jojoba, safflower and coconut oils; soy and oat derivatives; and cocoa and shea butters. In addition, products termed 'organic' generally do not contain synthetic chemicals such as phthalates, parabens, aluminum salts, and petrochemicals.

But what exactly does 'organic' mean? Certification is a complicated issue. In the US, for example, regulations distinguish between 100 Percent Organic, Organic and Made from Organic Materials.²⁷ In Europe, regulations can be even more detailed. There is also the question of whether natural ingredients automatically qualify as sustainable. BASF scores all of its products for sustainability and considers the entire product chain, including sourcing, water use, biodegradability and other areas, all of which need to be considered in determining whether a product can be called sustainable.²⁸

Nevertheless, certification is helping to drive product sales as consumers become more familiar with certification labels that quickly identify organic products and assure buyers of quality.



²⁶ Organic Personal Care Market Analysis by Product (Skin Care, Hair Care, Oral Care, Cosmetics) and Segment Forecasts to 2020, Grand View Research, 2015

²⁷ Natural Organic Program, Cosmetics, Body Care Products, and Personal Care Products, www.ams.usda.gov/sites/default/files/media/OrganicCosmeticsFactSheet.pdf

²⁸ New textures, natural ingredients drive discussion at Suppliers' Day, ChemWeek, 12 May 2016, http://www.chemweek.com/home/top_stories/New-textures-natural-ingredients-drive-discussion-at-Suppliers-Day_79362.html



What do personal care product manufacturers need from chemical suppliers?

As manufacturers produce more products, introduce new products, and fine-tune existing ones to meet changing customer demands, they need suppliers that can keep pace with these industry developments. Suppliers should be able to provide:

A greater number of ingredients

This includes the ability to provide a larger number of basic ingredients and specialty chemicals as well as the ability to quickly expand and diversify their portfolio with new ingredients.

Compliance and claims substantiation

Chemical suppliers need to provide accurate documentation and supporting evidence about the source of ingredients, their efficacy, and proof that they are not harmful to humans or the environment. First-tier suppliers should apply these same requirements to their own second-tier and third-tier suppliers. In addition, global suppliers should be well-versed in how regulations vary across regions and countries.

Faster delivery

Suppliers need to ensure that ingredients are delivered to manufacturers to support accelerated manufacturing times and shorter product lifecycles. In many cases, this involves faster delivery for a greater number of ingredients.

Increased ability to anticipate demand

Suppliers need to work closely with manufacturers to better understand their pipeline of new products, collaborate where possible on research and development and track consumer markets to develop a line of sight on future demand.

In addition, suppliers can help support market analysis and other essential services. Working together, chemical suppliers and product manufacturers can take full advantage of this vital and growing market.

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The global organic personal care market is growing at an annual rate of almost 10 percent, with expectations of a market valued at US\$15.98 billion by 2020.

Big Data

means big opportunities
for chemical companies

By **Martin Kaestner**

The global chemical industry has reached a tipping point, and it's all about information. Big Data and next-generation analytics are now being used by leading chemical companies to enhance manufacturing, fine-tune pricing, improve marketing and support innovation. Success depends on recognizing that Big Data is more than an incremental change in technology but a strategic transformation for the industry.



What exactly is Big Data?

Big Data means more than just ‘a lot of data.’ One definition is based on three V’s: the extreme volume of data being generated and gathered, a wide variety of data types, including texts, pictures and video from social networking, and the high velocity at which the data must be processed.

Big Data is used with advanced analytic software to recognize patterns, trends and associations not apparent in smaller data sets. In effect, analytics can support two more Vs: veracity to ensure data quality and value for businesses seeking greater productivity, lower costs and higher revenues.



People, process, technology

IT is nothing new for the chemical industry. In 2005, Dow Chemical was taking advantage of IT and operational data to develop cost models for freight, logistics and raw material spend. These models were first used to negotiate better terms with suppliers, helping to reduce expenses.²⁹ Today, chemical companies use IT and data gathered from operations and other sources to strengthen, enhance and generally improve the way they do business, support growth and compete in the marketplace.

For some analysts, the emergence of Big Data is more of an evolution than a revolution, simply one point on a continuum that represents the ongoing

development of technology. For the chemical and several other industries, however, Big Data can support a critical shift from reaction to changing market demands, production issues or other factors requiring action, to prediction — when these factors might occur — and ultimately to prescription — what should be done to address these events in the future.

In fact, it could be said that the traditional three pillars of a modern business — people, process and technology — should now be increased to five with the addition of data and analytics.

With Big Data and the right analytic tools, many chemical companies

are developing holistic solutions that integrate silos of information from suppliers, the plant floor, sales and marketing, laboratory information management systems (LIMSs) and third parties. By integrating data and applying advanced analytical techniques to raise their productivity, manufacturers can increase efficiency and enhance product quality. In emerging markets, companies can begin to build competitive advantages by capturing market share and improving margins. In developed markets, companies can use Big Data to reduce costs and deliver greater innovation in products and services.³⁰

²⁹ Big data and the chemical industry, ICIS, 13 December 2013

³⁰ How Big Data is Influencing Chemical Manufacturing, ChemInfo, 26 May 2015, www.chem.info/blog/2015/05/how-big-data-influencing-chemical-manufacturing



Smart production

In a modern chemical manufacturing plant, technology is used to automate production, apply and continuously improve process controls, integrate asset sensors, improve supply planning, and take advantage of manufacturing execution systems at the enterprise resource planning (ERP) level.

Big Data takes this a step further with the ability to ‘connect the dots’ from multiple data sources to improve asset utilization and make better operational decisions in real time. Data integration and distribution are made possible with platforms such as Hadoop, a Java-based scalable system that stores data across multiple networks. On the shop floor, terabytes of data generated from pump monitors, valve vibration analysis, agitator torque tracking, variable pressure meters and other sources are used by manufacturers to identify optimum production levels, reduce waste, and accelerate return on investment. With smart technology that monitors energy consumption, the data collected can be analyzed, and an energy utilization plan can be prepared to optimize energy usage.

The new technology can also help predict equipment failure, schedule preventive maintenance and document production processes — important

benefits that support safe working environments and regulatory compliance. If a safety-related incident occurs, manufacturers can review why it occurred and the best way to prevent it from happening again. The information can also be clearly communicated to regulators and the public. Providing better data means that everyone can make smarter, more informed decisions about the impact of chemical production on the facility itself and the environment in which it operates.

In addition, Big Data and analytics help create variants of existing products. These variants can lead to production processes that lower production cost per unit or, alternatively, produce a higher-quality substitute with higher profit margins.

Finally, combining the right data — for example, operational and financial — with analytics can dramatically streamline chemical supply chains and distribution systems. Regional exchange-rate risk models show where to buy raw materials and how to price finished goods. Distribution optimization projects enable chemical companies to move products from manufacturing facilities to hundreds or even thousands of destinations at the right time without excessive inventory holding costs.



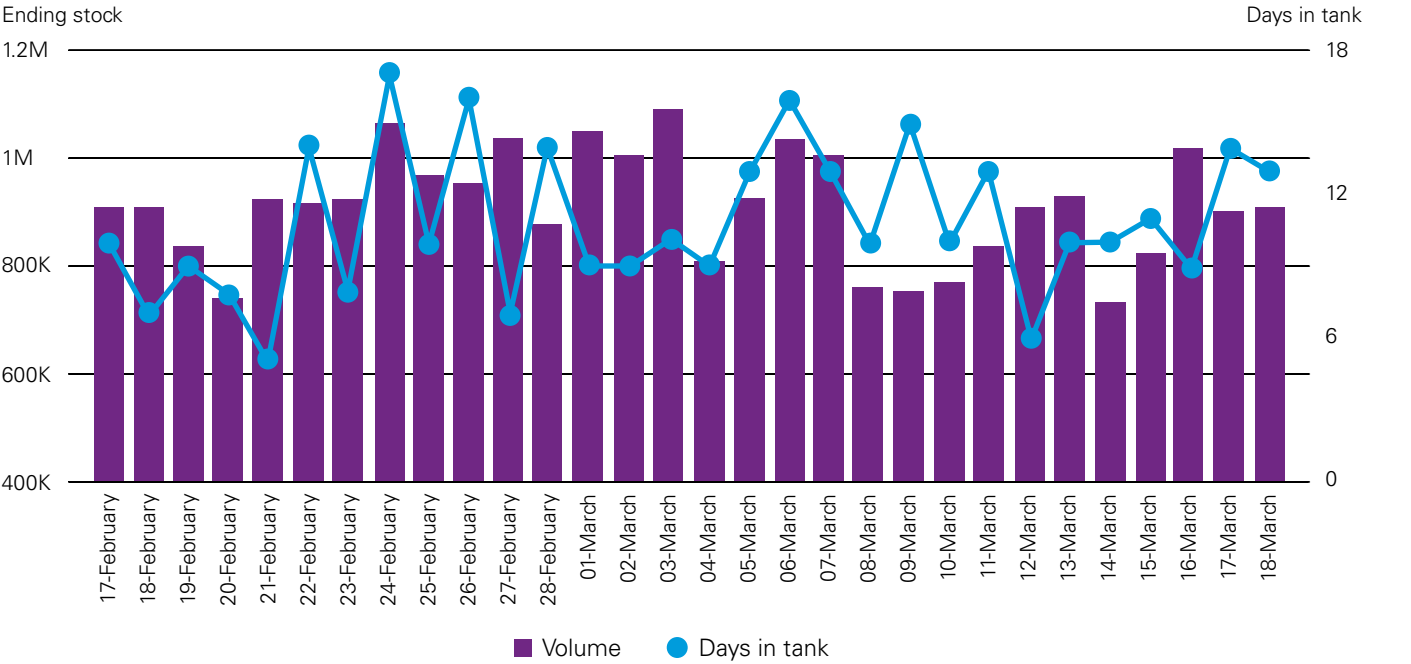
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Analytics software can help enhance demand planning processes and streamline business operations, enabling chemical companies to reduce costs, increase efficiency, and optimize

production. The following example shows two executive KPI dashboards that summarize chemical stock and production by geography, time period (daily, monthly, quarterly) and business

unit. Dashboards like these can deliver gross and net amounts, toggle between graphical and tabular views, and drill down to perform more granular analysis.

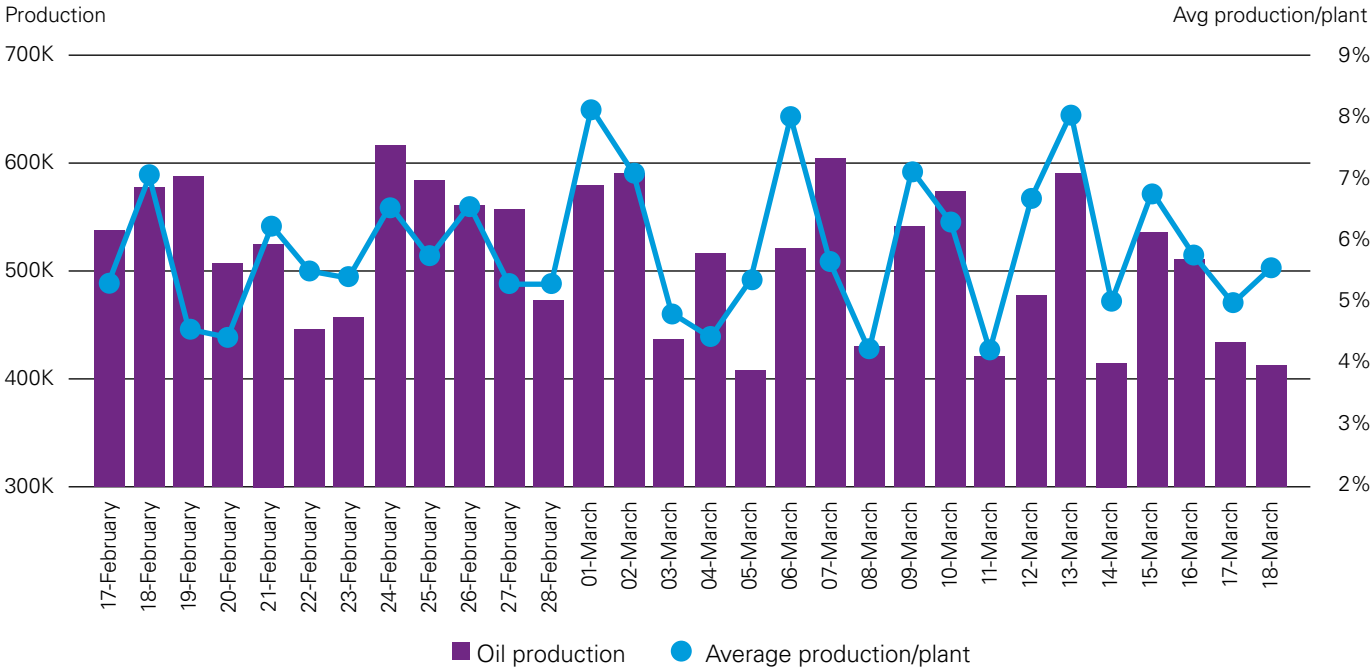
Ending stock and production — daily trend (in gallons)



Source: Visualbi, company website, <http://visualbi.com/analytics/chemicals-analytics/>



Production volumes — daily trend (in gallons)



Source: Visualbi, company website, <http://visualbi.com/analytics/chemicals-analytics/>



BASF saves US\$36 million through analytics³¹

BASF used MVT® (Multivariable Testing) analytic software from QualPro to optimize manufacturing processes, reduce costs, increase yield and improve product quality at its Freeport facility in Texas.

Based on advanced mathematical methods that can test up to 40 variables simultaneously, MVT® is applied to ideas brainstormed among staff and management to test multiple concepts in a short period of time, quickly revealing what factors have a positive, negative or negligent impact on business decisions. BASF was able to quickly identify ways to make major improvements such as boosting sales, reducing waste, increasing production, enhancing advertising strategies or optimizing service levels. These improvements have resulted in total savings of US\$36 million over a three-year period for the facility.

KPMG in the US helps utility leverage Big Data to improve service and lower costs³²

A major US energy utility is working with KPMG in the US to improve customer satisfaction and reduce operational expenses. By applying advanced analytics built on top of a Big Data customer analytic insight platform, developed with KPMG in the US, the utility has created a '360 degree customer profile.' Using multiple methods of prognostic and predictive analytics, the customer profile provides the utility with a deeper understanding of their customers as well as the ability to anticipate customer behaviors.

Results from the analytics are fed into reporting dashboards that provide decision makers with interactive visualizations that can be used to make real-time decisions. These dashboards allow the utility to determine why certain segments of customers are contacting call centers and enable managers to develop strategic initiatives that can reduce call volume. With KPMG in the US, the utility has been able to improve operational efficiency, increase customer satisfaction and reduce operational expenses within their customer operations unit.

Energy distributor uses predictive analytics to effectively manage asset failure and optimize maintenance³²

A leading US energy distributor is working with KPMG in the US to leverage operational data and analytical modeling to support predictive capabilities for capital-intensive asset failure and optimized maintenance. The distributor combines and analyzes data from disparate sources that is fed into interactive visualization tools made available to key stakeholders for financial and operational decision-making. The tools help create predictive indicators for when individual assets are likely to fail so managers can plan for the type of maintenance, materials and hours needed to address the failure.

Decision makers are now able to optimize investments of physical assets; reduce operational failures using asset management strategies; enhance overall asset management through effective preventative and predictive strategies; and reduce costs by identifying assets where replacement is cheaper than continued maintenance.

³¹ BASF Achieves \$36 Million Cost Savings with QualPro, press release, <http://qualproinc.com/basf-case-study/>

³² KPMG International, 2016



Improved pricing, marketing and customer service

Although chemical pricing is an increasingly complex process, specific prices are sometimes based on little more than spreadsheets, experience and intuition. And even as prices are being announced, the data on which they are based is becoming out of date.

However, Big Data and analytics are now being used to develop competitive pricing strategies based on accurate, timely data from a variety of sources. A leading chemical company in Europe integrated internal data as well as external marketing information and was able to identify 10 key value-based drivers for customer behavior.³³ Based on this information, the company can now make more informed pricing decisions in conjunction with field sales operations, providing specific pricing guidance during contract negotiations.

In many cases, Big Data can help companies fine-tune their product portfolio. By understanding the distribution of existing prices and reviewing margin outliers among their customer base, companies can explore the underlying causes of under-performance for specific products and adjust their production portfolio accordingly.

Chemical companies are also using Big Data to develop accurate short- and long-term market forecasts to support effective production, procurement and investment planning.³⁴ This is especially

valuable for global chemical companies serving multiple markets across regions.

Dow Chemical has reported a number of sales and marketing benefits with advanced analytics. Sales forecasts are accurate to within 10 percent, versus an error rate that was sometimes as high as 40 percent previously.³⁵ Business unit leaders know by Day 12 of each month how to adjust strategy to meet targets.³⁶

Big Data is also key in the development of new markets for chemicals. With Precision Farming, for example, the detailed analysis of weather, soil conditions, seed traits and historical yields on a field-by-field basis helps farmers determine exactly what to plant, when to plant and what types of crop protection chemicals to apply. This is increasing demand for agro-chemicals and related products to serve this rapidly growing market segment.³⁷

In addition, Big Data can provide more information for today's demanding customers. This includes technical data sheets, certificates of analysis, safety data sheets, samples, customized labels, pricing documents, call reports, marketing analysis and other highly specialized reports. Customer service representatives must be able to process nearly any request, and the data must be readily available. Big Data is helping to make this possible.

³³ Marketing executives learning to leverage big data for pricing and profitability, Pros, <http://www.pros.com/about-pros/news/fourth-source-marketing-executives-learning-leverage-big-data-pricing-and-profitability/>

³⁴ Big data and the chemical industry, ICIS, 13 December 2013, <http://www.icis.com/resources/news/2013/12/13/9735874/big-data-and-the-chemical-industry/>

³⁵ Advanced analytics support a world of business decisions, SAS website, http://www.sas.com/en_us/customers/dow-chemical-analytics.html

³⁶ Ibid.

³⁷ Agricultural Adjuvants Market Accelerating Rapidly, Precision Farming Dealer, 13 July 2015, www.precisionfarmingdealer.com/articles/1542-agricultural-adjuvants-market-accelerating-rapidly#sthash.RhPls9Qy.dpuf

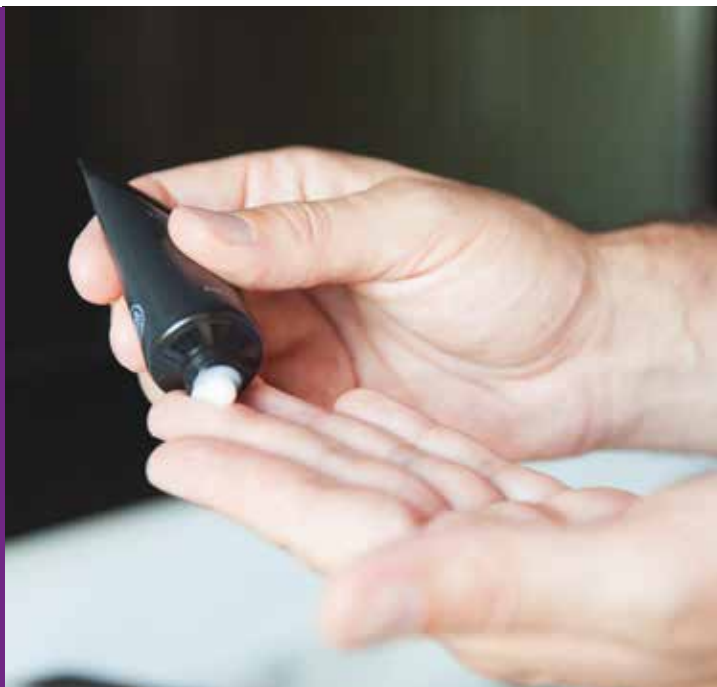


Innovation and a greener industry

A better body lotion³⁸

Beiersdorf, an international skin care company, was formulating a new body lotion from natural ingredients. Initial attempts resulted in a formula that destabilized after a few months. The company needed to create a stable formulation, and they also recognized the importance of accelerating their product development cycle. The team of Thomas Bäck of NuTech Solutions GmbH was engaged to address these challenges.

Bäck and his colleagues used ClearVu Analytics, a data analysis and optimization technology, to develop a predictive model for stability that was generated from Beiersdorf's experimental data. This model was then combined with a virtual formulation development process, with each new formulation improved and then used as the starting point for the next one. As a result, a stable formulation was achieved in a fraction of the time required by traditional laboratory procedures.



Mapping compounds with cheminformatics software

Cheminformatics software can be used to develop custom computer applications for use in virtual screening, chemical database mining, and structure-activity studies. This example shows a portion of a network of predicted hits for a chemical assay. A 2D structure graphic has been generated for selected nodes. Calculated acceptors and donors were mapped to attributes and used to set the node color and node border color in the network. The 2D structures for the compounds have been painted directly onto the nodes.

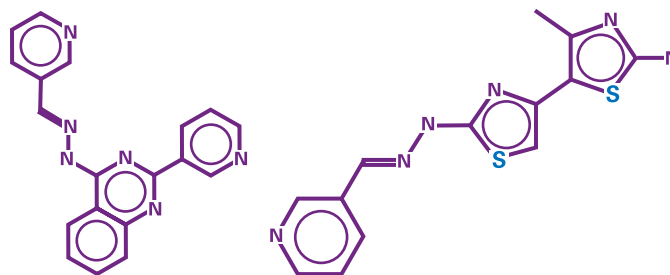


Image source: University of California, San Francisco, <http://www.cgl.ucsf.edu/cytoscape/chemViz/>

³⁸ Beiersdorf: Optimization of Cosmetics Formulations using ClearVu Analytics, Divis, 13 March 2012, www.divis-gmbh.de/fileadmin/download/fallbeispiele/Fallbeispiel-Beiersdorf-AG-EN.pdf

Big Data and analytics can make chemical manufacturing far more efficient, cutting the cost and time needed to bring a new product to market.³⁹ Researchers can integrate lab data with in-house and academic databases to expand their research efforts and quicken the pace of innovation cycles.

In addition to real-life compounds and structures, chemical databases and libraries can contain hypothetical compounds and structures. These are useful for guiding exploratory research or suggesting pathways to certain desired functionalities that do not exist yet. Virtual screening uses chemical and physical principles to identify and evaluate the best candidates for a particular property or reaction from large libraries of real and virtual molecules. The most desirable candidates can then be verified in laboratory studies.

Computational chemists are using mathematical algorithms, statistics and Big Data to integrate chemical theory and modeling with experimental observations. Some chemists create models and simulations of physical processes, and others use statistics and data analysis techniques to extract useful information from sets of

Big Data. With computer visualization, computational chemists can present complex analyses in a readily understandable form, which they can use to design experiments and validate the results.

Polymer researchers can extract short lists of candidates with the right combination of tensile strength, melting point, toughness and molecular weight, and sustainable synthesis processes from a database containing tens of thousands of real and hypothetical compounds and molecular structures. Chemists developing active ingredients for personal care products can screen large combinatorial databases for the candidate molecules that are most likely to provide a specific functionality or effect on the human body.

Big Data and analytics can also help chemical companies find and formulate new compounds that are more environmentally friendly. Researchers can model factors like toxicity or energy consumption and develop products that support both profitability and long-term sustainability. For bio-based chemicals, analytics can be used to model the pathways in micro-organisms that make the most efficient use of new feedstocks.

“Chemists developing active ingredients for personal care products can screen large combinatorial databases for the candidate molecules that are most likely to provide a specific functionality or effect on the human body.”

³⁹ Big Data and Analytics in Chemicals: From Cheminformatics and LIMS to Launch, Lux Research; cited in How Big Data is Changing Chemical Manufacturing, Environmental Leader, 23 February 2016



Improved workforce management

The war for talent shows no signs of winding down in the global chemical industry. As discussed in REACTION Issue 17, *Chemical companies winning the new war for talent*,⁴⁰ demand is steadily outpacing the supply of chemical engineers, technicians and other professionals, especially in emerging markets. Job growth in the global chemical industry is expected to climb at a steady 4 percent rate until at least 2022, making it difficult for managers to find the right people with the right skills. One troubling development in particular is the

growing shortage of applicants with science, technology, engineering and mathematics (STEM) degrees.

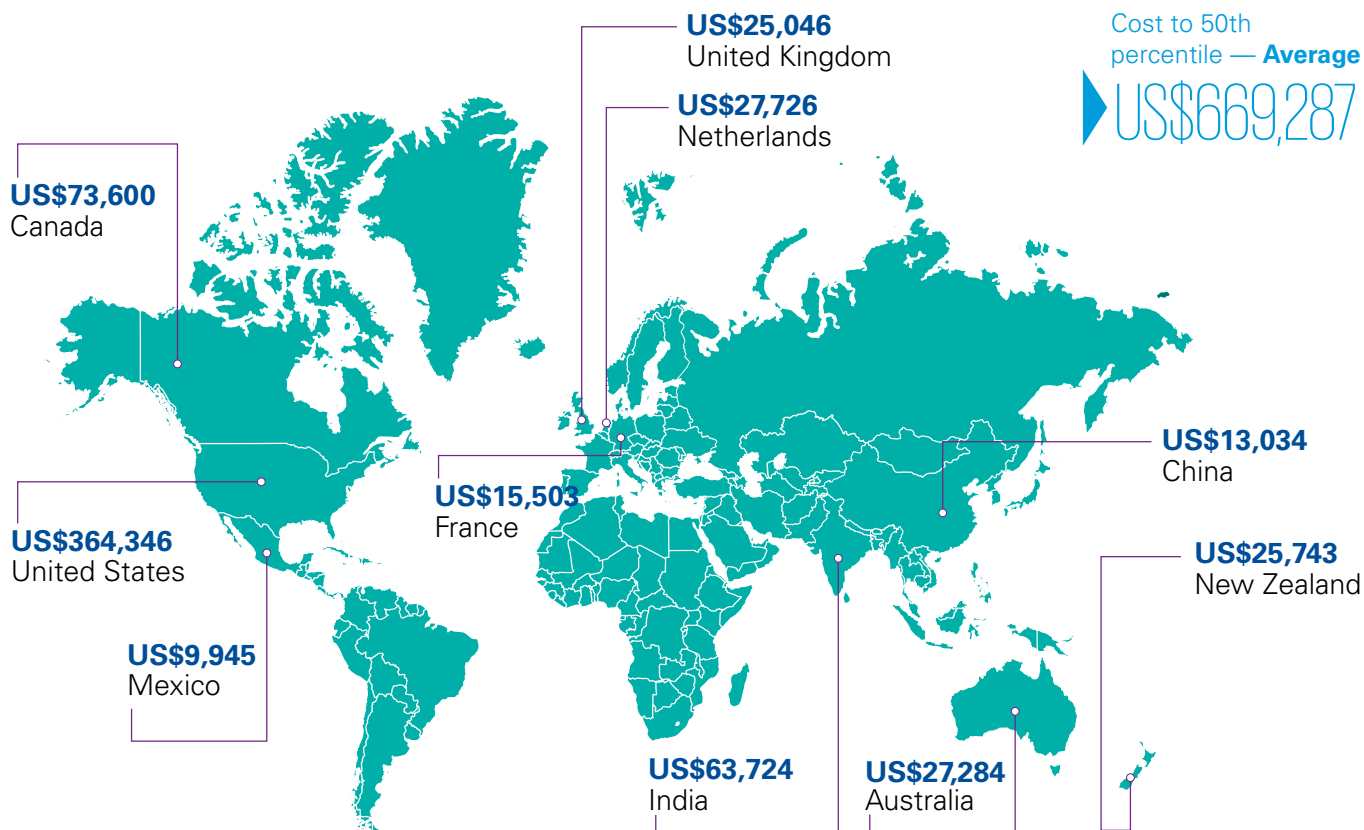
New technologies allow HR functions to evaluate and make evidence-based decisions that help find, train, manage and retain the talent they need to remain competitive. Using internal data complemented by industry data from third-party sources, operational executives and front-line managers can identify trends and patterns, highlight outliers, quantify factors that influence employee job satisfaction, forecast workloads and measure employee

engagement against peer benchmark data. If problem areas are identified, managers can drill down into data to uncover root causes and develop new strategies for resource management.

Big Data can also be used to quickly discern contextual insights not visible before, such as who is most likely to leave based on benefits or salary, all relative to industry benchmarking data. These insights can be used to develop new compensation packages that improve the quality of new hires and reduce turnover.

Cost to move employees to base of operations

All numbers exemplify reporting capabilities of current software and are hypothetical; numbers not referring to a specific company.

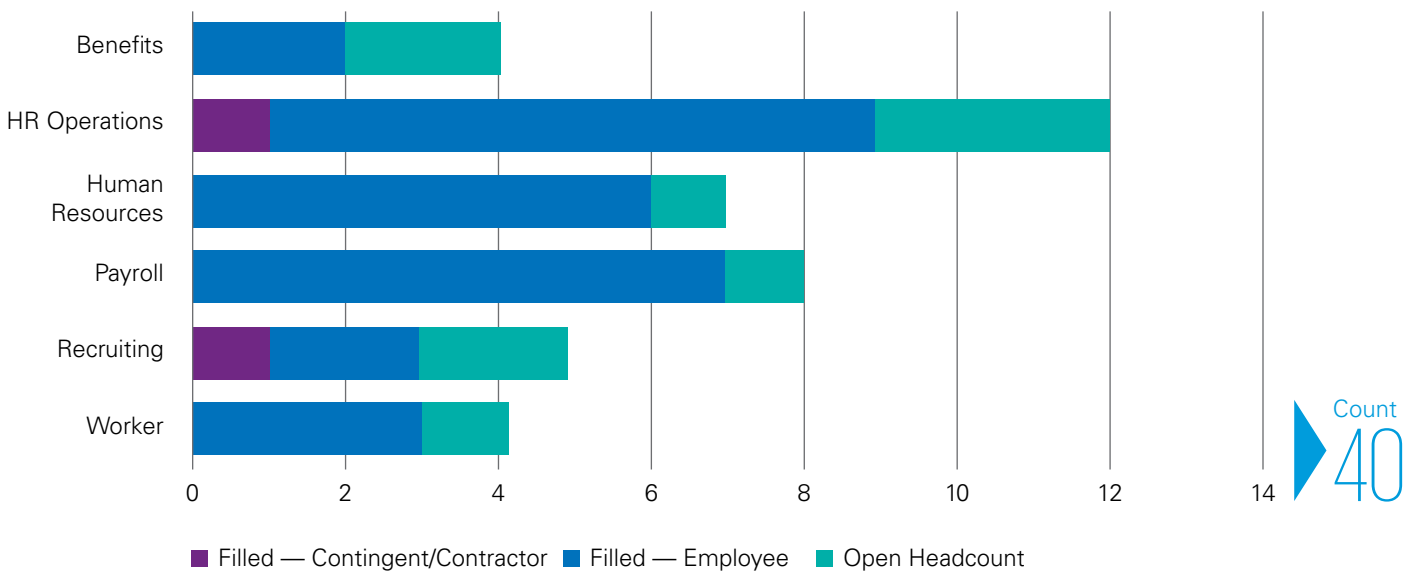


Source: Example from Workday, cited by Technology Advice, <http://technologyadvice.com/wp-content/uploads/2015/05/workday-HCM-interface.png>

⁴⁰ Chemical companies winning the new war for talent, Reaction 17

Headcount and open positions

All numbers exemplify reporting capabilities of current software and are hypothetical; numbers not referring to a specific company.



Source: Example from Workday, cited by Technology Advice, <http://technologyadvice.com/wp-content/uploads/2015/05/workday-HCM-interface.png>

Workforce visibility

All numbers exemplify reporting capabilities of current software and are hypothetical; numbers not referring to a specific company.



Source: Example from Workday, cited by Technology Advice, <http://technologyadvice.com/wp-content/uploads/2015/05/workday-HCM-interface.png>

KPMG point of view

“Understanding your biggest issues will direct you to where you can best focus your Big Data capabilities.”

We believe that many organizations do not yet see how Big Data and analytics can transform their company's ability to serve customers and generate revenue in entirely new ways.⁴¹ Many are simply assuming that this technology will eventually lead to improved growth or competitive advantage. However, most do not yet have a clear vision of what is truly possible with Big Data.

Chemical companies can help inform their strategies for Big Data and analytics by considering the following action areas:

Address the business issues you are facing. Most clients KPMG member firms work with do not ask for a Big Data solution; they ask for a solution

to a specific business problem. Understanding your biggest issues will direct you to where you can best focus your Big Data capabilities.

Understand that the insights do not come from data alone. They come from analyzing the data and working across silos to map back to the issues and challenges the business is addressing. Big Data is a team game.

Go beyond point solutions. Transcend individual projects towards an overarching, enterprise-wide data-driven culture that underpins investment decisions.

Define what value you are looking for. What is it you want to achieve? Is it reduced cost? Better management of



⁴¹ Going beyond the data: turning insights into value, KPMG, 2015

risk? Improved customer experience? The reality is that 'value' differs depending on the issue you are dealing with and its relative importance to the business.

Focus on customers. Ask yourself how to use new forms of data and algorithms for data-driven decision-making to help you improve customer service and expand your capacity to transact profitably with your customers.

Ask the right questions. Don't do Big Data just for the sake of doing it. Prioritize your insights and understand their potential business value. Focusing on business value, and developing and prioritizing Big Data use cases allows you to gain tangible business benefits quickly

and to identify synergies between use cases.

Measure your success. Use your successes and evidence of the value created to fund more projects and share your expertise and knowledge across the organization.

Engage early with stakeholders. Articulate the value of Big Data to the business and to investors to underscore the fact that Big Data can be a transformative strategy, not just a way to better understand your existing business problems.

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Martin is a Managing Director in KPMG's Center of Excellence for Data & Analytics. He manages the execution of data & analytics projects. He has over 18 years of business and system consulting experience, assisting clients with leveraging technology and analytics to gain tangible business improvements. He delivers comprehensive solutions to implement business strategies, manage risk, reduce costs, improve efficiencies and comply with regulations by effectively turning data & analytics into business value.

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KPMG in the Industry



KPMG in Spain

Invest in Chemicals, Invest in Valencia:
business seminar

30 March 2016

Paul Harnick, Global COO and Head of Chemicals, KPMG in the UK, gave his view on the medium- and long-term outlook for the chemical sector worldwide. In his opinion, demand in the chemical sector will be increasingly located in emerging markets such as China, which will continue to be an 'unstoppable driver', and India or Brazil, which are still experiencing a lot of challenges and difficulties. In order to compete with these countries, the US needs to open up to new markets, whereas Europe will continue to depend on research and development as its lifeline.



KPMG in Germany

KPMG in Germany held their annual Chemicals Roundtable 'Global Trends in Chemicals — Innovation and Growth Strategies' in Düsseldorf on 28 June 2016. With an assembled panel of experienced speakers, including Mike Shannon and Paul Harnick, they debated how major chemical producers in China, the US and the Middle East are dealing with uncertainty. In addition, they explored the most effective growth strategies for German chemical companies and how they can continue to benefit from a strong tradition of innovation. Plus, the agenda included conversation around global trends in the chemical industry and how innovation is a differentiator for strategies to grow in major markets, particularly in China.



KPMG in China

KPMG Global Markets banquet

20 April 2016

KPMG in China held an executive reception at the landmark Peace Hotel in Shanghai. Norbert Meyring, Head of Chemicals for China, hosted a table of top chemical sector executives, which included country heads and senior leaders of multinationals from the UK, France, the US and Germany.



KPMG Partner Profile



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Christine has more than 24 years of experience providing federal, state and international tax consulting and compliance assistance to corporate and partnership clients. She has specialized over much of her career in serving companies in the chemicals and energy industries, including leading chemical manufacturers and distributors along with oil and gas exploration and production, oil field services and drilling companies. Christine is the Partner-In-Charge of the KPMG US Tax Business School, member of the Texas State School of Accountancy Advisory Board and the American Taxation Association Advisory Board. She holds a BBA from Texas State University.

The global chemical industry network within KPMG is a very exciting place to be. We have very strong leaders in different functions, as well as tax specialty areas. This industry focus differentiates us and brings the power of the entire firm behind us when we are addressing our clients' needs.

As the newly appointed leader of the US Chemicals Tax Practice, my focus will be to move forward with what Frank Mattei successfully built when he was our Chemicals Global Tax Leader. I am looking forward to strengthening the overall industry initiative within tax and to grow the network across the specialty lines in tax, as well as leveraging our global connectivity. In addition, in light of my training role, I will be looking at how to improve the training curriculum within the sector. I will be building this training, with a focus on business acumen, understanding of overall market drivers in the industry, technical knowledge which is industry focused, and cross functional market pursuits.



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