

REACTION

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KPMG GLOBAL CHEMICALS INSTITUTE

Renewed strength in key chemical end markets

kpmg.com/reaction



cutting through complexity

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Automotive
chemicals

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Innovations
in supply
chain
management

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Chemicals and
construction



Introduction

Welcome to the first edition of Reaction Magazine for 2015. With the start of a new year, the underlying dynamics affecting the industry are certainly mixed. A return to strong growth seems to be entrenched in the US and UK, where long-awaited wage growth and low inflation are finally feeding through to increased consumer spending. China's new normal of lower growth really does appear to be here to stay. And the specter of eurozone chaos has re-emerged with the recent issues in Greece. Meanwhile, the collapse in the price of oil is either a blessing or a curse, depending on where you are in the world as you read this. However, as we speak to our clients, the overall feeling in the industry is one of optimism, with thoughts very much focused on growth and expansion. Let's all hope that continues.

In this edition, we bring you a look at some of the chemical industry's key end markets with a focus on the outlook for the automotive and construction sectors, courtesy of KPMG's industry leaders in those segments. We also follow up recent performance related articles with a deep dive on supply chain excellence in the chemical industry.

As ever, we continue to be active in the industry, with members of our Chemicals and Performance Technologies leadership team present recently at the Annual Gulf Petrochemicals and Chemicals Association (GPCA) Forum in Dubai, as well as making speaking appearances at the Future of Polyolefins conference in London and the Petrochem China conference in Chengdu.

We will be back with our next edition in June which will focus on the latest issues and opportunities in the US chemical industry as well as a look at talent management, a key area of concern for many companies in the industry.

If there are any topics you would like us to cover in future editions of Reaction, please don't hesitate to contact us.

Mike Shannon

Global Chair
Chemicals and
Performance Technologies

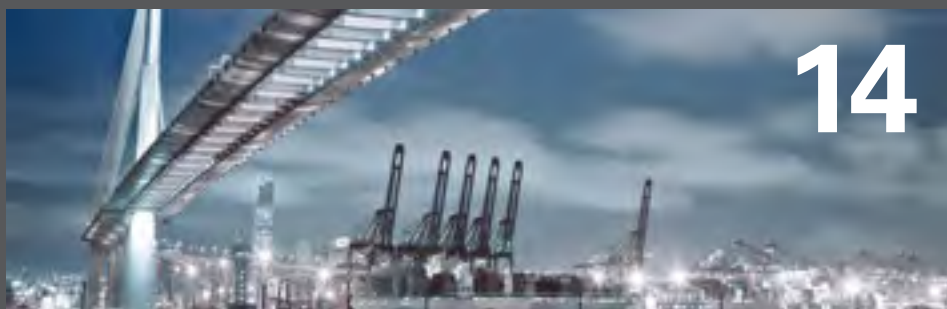


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Global automotive industry growth driving demand for chemical products



With few exceptions, the global automotive industry has made a solid recovery from the downturn in 2008. Led by China, Japan, the US and new growth markets, world production levels have increased, sales are growing and prospects are positive for the industry as a whole. Specialty chemicals help support the automotive industry through a range of products designed to reduce vehicle weight for better mileage, enhance performance, increase energy efficiency and improve manufacturing quality. Especially exciting is the increased use of silicon-based microchips for displays, safety-critical functions and entertainment systems in tomorrow's

'connected cars'.

Shifting back into high gear

Back in the dark days of the economic downturn, the global automotive industry faced plummeting sales levels and frozen credit markets. Since then, the industry has come roaring back. Global production has increased by approximately 25 million units since 2009 and current revenue stands at more than US\$2 trillion.¹ Around 1 billion cars and light trucks are now on the road, a number that is growing by roughly 4 to 5 million yearly.² According to many analysts, industry growth will continue into the next decade and global production will increase by 21 million units by 2021.³

As in many industries these days, most of this growth is coming from emerging markets in Asia. "Segments are changing globally as the emerging markets tip the balance and mature markets come under pressure to downsize," said Mark Fulthorpe, director of global vehicle production forecasting at IHS Automotive.⁴ Automakers are shifting production from high-cost regions, such as North America and Western Europe, to low-cost regions, such as China, Mature Asia, India and the Association of Southeast Asian Nations (ASEAN). According to the KPMG Competence Center Automotive, China, India, ASEAN and Mature Asia together will contribute to more than 50 percent of the global light vehicle production until 2021.⁵

In January 2010, China passed the US as the world's largest automotive market⁶ and by 2013, annual domestic sales of light vehicles were exceeding 20 million units. In fact, China's sales could grow to more than 34 million by 2020,⁷ depending on economic growth, the availability of credit and the regulatory environment.

India has also seen significant growth in its automotive sector in recent years. However, high fuel prices, relatively high inflation and other factors depressed sales in India during 2013, as total units sold dropped almost 10 percent to 2.9 million.⁸ This level remained steady for 2014.⁹ Korea, home to Hyundai and its brand Kia, has enjoyed soaring global sales that now exceed 8.9 million vehicles annually.¹⁰

After a painful recession, the North American automotive industry seems to be stronger than ever. Bankruptcies at General Motors (GM) and Chrysler in 2009 enabled those firms to shed debt, cut employees, renegotiate contracts and dramatically reduce operating costs through increased efficiencies and greater cooperation between manufacturers and their suppliers in the design and manufacture of new cars.¹¹ In the US, 2014 auto sales ended on a strong note, with total light vehicle sales reaching 16.5 million units.¹²

// "Segments are changing globally as the emerging markets tip the balance and mature markets come under pressure to downsize," said Mark Fulthorpe, director of global vehicle production forecasting at IHS Automotive. //

Mexico has become the world's fourth largest automotive exporter. Over 80 percent of the cars made in Mexico are marked for export and the country has negotiated more than two dozen free trade agreements with 44 nations.¹³

In Europe, estimated GDP growth is forecast to rise to 1.7 percent for the EU as a whole¹⁴ and weak demand is expected to continue for the foreseeable future. Car sales have been falling since the onset of the financial crisis, but the number of homes with sufficient disposable income to buy a new car has been static, suggesting that over 10 million units in sales have been lost since 2008.¹⁵ New car sales may not return to pre-crisis levels this decade, but they are predicted to climb to 22.5 million units by 2021.¹⁶

¹ Automobile Dealers Industry Profile, FirstResearch, January 2015.

² Automobile Industry Market Research, Plunkett Research Ltd., <http://www.plunkettresearch.com/automobiles-trucks-market-research/industry-and-business-data>; LMC Automotive.

³ IHS: Global vehicle production to increase by 21M units by 2021, China to account for half, www.autoblog.com/2014/05/12/ihs-global-vehicle-production-forecast/, 12 May 2014.

⁴ *Ibid.*

⁵ KPMG's Competence Centre Automotive, LMC Automotive, Global Automotive Production Forecast.

⁶ China Passes US as World's Top Car Market, *Wall Street Journal*, www.wsj.com/articles/SB10001424052748703652104574651833126548364, 10 January 2010.

⁷ KPMG's Competence Centre Automotive, LMC Automotive, Global Automotive Sales Forecast.

⁸ *Ibid.*

⁹ *Ibid.*

¹⁰ Korea - flash report, sales volume, 2014, *Marklines*, www.marklines.com/en/statistics/flash_sales/salesfig_korea_2014.

¹¹ Op.cit. Plunkett Research.

¹² J.D. Power and LMC Automotive Report: New-Vehicle Sales in 2015 Off to a Strong Start; January Retail Sales Highest Since 2004, press release, <http://canada.jdpower.com/press-releases/jd-power-and-lmc-automotive-forecast-january-2015>, 26 January 2015.

¹³ *AutomotiveNow Magazine*, KPMG, Edition 1, 2014.

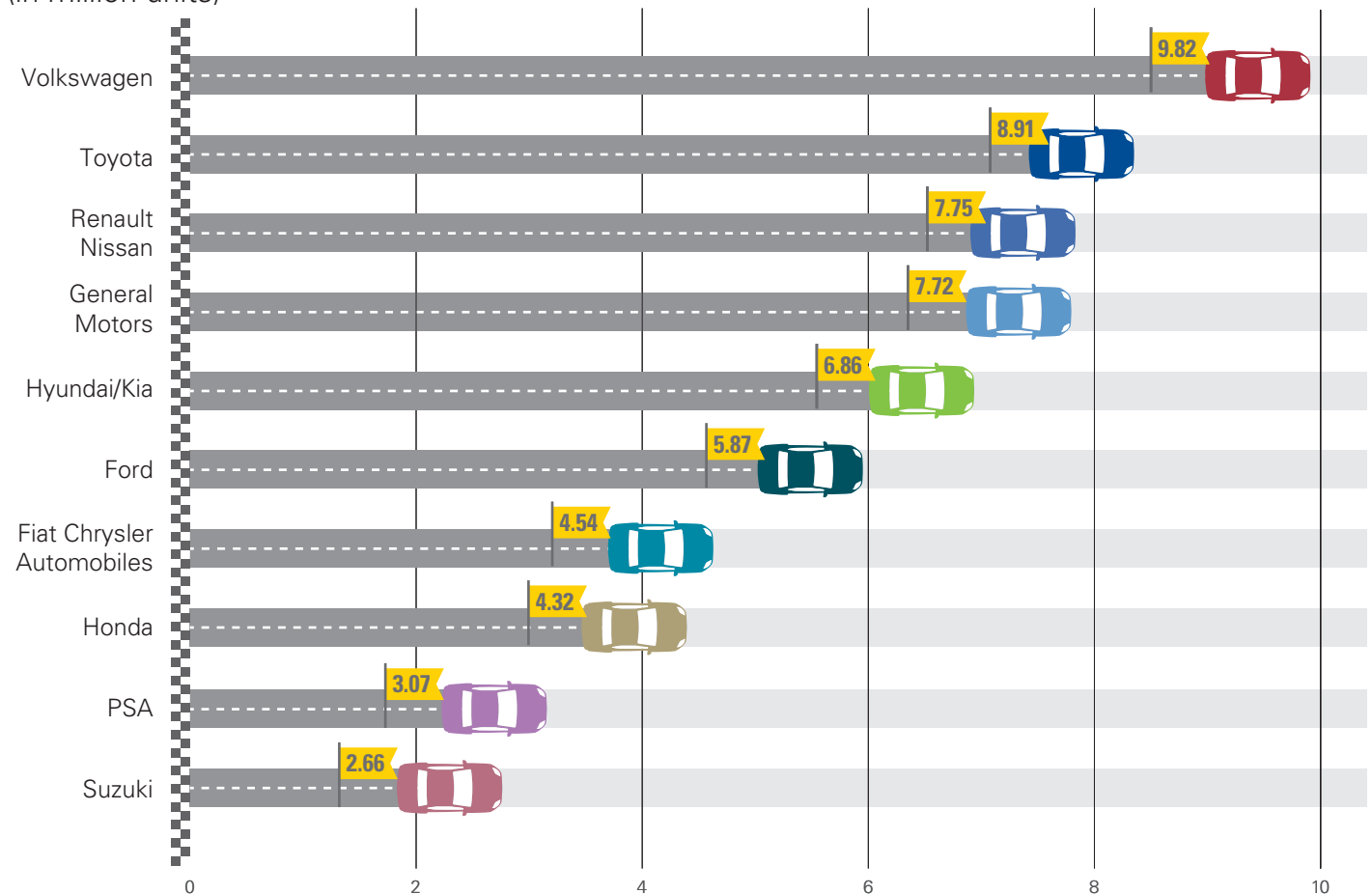
¹⁴ Winter Economic Forecast: outlook improved but risks remain, press release, http://europa.eu/rapid/press-release_IP-15-4085_en.htm, 5 February 2015.

¹⁵ Positives and Negatives Affecting the Recovery of Western Europe's Car Market, Euromonitor International, March 2014.

¹⁶ *Ibid.*; LMC Automotive

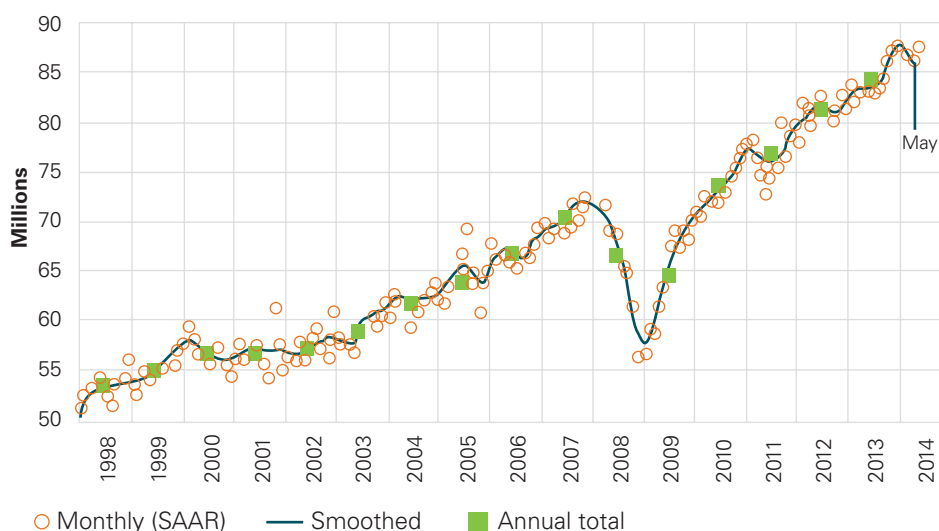
Approximate global light vehicle sales by top manufacturers 2014

(in million units)



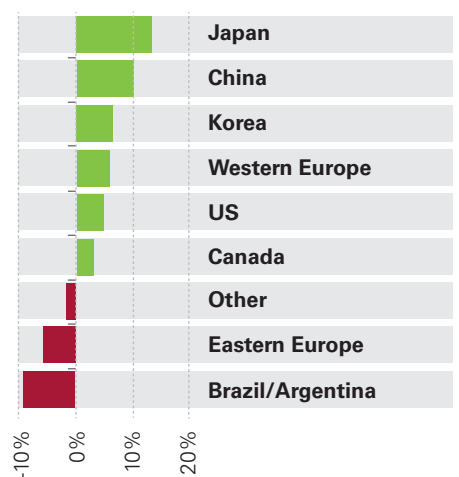
Source: KPMG's Competence Centre Automotive, LMC Automotive

Global light vehicle sales

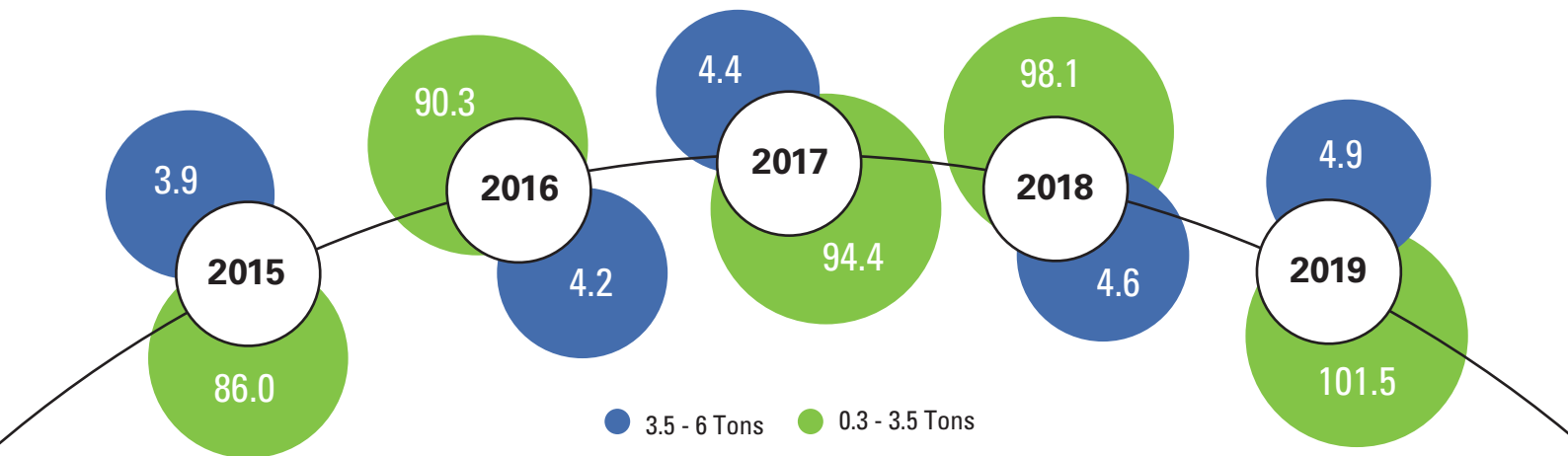


Source: LMC Automotive

YT-May % change



Global automotive production (million units)

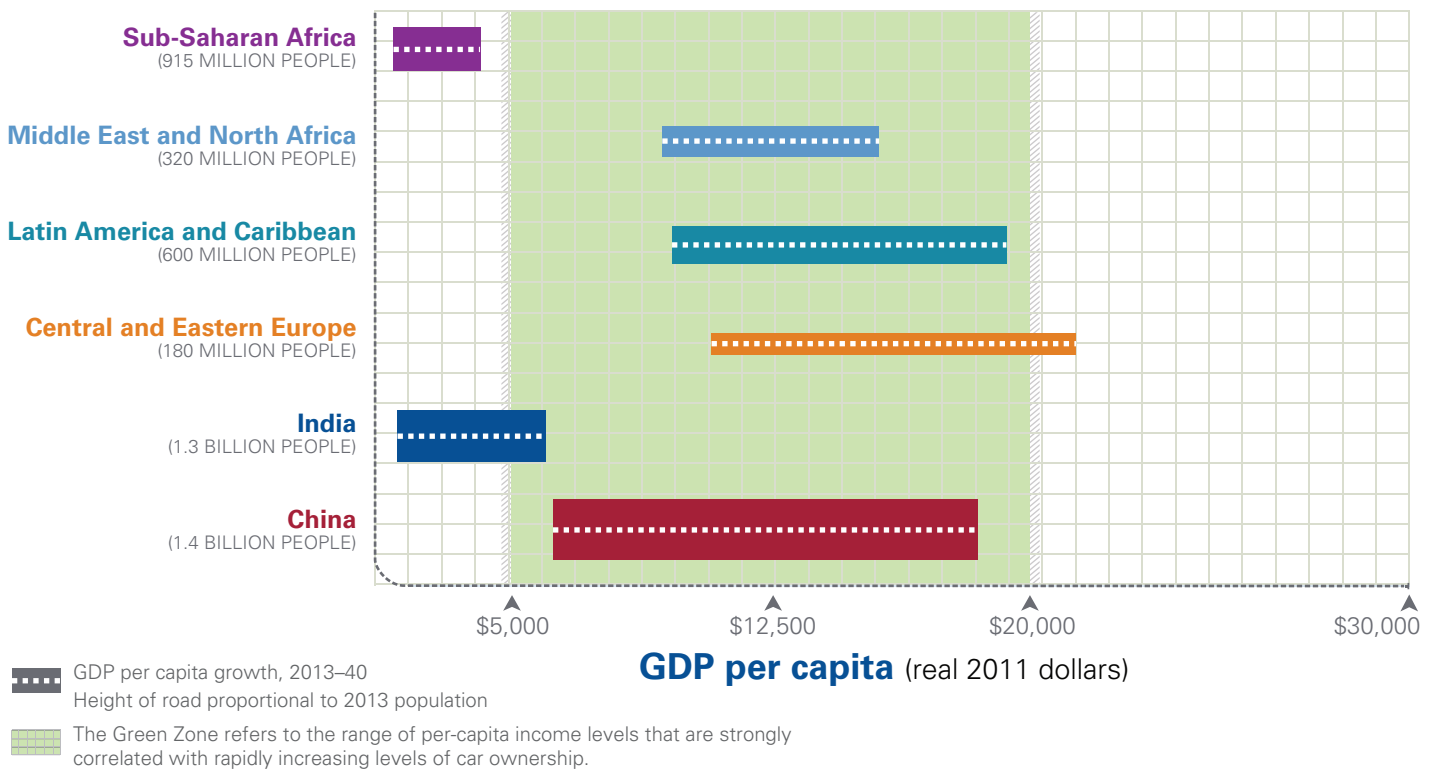


Source: KMPG's Competence Centre Automotive, LMC Automotive



Shifting global markets

Developing economy growth and the green zone (2013–40)



Sources: LMC Automotive and Centennial Group Growth Model
Me, my car, my life... in the ultraconnected age, KPMG



Automotive chemicals: industry overview

The global automotive chemicals market is influenced mainly by passenger car production and the increasing utilization of plastics in vehicle designs. Plastics now account for around 15 percent of materials in a mid size car¹⁷ and plastic-based products and materials are found in car exteriors, bumpers, interiors, electronics, seats, runners, lights, dashboards and windshields.

Automotive plastics consumption worldwide is expected to grow from 7.1 million tons in 2012 to 11.3 million tons by 2018 at an expected growth rate of 8 percent annually.¹⁸ The Asia-Pacific region leads consumption with 50.5 percent of the market, followed by Europe (28 percent) North America (11.3 percent) and the rest of the world (10.1 percent).¹⁹

Along with plastics and plastic composites, automotive chemicals are used in fuel additives, films, coolants, insulation for noise abatement, airbags, batteries, tires and many other products. Chemicals are also a key ingredient in engine oils and transmission fluids, helping today's high-performance engines perform over a broad temperature range while maximizing performance and minimizing formulation costs.

Chemicals are even being used to enhance the automotive manufacturing process. For example, original equipment manufacturers (OEMs) are converting many steel structural components that are stamped and welded to lighter weight aluminum components that are dye cast.

Lubricants tailor-made for automotive dye casting help ensure high levels of quality and structural integrity that are crucial for safety and performance.

Major suppliers and producers of automotive chemicals include:

- AkzoNobel (Netherlands) and PPG Industries (US), manufacturing automotive coatings to preserve the appearance and durability of vehicles.
- Bayer MaterialScience (Germany), supplying raw materials for high-performance plastic polycarbonate, polyurethane foams, coatings and films.
- Dow Chemical Company (US), providing structural foams, brake fluids, adhesives, resins and glass bonding systems.
- Evonik Industries (Germany), supplying specialty chemicals for polymers, composites, oils, fluids, coatings and other solutions used in automotive manufacturing.
- Momentive Performance Materials (US), providing adhesives, sealants, coatings and resins.

Recent chemical industry developments reflect the growing importance of emerging economies and the necessity for automotive chemical producers to follow their customers. BASF is building an automotive coatings plant in China.²⁰ BASF is also investing in India.²¹ A Würth (Germany) subsidiary headquartered in Navi Mumbai, India, will take over the import, distribution and technical services in India of Glasurit, a BASF automotive refinish paint brand.

Several countries in the Asia-Pacific region are also focusing on investments in specialty chemicals. For instance, Singapore has gained traction in automotive-related chemicals with a nearly US\$2 billion investment in lubricants and synthetic rubber.²² Asia-Pacific is also emerging as a key market for automotive lubricants. The longer operating life of vehicles, increased production of vehicles and a greater awareness among customers have increased the demand for automotive coolants among consumers and by 2019, the Asia-Pacific region is expected to represent more than 40 percent of the global automotive coolants market.²³

Automotive plastics consumption worldwide is expected to grow from 7.1 million tons in 2012 to 11.3 million tons by 2018 at an expected growth rate of 8 percent annually.

¹⁷ Bayer MaterialScience, materials.bayer.com/.../automotive.aspx.

¹⁸ Global automotive plastics market to grow at a CAGR of 13.4% to 2018, www.plastemart.com/Plastic-Technical-Article.asp?LiteratureID=2096&Paper=Global-%20automotive-plastics-market-to-grow-till-2018.

¹⁹ *Ibid.*

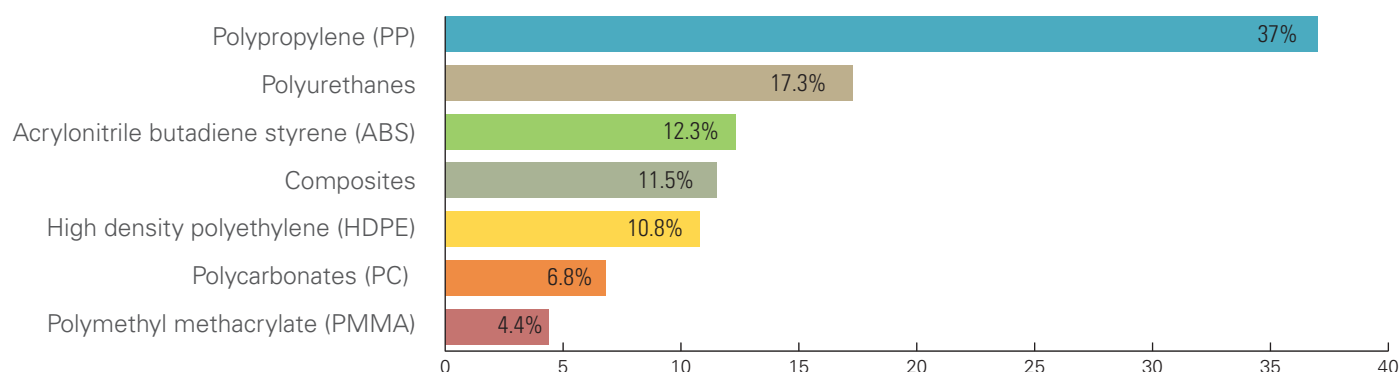
²⁰ BASF opens €50-million automotive coatings plant at Shanghai, *Chemical Week*, http://www.chemweek.com/markets/specialty_chemicals/paints_and_coatings/BASF-opens-euro50-million-automotive-coatings-plant-at-Shanghai_62688.html, 24 July 2014.

²¹ BASF and Würth team up for automotive refinish coatings business in India, *Chemical Week*, www.chemweek.com/home/top_of_the_news/BASF-and-Wurth-team-up-for-automotive-refinish-coatings-business-in-India_66224.html, 17 December 2014.

²² New plan, rethink for Jurong Island, *The Business Times*, www.businesstimes.com.sg/energy-commodities/special-feature-jurong-island/new-plan-rethink-for-jurong-island, 24 November 2014.

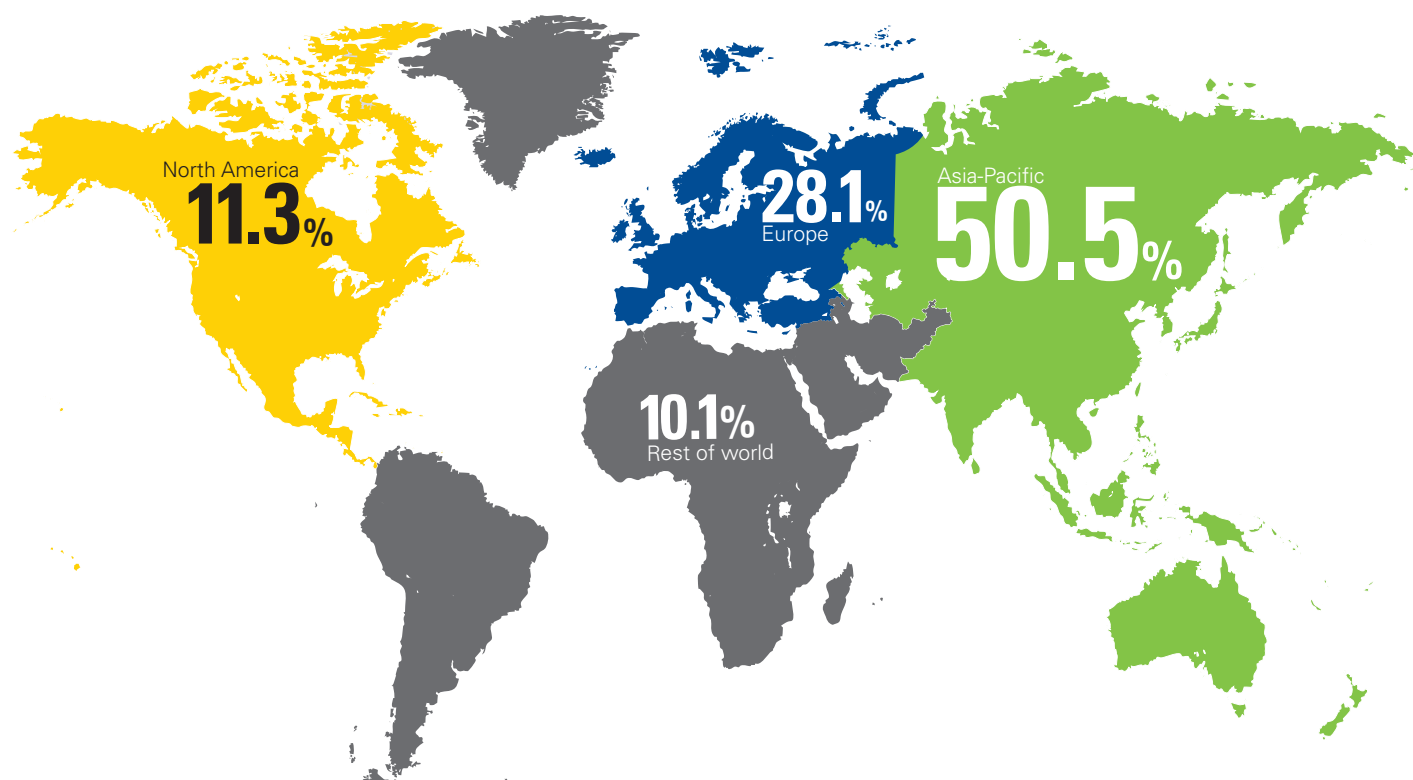
²³ Lucintel estimates that Asia Pacific will consume more than 40% of the global automotive coolants by 2019, press release, www.digitaljournal.com/pr/2279555, 23 October 2014.

Global automotive plastics consumption by type, 2012 (7.1 million tons total)



Source: Global automotive plastics market to grow at a CAGR of 13.4% to 2018, Plastemart.com

Automotive plastics regional consumption, 2012



Source: Global automotive plastics market to grow at a CAGR of 13.4% to 2018, Plastemart.com

Leaner and greener

The automotive industry clearly understands that less is more when it comes to weight. Less weight means greater savings in fuel costs, lower fuel costs and reduced levels of greenhouse gas (GHG) emissions. The good news is that chemicals are supporting these objectives in more ways than one.

Plastics now make up 50 percent of the volume of new cars, but only 10 percent of the weight.²⁴ Modern polyesters reduce the quantity of foam used in seats, decreasing their weight significantly. Light weight polycarbonates and their blends are starting to be tailored for sunroofs, panoramic roofs and side and rear windows. Polyamide containers for air bags are more than 50 percent lighter than their metal equivalents.²⁵ Body plastic panels also help to reduce weight, besides being cheap and easy to produce.

One type of polymer composite in particular – carbon fiber reinforced composites – presents major weight-saving opportunities for structural vehicle components. The material is 50 percent lighter than conventional steel and 30 percent lighter than aluminum. BMW is using the material as the body structure of its electric city car, the i3, which was introduced in 2014.²⁶

To help make cars even greener, chemical engineers have worked with manufacturers to devise ways to reduce the amount of pollution produced by

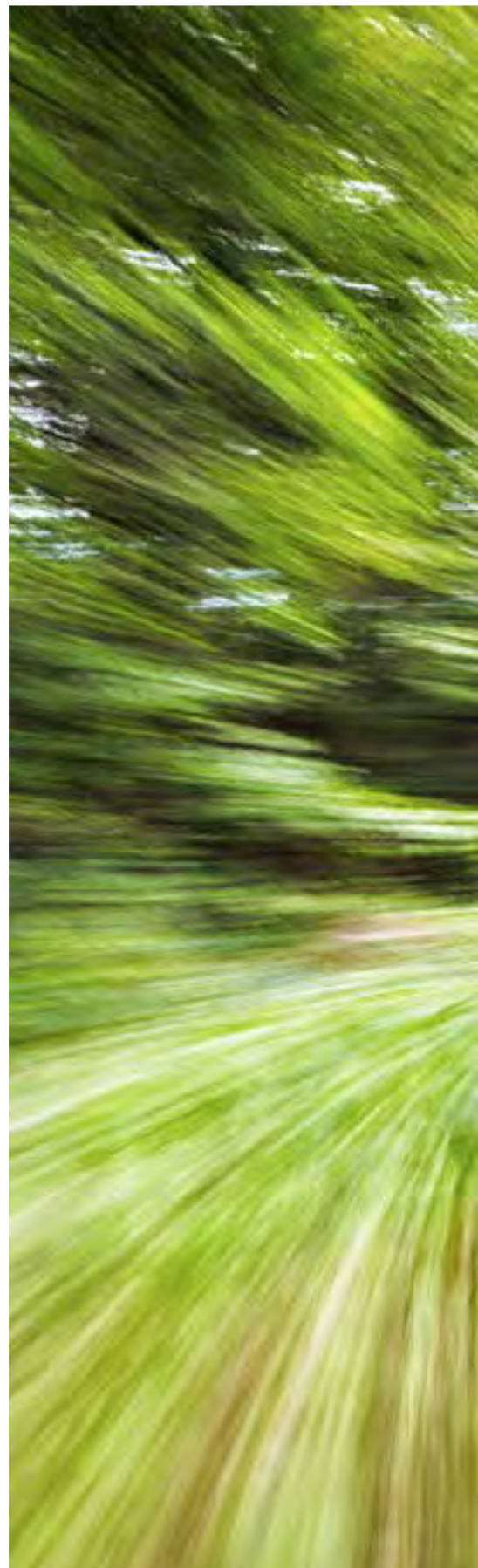
petroleum-derived, fuel-burning engines. Key developments include improved engines with more efficient fuel and air management systems and catalytic devices that destroy pollutants found in exhaust tailpipes.

Advanced petroleum refining techniques developed by chemical engineers also help reduce pollutants. One example is hydrotreatment, which uses hydrogen gas and a catalyst to produce gasoline and diesel fuel with significantly lower levels of sulfur and lead. These techniques have made it possible to produce reformulated fuels that function as effectively as earlier leaded fuels while releasing fewer pollutants.

In addition, automotive chemical products save twice the GHG emissions than are emitted in making the products themselves.²⁷ The following ratios refer to emissions saved by employing the product versus emissions from creating the product:

- diesel additives (improved fuel efficiency): 111:1
- engine efficiency: 21:1
- plastics for light weighting automobiles: 3:1.

// Plastics now make up 50 percent of the volume of new cars for only 10 percent of the weight. **//**



²⁴ Plastics in Automotive Applications, American Chemistry Council, <http://plastics.americanchemistry.com/Market-Teams/Automotive>.

²⁵ How does the automotive industry rely on petrochemistry?, Xperimania.net, www.xperimania.net/www/en/pub/xperimania/news/world_of_materials/car_industry.htm.

²⁶ ACC's 'Roadmap' gaining traction, *Plastics News*, www.plasticsnews.com/article/20150122/NEWS/150129969/accs-roadmap-gaining-traction, 22 January 2015.

²⁷ Innovations for Greenhouse Gas Reductions, American Chemistry Council, www.americanchemistry.com/Policy/Energy/Climate-Study/Innovations-for-Greenhouse-Gas-Reductions.pdf, 2009.



A safe, comfortable trip

In the recently published KPMG's Global Automotive Executive Survey 2015, respondents said that consumers are still fixated on traditional product issues, with fuel efficiency rated clearly as number one, followed closely by safety and comfort.²⁸ Safety is a critical benefit of automotive chemicals. While the airbag container contributes to the weight of the car, airbags are vital to the safety of the passengers. Modern nylon offers a good balance of strength and resistance for airbags. Tires made from styrene-butadiene-rubber (SBR) reduce rolling resistance and improve safety.

Flexible molded foams made of polyurethane are used in seats, headrests and armrests. These foams help to dampen vibrations and offer increased stability to passengers. Drivers' and passengers' comfort is also taken care of with noise insulation by sound-absorbing polyurethane. Modern coatings protect against rain and snow, UV rays and corrosion. They also offer color stability over a long period. The chemical industry is even conducting research on phosphorescent coatings which absorb sunlight during the day and release it at night.

// Around 52 percent of automotive executives in a recent KPMG survey believe that safety innovation is one of the most important features of the consumer purchase decision. //

Chemicals and their influence on tomorrow's automotive industry

Insights from Dieter Becker

Dieter Becker

Global, EMA and German
Chair of Automotive
KPMG International



In the past years the importance of semiconductors has increased significantly in the automotive industry. According to the World Semiconductor Trade Statistics (WSTS) 2015 forecast, the market growth of semiconductors will in fact be largely driven by the automotive industry. Moreover, due to increasing demand for connectivity and the resulting need for microchips the automotive semiconductor market is expected to grow stronger than other industry segments. These microchips are mostly made out of silicon due to its effective semi-conductive properties that ensure a partial conduction of electricity, which is essential for the complex electronics connectivity systems require. Furthermore, since Original Equipment Manufacturers (OEMs) should consider customers' lives as a whole, rather than viewing them as simply 'drivers', microchips are the enabler to do so. Additionally, to capture the real value of connectivity, vehicle manufacturers have to use the power of data to get inside their customers' heads, understand what drives their behavior and adapt business models to target groups of like-minded individuals. Connected car

technologies based on semiconductor microchips can be a crucial interactive tool, especially when linked to location, offering not just traffic guidance, but also useful local retail or leisure options, personalized news and entertainment, and other services, which can all provide a healthy revenue stream. Ultimately, it should be possible to predict what products and services the customer is most likely to want.

But that's not the only example – as showcased in KPMG's Global Automotive Executive Survey 2015, respondents said consumers would remain focused on traditional product issues such as fuel efficiency and safety when buying a car. Thus, with chemical companies developing materials to provide the highest safety standards possible and reduce the weight by using plastics and carbon fiber, which implies fuel savings, it is of value to the automotive sector. Whatever direction the global automotive industry takes, automotive chemicals can help to lower costs, improve performance, and increase sustainability for raw materials, components, and vehicles around the world.

²⁸ KPMG's Global Automotive Executive Survey 2015.

Connected cars: riding on a microchip

For today's cars, performance means processing capability as much as horsepower. In fact, increasingly tech-savvy customers are helping to create a completely new mobility culture where cars are expected to be not only greener, but also smarter and more connected.²⁹ Driver assistance systems, security, entertainment, sensors, cameras, anti-skid systems, location devices and various engine control systems are now directly or indirectly dependent on computers.

All of these innovations are dependent on computer microchips and that is where the automotive chemical industry plays a vital role. Producing microchips is one of the most challenging procedures in modern manufacturing. Even the tiniest of impurities found in processed

chemicals and gases can create a huge problem.

Chemical engineers pioneered the mass production of silicon microchips in the 1970s³⁰ and today they are routinely involved with the development of advanced semiconductor materials and the manufacturing processes required to produce them. Chemical engineers are also constantly pursuing advanced technologies and procedures to ensure that the substances used in critical procedures maintain low levels of contaminants – so low, in fact, that they are measured in parts per million to parts per trillion. Modern clean rooms rely on highly engineered systems developed by chemical engineers to capture, contain and control dust, airborne microbes and chemical vapors.

What global automotive executives are thinking

In the KPMG Global Automotive Executive Survey 2015, the majority of executives stated that the growth of emerging markets is the number one key industry trend.³¹ Mature markets in developed economies are becoming saturated, while new markets are emerging in China and India where millions, if not billions, of new buyers are moving into the middle class. Being close to these customers is critical, so automotive chemical companies are developing market initiatives, joint ventures and relocation strategies.

Only a minority of survey respondents consider alternative powertrain technologies and vehicle connectivity as extremely important key trends at least until 2025. Respondents said that consumers remain

focused on traditional product issues such as fuel efficiency and safety.

The results show that the sector is currently under pressure from two sides. On the one hand are governments, setting high standards for environmental protection requirements and thus pressuring OEMs to spend significant funds on the optimization of internal combustion engines and on research and development of new propulsion technologies. On the other hand are the customers, who are becoming more tech-savvy and thus demand highly innovative services around the connected car. Due to these requirements, a completely new mobility culture is emerging in which chemicals will play an important role.

²⁹ Me, my car, my life... in the ultraconnected age, KPMG, www.kpmg.com/Ca/en/IssuesAndInsights/ArticlesPublications/Documents/me-my-life-my-car.pdf, 2014.

³⁰ Achievements in Electronics, Chemical Engineers in Action, <http://www.chemicalengineering.org/electronics/achieve.html>.

³¹ KPMG's Global Automotive Executive Survey 2015

Supply chain optimization



Preparing chemical companies to better perform in a volatile world

Shifting patterns in supply and demand, cost pressures, market segmentation, third-party distribution and other factors mean that chemical supply chains need to be increasingly agile, sustainable, cost-effective, efficient and responsive to customer demands. New solutions are on the way that involve supply chain customization, improved people management, industrial parks for suppliers and manufacturers and disruptive technology such as 'big data' and predictive analytics that are turning risks into opportunities for today's chemical companies.

By
Haijo Kampinga
Ricardo Tulken

Key issues impacting the chemical supply chain

By their very nature, today's supply chains are global systems, connecting multinational producers, suppliers and customers across different nations, regions and continents. In 2015, three global changes in particular have significantly increased supply chain complexity, introduced uncertainty and forced chemical companies to rethink their supply chain strategies.

Supply moving West, demand moving East

Shale fracking in the US has produced a surge in the production of natural gas and crude oil, making the country one of the lowest-cost chemical producers after the Middle East. The American Chemistry Council predicts that US chemical output will increase 4 percent in 2015, up from last year's growth rate of 2.4 percent.³²

At the same time, demand in Asia will continue to soar due to overall

population growth, an expanding middle class, urbanization, new consumer markets and a maturing chemical industry moving from the supply of commodities to specialty chemical production. Chemical shipments to China have grown from 8 percent in 2002 to 29 percent in 2012 and demand trends are expected to continue as more industries move toward the East.

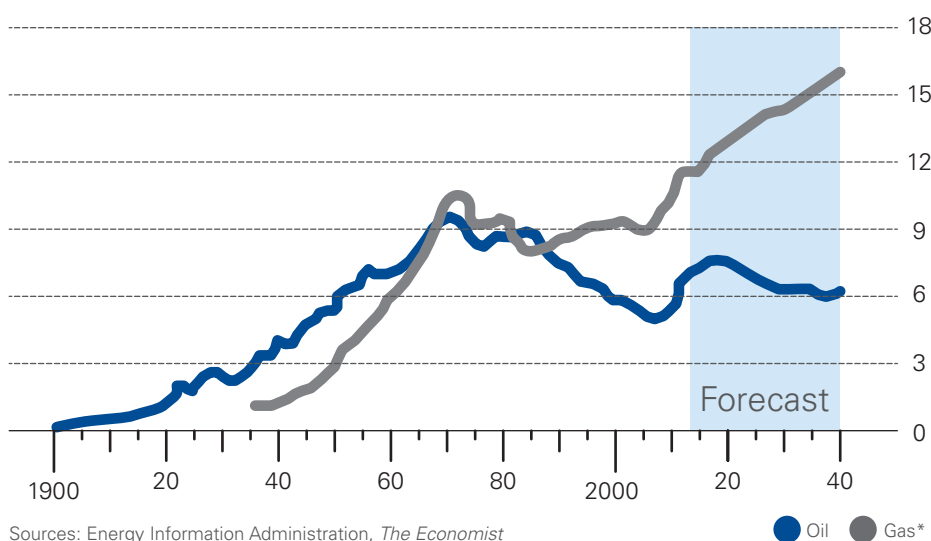
Oil price volatility is also affecting supply and demand patterns across multiple industries around the world. For more information, see Building the 21st century: chemicals and the global construction industry on page 22.

Regional market segmentation

The global shift in supply and demand also means that a one-size-fits-all approach for supply chains needs to be replaced with supply chains customized to fit different regional

Ever-expanding gas

US production, million barrels per day



Sources: Energy Information Administration, *The Economist*
 From sunset to new dawn, *The Economist*, 13 November 2013
 *Converted from cubic feet to barrels of oil equivalent

³² Strong Chemical Output Forecast For The U.S. In 2015, *Chemical and Engineering News*, cen.acs.org/articles/92/web/2014/12/Strong-Chemical-Output-Forecast-US.html, 15 December 2014.

markets that are rapidly changing in size and composition.

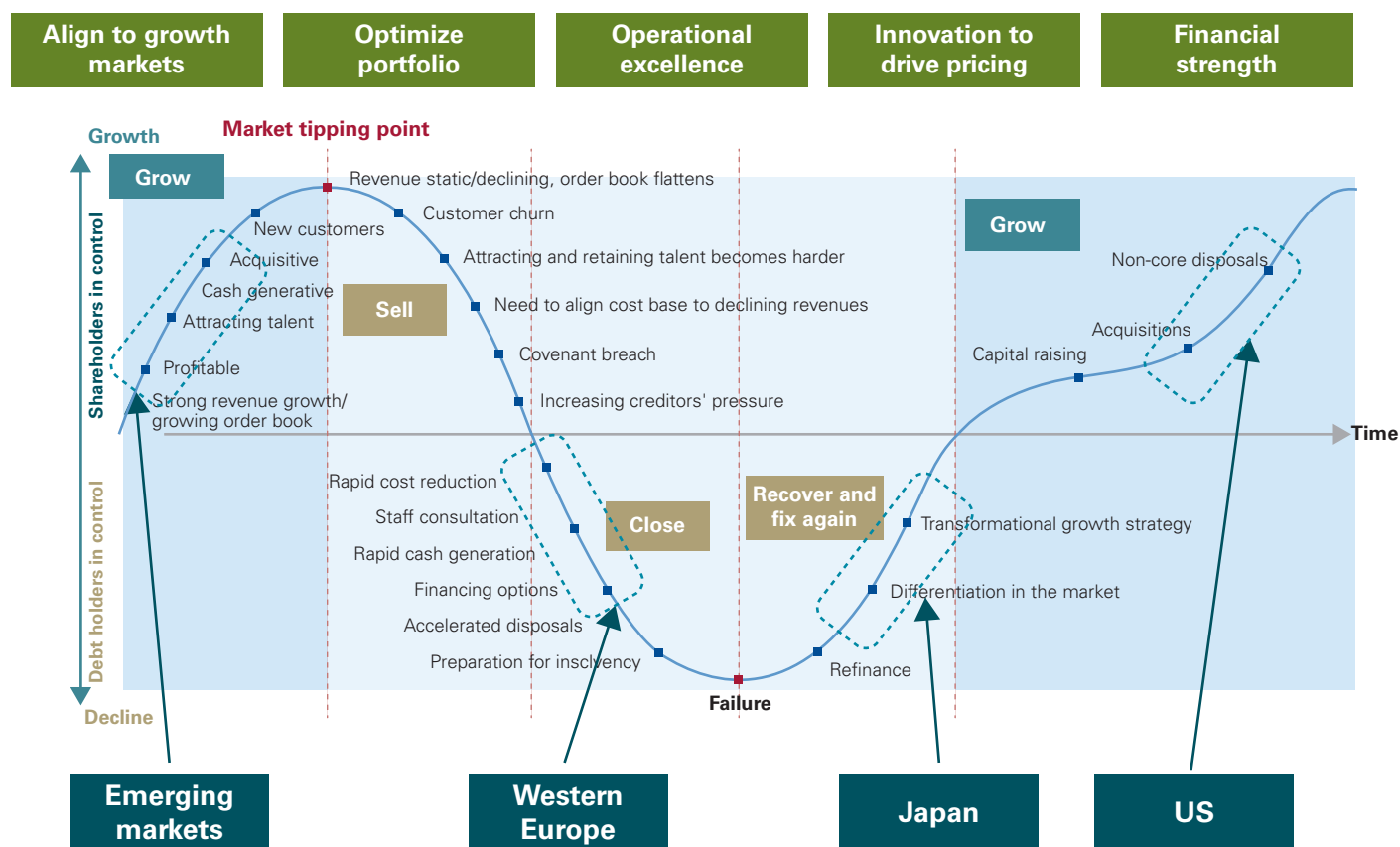
This is especially important as traditional distinctions between developed and emerging markets continue to evolve in an increasingly globalized economy. Speaking broadly, we might say that parts of Africa are where India was 20 years ago in terms of chemical production and consumption. India is where China was 20 years ago. And other areas, such as Latin America and the Association of Southeast Asian Nations (ASEAN) countries fall somewhere in the middle of this growth trajectory. Each region demands its own approach to the design and development of supply chains.

For example, China is investing heavily in supply chains for coal-based olefins to support increased production levels. In the US, supply chains need to support continued growth based on cheaper feedstocks and a growing domestic market, especially in automotive and construction. US chemical shipments are expected to rise by about 25 percent over the next 5 years to a total of US\$1 trillion.³³ By contrast, European chemical production is forecast to rise only 1 percent in 2015 according to the European Chemical Industry Council (Cefic).³⁴ Other markets, such as Latin America, Africa and Japan continue to grow but at a slower pace, requiring less investment in supply chain development.

Changing customer base

Chemical companies will continue to generate the majority of their revenues from fewer key customers. As a result, outsourcing of smaller customers to a third-party distributor will be an attractive option to enhance profitability and efficiency.

In short, the shifting balance between supply and demand regions combined with the trend toward market segmentation and third-party distribution is requiring new supply chain strategies that focus on low-cost, efficient supply chains for commodity chemicals and a responsive, innovative and customer-centric approach for specialty chemicals.



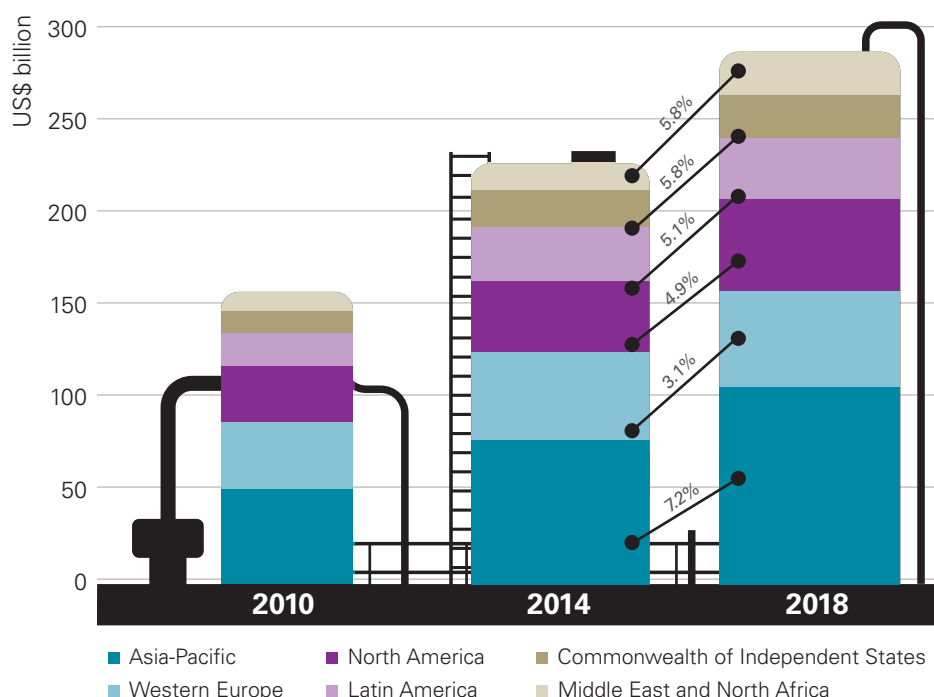
Source: KPMG analysis, 2012

³³ Ibid.

³⁴ Cefic Cuts Forecast for 2015 European Chemical Output to 1%, PUDaily.com, www.pudaily.com/News/NewsView.aspx?nid=48944, 11 December 2014.

Third-party distribution market

Significant growth of third-party distribution channel



Source: Specialty Chemical Distribution-Market Update, Strategic Imperatives for Suppliers and Distributors, The Boston Consulting Group, April 2014

Never waste a good risk

Any change in the supply chain introduces an element of risk. Chemical companies have always been risk-aware, but risk-averse. This makes good business sense in an industry that requires complex infrastructures, capital-intensive assets and long-term market strategies. However, the recent global downturn has showed us that a crisis can spur new ways of thinking and innovations that result in improved performance and profitability. In the same way, chemical companies can turn supply chain risks into business opportunities for sustainable growth.

Big data, social media, predictive analytics and cloud-based solutions are disruptive technologies that influence risk in terms of margins, customer retention, market growth, product

development, operational planning and many other areas. Companies can leverage big data and social media to realize customer intelligence across channels, enabling them to provide proactive and personalized customer service. Data analytics can be used to identify waste, monitor overcapacity, prevent shortages, understand the true cost to serve a particular market and gauge the impact of new customer channels.

A company's risk posture can also be changed by rethinking how manufacturers and their suppliers can work together to help save resources and energy. European chemical companies such as BASF have developed a solution called verbund manufacturing in which working

together is a matter of literally placing production plants and their suppliers side-by-side in the same industrial park, sometimes just a few feet apart. This approach has also been adopted by Singapore with Jurong Island, an integrated manufacturing complex developed by a partnership between the government and the private sector.³⁵ Verbund manufacturing enables companies to create efficient, value-adding supply chains starting with basic chemicals and extending to higher value products like coatings and crop protection products. In addition, by products from one plant can be used as raw materials elsewhere, further increasing supply chain efficiencies.

³⁵ ASEAN: emerging market leaders in Southeast Asia, *Reaction Magazine*, issue 15, December 2014.



The people factor: stakeholder buy-in

Supply chain optimization requires a top-down, enterprise-wide understanding of processes and technology. But equally important is a bottom-up engagement with stakeholders who are directly affected by changes in the supply chain. Changes affect both internal and external parties so companies need to consider the greater universe of stakeholders such as suppliers, customers, outside investors and shareholders. Business surveys suggest that change initiatives often fail to reach their goals – most often because of people-related issues involving leadership, communication and engagement.³⁶

Based on our experience, three approaches can help secure and maintain stakeholder buy-in:

Get everybody in the same room: This might sound obvious, but supply chain leaders are often surprised at the misconceptions that co-workers — not to mention third-party vendors — have about each person's role and responsibility. Face-to-face discussions can clarify who is responsible for what, helping to reduce situations where a lack of accountability causes key activities to fall between the cracks. Meetings held on a regular basis can also be an effective venue for problem-solving, the exchange of new ideas and a way to keep stakeholders informed of new issues and developments related to the supply chain. Improved communication can help manage expectations, anticipate objections, control demand-supply volatility and mitigate unforeseen developments.

These improvements can apply to not only innovations, but also regular operating and business planning.

Share control: Changes and improvements to the supply chain should be a group effort guided by the supply chain leader but planned and implemented by everyone responsible for the success of the supply chain. Stakeholders need to 'own the change' by clearly positioning themselves as strong advocates for the change and consistently supporting the future vision and its benefits. Some supply chain leaders have focused on empowering their sourcing teams to make decisions and solve problems on the fly in order to quickly respond to demand changes in real time.

Be specific: "If you can't measure it, you can't change it." This adage applies to supply chains as much as anything else in business. Key performance indicators (KPIs) are needed to accurately track performance and identify issues and shortfalls. KPI-based reports can also be shared with finance departments to help them better understand the supply chain's cost drivers. This understanding by finance can help build a bridge between the objectives of the CFO and the realities of supply chain operations. Moreover, our experience shows that once finance professionals are properly informed about supply chain operations, they uncover untapped cost savings that may not have been apparent to supply chain professionals.

³⁶ Enabling Organizational Change Through Strategic Initiatives, PMI.org, www.pmi.org/~media/PDF/Publications/Enabling-Change-Through-Strategic-Initiatives.ashx, March 2014; Why Good Strategies Fail: Lessons for the C-Suite, The Economist Intelligence Unit, www.pmi.org/~media/PDF/Publications/WhyGoodStrategiesFail_Report_EIU_PMI.ashx, July 2013; Cracking the Code for Change, *Harvard Business Review*, <https://hbr.org/2000/05/cracking-the-code-of-change/ar/1>, May 2000.

Conclusion: toward a better supply chain

Although the ideal supply chain may not exist, we can propose a number of characteristics and capabilities that chemical companies should keep in mind as they optimize their supply chain.

End-to-end visibility: You need to know what has happened, what is happening and what you think will happen. Data and information needs to include short- and long-term assessments to support proper sales and operations planning. Predictive analytical capabilities also require new skill sets and these are sometimes more important than IT capabilities.

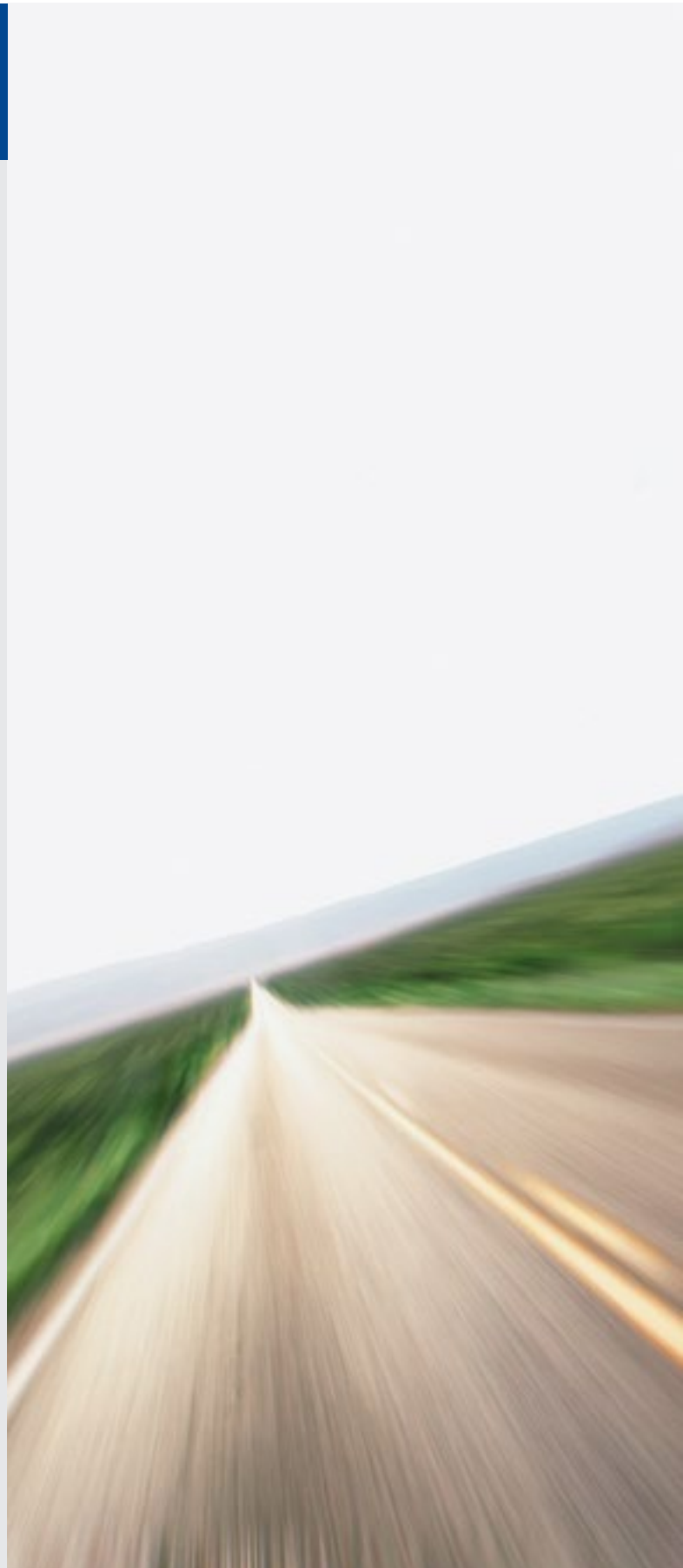
Horizontal collaborations: Siloed departments and units need to be replaced by more integrated teams of workers sharing information, KPIs, ideas and processes.

Shared accountability for the bottom line: The supply chain needs to be understood as less a cost factor than a way to support profits for the company as a whole. So it is possible you have to increase cost at one part of the value chain to increase total profits for the company.

Segmentation according to regions and products: As noted at the beginning of this article, supply chains need to be customized to support specific regions and products, whether the company produces commodities or specialties. At the same time, some companies operate at a global level for global customers, so the supply chain needs to be designed and integrated to address these global markets as well.

Smart growth in partnerships: Upstream partnerships need to be developed on a long-term, strategic basis that takes into consideration cost, quality and reliability. Downstream supply chain partnerships need to have the capacity to react quickly to volatile markets and new opportunities, especially in consumer and/or retail markets.

A 'supply chain' of new ideas: In the past, supply chain management consisted of engaging the necessary suppliers and squeezing out costs, perhaps by a few percentage points a year. Companies now need to think beyond cost and focus on value. This can mean value to the customer by providing the right product to the right market at the right time and value to the company in terms of supporting competitive advantage, improved performance, strong revenues and sustainable growth. A steady inflow of new ideas from internal and external stakeholders is critical for successful supply chain optimization in today's global chemical industry.





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Building the 21st Century:

chemicals and the global construction industry

Specialty chemicals have helped shape today's global construction industry, introducing new levels of structural strength, protection and energy efficiency to homes, commercial buildings and public infrastructure around the world. The industry faces a number of issues, such as feedstock price volatility, changing patterns of regional demand and economic uncertainty, but the benefits and, indeed, the necessity of chemicals used in construction promise strong growth for the sector in the years ahead.

By
Geno Armstrong
Clay Gilge



The construction chemicals sector today

Construction chemicals are a part of the specialty chemical sector, serving a critical role for every commercial building, residential property or infrastructure project in the world today. Concrete admixtures, asphalt modifiers, adhesives, sealants, grout and mortar, insulation, protective coatings and other products can improve workability, enhance performance, add functionality and protect structures from weather and pollution.

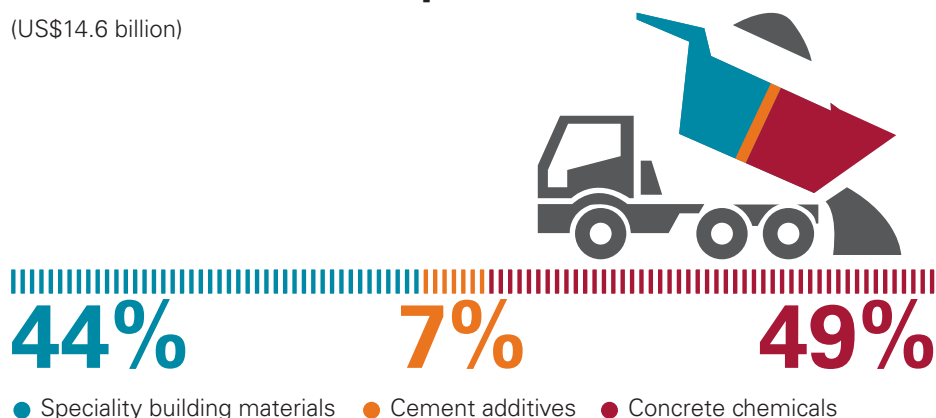
Although a large number of small and midsize companies operate on a regional basis, construction chemicals are manufactured mainly by a relatively small number of global players that include:

BASF, the largest producer of construction chemicals worldwide.

DuPont, which provides products, materials and services for construction as well as a range of other industries.

Global construction products market*

(US\$14.6 billion)



● Specialty building materials ● Cement additives ● Concrete chemicals

*Excluding adhesives, sealants and protective coatings

Source: Rediscover Grace, investor presentation, W. R. Grace, March 2014

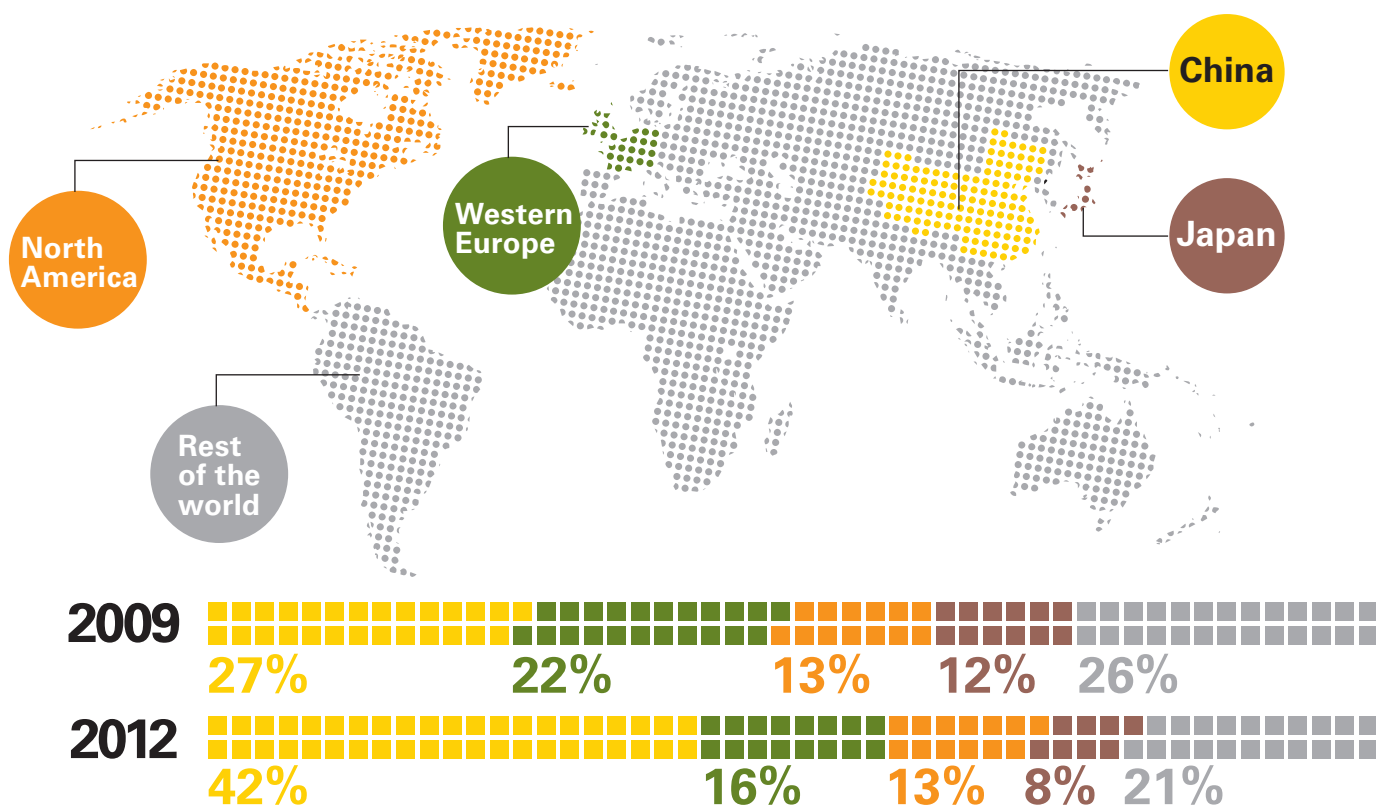
Dow, which manufactures a large number of sealants, coatings and insulation systems for residential and commercial buildings.

W.R. Grace, which produces a variety of concrete admixtures and waterproofing materials.

RPM, which produces floor coatings, sealants, building materials roofing systems and related products.

Sika, which specializes in roofing, waterproofing, flooring and concrete admixtures.

World consumption value of construction chemicals 2009-12



Source: Construction chemicals, IHS, 1 October 2013

Better building with innovations in chemistry

From a green roof to a solid, long-lasting foundation, construction chemicals are a key ingredient in building safer, stronger and more energy efficient structures.

Often, a single type of product provides several benefits to the builder. For example, concrete admixtures can reduce the cost of concrete construction; modify the properties of hardened concrete; ensure the quality of concrete during mixing, transporting, placing and curing; and slow down the setting process if required during a concrete pour. Admixtures have also dramatically increased the strength of concrete. The diameter of a pillar needed to carry 100 tons was reduced from 100 centimeters in 1920 to only 10 centimeters in 2004.³⁷

Flame retardant chemicals offer another example of multiple benefits. Added to materials or used as coatings, these chemicals are used to raise the threshold temperature at which a material ignites, reduce the rate at which materials burn and minimize the spread of flames, helping to protect the building and provide critical escape time for occupants should a fire start. Three major categories of building materials that require the fire-protective benefits of flame retardants include cables and electrical wiring, insulation and structural elements.

Equally important are materials made with construction chemicals that help increase energy efficiency and reduce the overall carbon footprint of a building. Plastic house wrap that creates a weather-resistant barrier saves up to 360 times the energy used to produce it and urethane foam thermal insulators can save up to 40 times the energy used to create it.³⁸ In addition, spray polyurethane foam (SPF) in the attic and rigid foam polyiso cyanurate board on the roof offer durability and moisture control. When used for retrofit

situations, they also help reduce the amount of building waste sent to landfills. In walls, behind walls and under floors, the use of polystyrene foams can also provide significant energy efficiency.

A recent study found that the use of plastic construction materials saved 467.2 trillion British thermal units (BTUs) of energy over alternative construction materials – enough energy saved in a year to meet the average annual energy needs of 4.6 million US households.³⁹

Other construction applications include highly reflective 'cool roof' coatings to reduce cooling costs, chemicals that provide high durability such as asphalt modifiers and protective coatings maintenance-assisting chemicals like photocatalytic coatings and environmentally friendly products such as water-based coatings and formaldehyde-free adhesives.

// Three major categories of building materials that require the fire-protective benefits of flame retardants include cables and electrical wiring, insulation and structural elements. //



³⁷ Construction chemicals, IHS, 1 October 2013.

³⁸ American Chemistry Council, www.americanchemistry.com.

³⁹ *Ibid.*

Industry issues for 2015

As we discuss below, global economic trends suggest that the construction industry will continue to grow in size and diversity as a market for construction chemicals.⁴⁰ However, a realistic assessment of the future should include a number of issues that may have a significant impact on construction activity and demand for construction chemicals in 2015.

Oil price volatility: From July 2014 to January 2015, the price of oil dropped from over US\$100 per barrel to under US\$50, a plunge of 55 percent in 6 months.⁴¹ In the same way that domestic natural gas supplies are helping US companies, lower oil prices should be a net positive for the chemical industry in general and construction chemicals in particular. End-market demand by builders continues to strengthen and declining oil prices cut raw material costs for chemical manufacturers. According to Dewey Johnson, vice-president of petrochemicals and feedstocks at IHS Chemical, lower oil should fuel stronger overall GDP growth and the potential for greater product substitution as lower feedstocks make chemicals more cost competitive relative to competing materials.⁴²

Economic uncertainty: Despite a general consensus that the global economy should benefit from lower oil prices, the dramatic and rapid fall in these prices has some analysts and industry leaders concerned. "A gradually declining price would be a positive," says Craig Rogerson, chairman and CEO of Chemtura, "but the swift decline we've seen could indicate further softening or a major disruption in the global economy."⁴³ The chemical industry has made a steady recovery since the global downturn, but slowing economic growth rates in Asia and persistent financial problems across Europe are having an impact on global economic confidence. These developments suggest the oil price decline is not just a supply side issue, as has been widely reported.

Changing usage patterns: Chemical companies serving the construction industry are large and multinational entities, with upstream and downstream supply chains crossing multiple regions. Successful companies will have to adapt to complex global markets as they expand, contract and diversify. In Asia, South and Central America and Eastern

Europe, construction will be focused on new buildings while renovation is likely to be the focus in more mature economies such as Europe. This will directly influence the usage patterns – concrete admixtures are predominantly used for new buildings while adhesives and sealants are consumed more during renovation.

“A gradually declining price would be a positive,” says Craig Rogerson, chairman and CEO of Chemtura, “but the swift decline we’ve seen could indicate further softening or a major disruption in the global economy.”



⁴⁰ The Chemistry of Construction, *Reaction Magazine*, June 2011.

⁴¹ Will Collapse in Oil Price Cause a Stock Market Crash?, Oilprice.net, <http://oil-price.net/en/articles/will-collapse-in-oil-price-cause-stock-market-crash.php>, 1 January 2015.

⁴² *Ibid.*

⁴³ *Ibid.*

KPMG Global Construction Survey 2014

KPMG recently completed its latest survey of executives representing 109 companies from throughout the globe. Annual revenues from the companies surveyed varied in size from turnovers of US\$200 million to more than US\$100 billion. The companies served a range of markets including energy, power, industrial, healthcare/pharmaceutical, manufacturing, mining, education and government.

In general, respondents expected continued growth based mainly on increased demand for large infrastructure development. For example, the boom in shale oil and gas is driving new capital projects, particularly in the US, for building new chemical, methanol and ethylene plants, liquid natural gas (LNG) processing plants and export terminals and gas-fired power stations. When asked about current challenges in the industry, respondents cited a number of issues that reflect both risks and opportunities for the industry:

Safety

Serious injuries or fatalities on projects are unacceptable, despite the unavoidable risks of construction.



Costs

Estimating anticipated costs prior to committing to a project is increasingly difficult. Projects are so large and moving so fast that the builder has limited time to properly develop cost projections. The standard contingency of 10 percent is no longer enough to cover today's project risks.



Talent scarcity

The lack of available planners and project management professionals is being felt worldwide. Builders also have difficulty in attracting qualified craft labor to projects.



Environmental regulations

Frequent changes in government policies and different interpretations by various states or districts result in confusion and a lack of clarity. However, new safety and regulatory requirements were also cited as a significant driver for growth.



Cyber security

Protecting data, IT systems and communications related to proprietary designs, client information, the power grid and other areas is an increasing concern to both builders and their clients.



Management of mega projects

Most respondents reported using an integrated project management information system (PMIS) to plan and control capital construction projects. Often, the PMIS was integrated with accounting and procurement software. Despite these systems and other capabilities, the increasing size and complexity of mega projects have led to greater difficulty in transferring or mitigating project and program risks.



To help meet the challenges facing the global construction industry, builders, architects and engineers need to take a more active role in their clients' businesses by helping to enforce engineering standards, protecting intellectual property and improving facilities,

design. They also need to demonstrate a greater level of sophistication in controls and governance and adopt a more strategic, portfolio-wide view by introducing innovative ways to implement multiple projects to bring greater efficiencies and to reduce costs.

Global construction on the rise

If a rising tide lifts all ships, then chemical companies serving the global construction industry should be encouraged by recent estimates of a steady rise in GDP growth and the number of building projects around the world.

World real GDP growth is expected to increase to 3 percent in 2015 from 2.7 percent in 2014, reaching 3.4 percent in 2016.⁴⁴ In line with this trend, the global construction industry – which currently represents 13 percent of global GDP – is expected to expand to 15 percent by 2020, representing over US\$12 trillion in value.⁴⁵

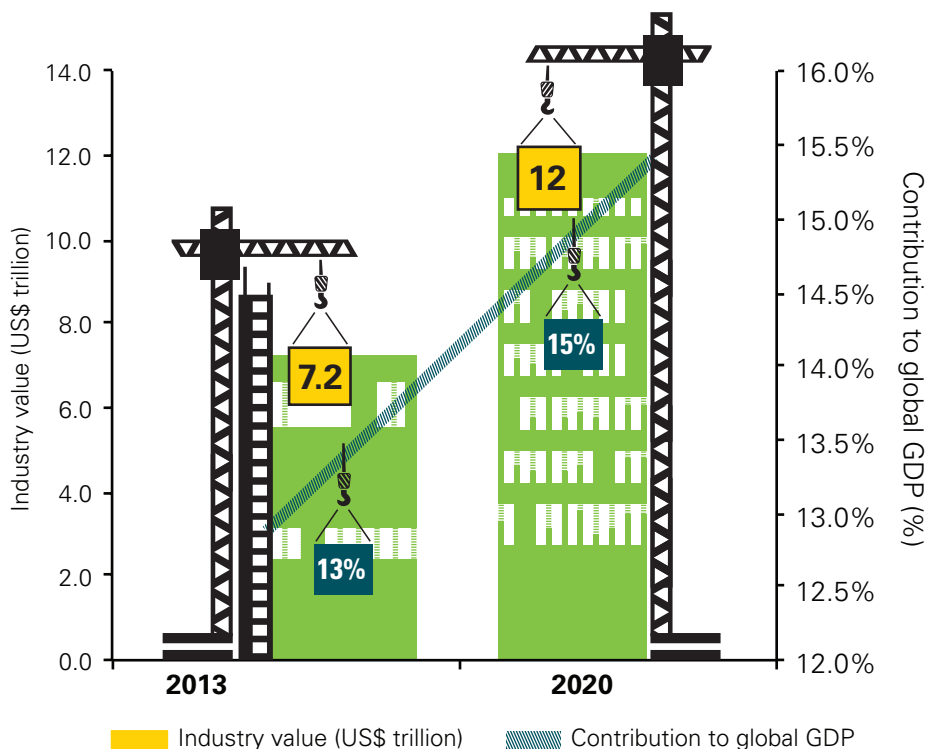
Not surprisingly, most of this growth will occur in emerging countries as

their share of global construction increases from 35 percent to 55 percent by 2020.⁴⁶

In the Chinese construction sector, the government recently initiated a mini-stimulus to the economy by relaxing home purchase restrictions and cutting the benchmark interest rate.⁴⁷ This is expected to trigger greater domestic demand over the next year. Key growth areas in China also include infrastructure projects for transportation, energy, schools, hospitals, government buildings and water supply. Infrastructure projects in emerging countries overall are expected to increase 130 percent by 2020.⁴⁸

// In line with this trend, the global construction industry – which currently represents 13 percent of global GDP – is expected to expand to 15 percent by 2020, representing over US\$10 trillion in value. **//**

Global construction: contribution to global GDP



Source: Global Construction Expected to Increase by \$4.8 Trillion by 2020, Industry Tap, 8 March 2013

⁴⁴ 2015 Forecast: Can demand shrug off crude price shock?, IHS Chemical Week, www.chemweek.com/lab/2015-Forecast-Can-demand-shrug-off-crude-price-shock_66710.html, 14 January 2015.

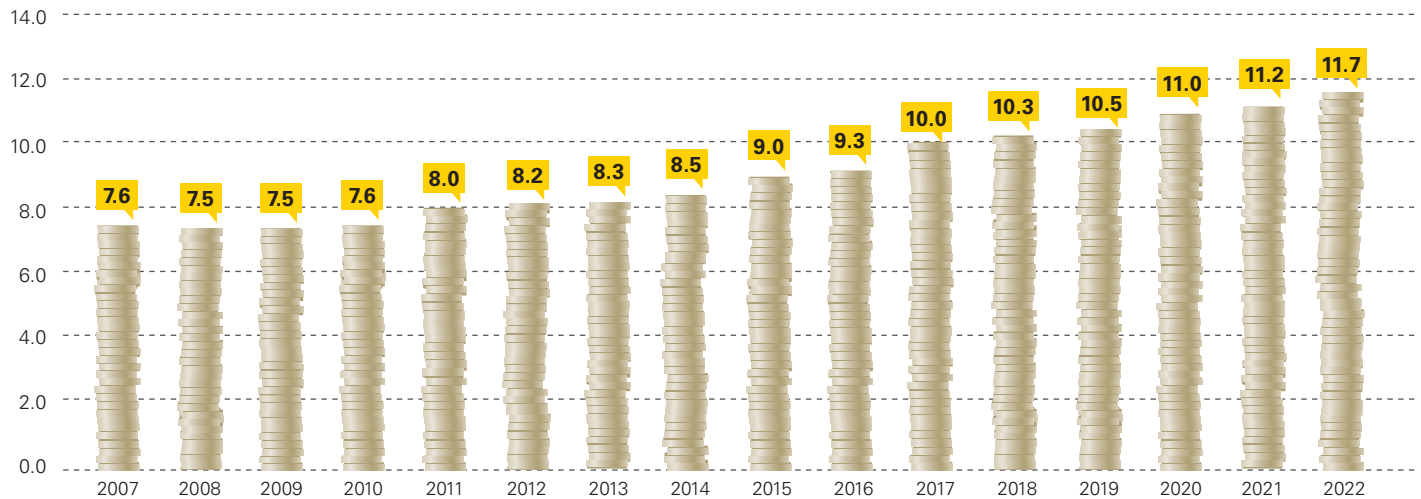
⁴⁵ Global Construction Expected to Increase by \$4.8 Trillion by 2020, Industry Tap, 8 March 2013. See also Global construction outlook: executive summary, IHS Economics, 12 December 2014.

⁴⁶ First-tier cities expected to lift property restrictions, China Daily, 6 January 2015.

⁴⁷ Global Construction Expected to Increase by \$4.8 Trillion by 2020.

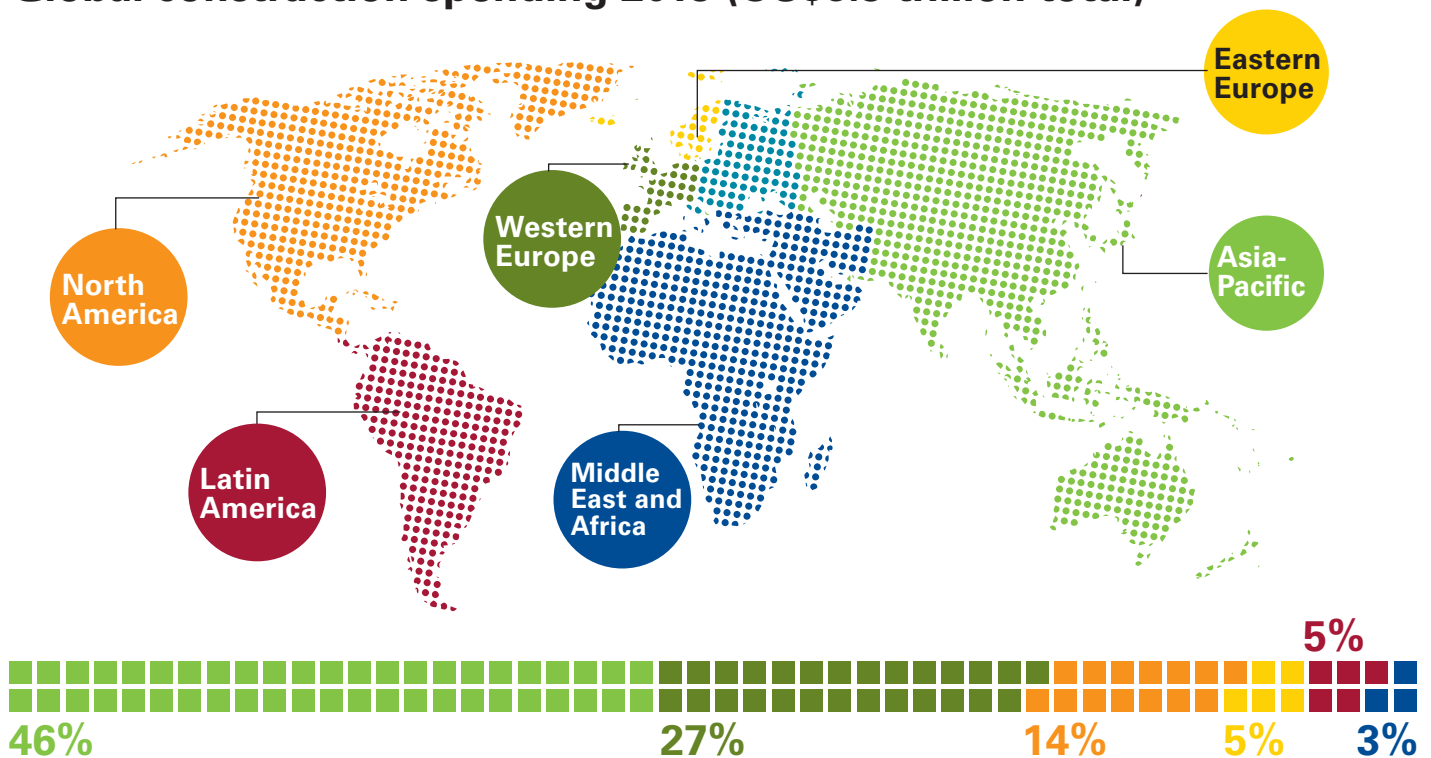
⁴⁸ *Ibid.*

Global construction spending (US\$ trillion)



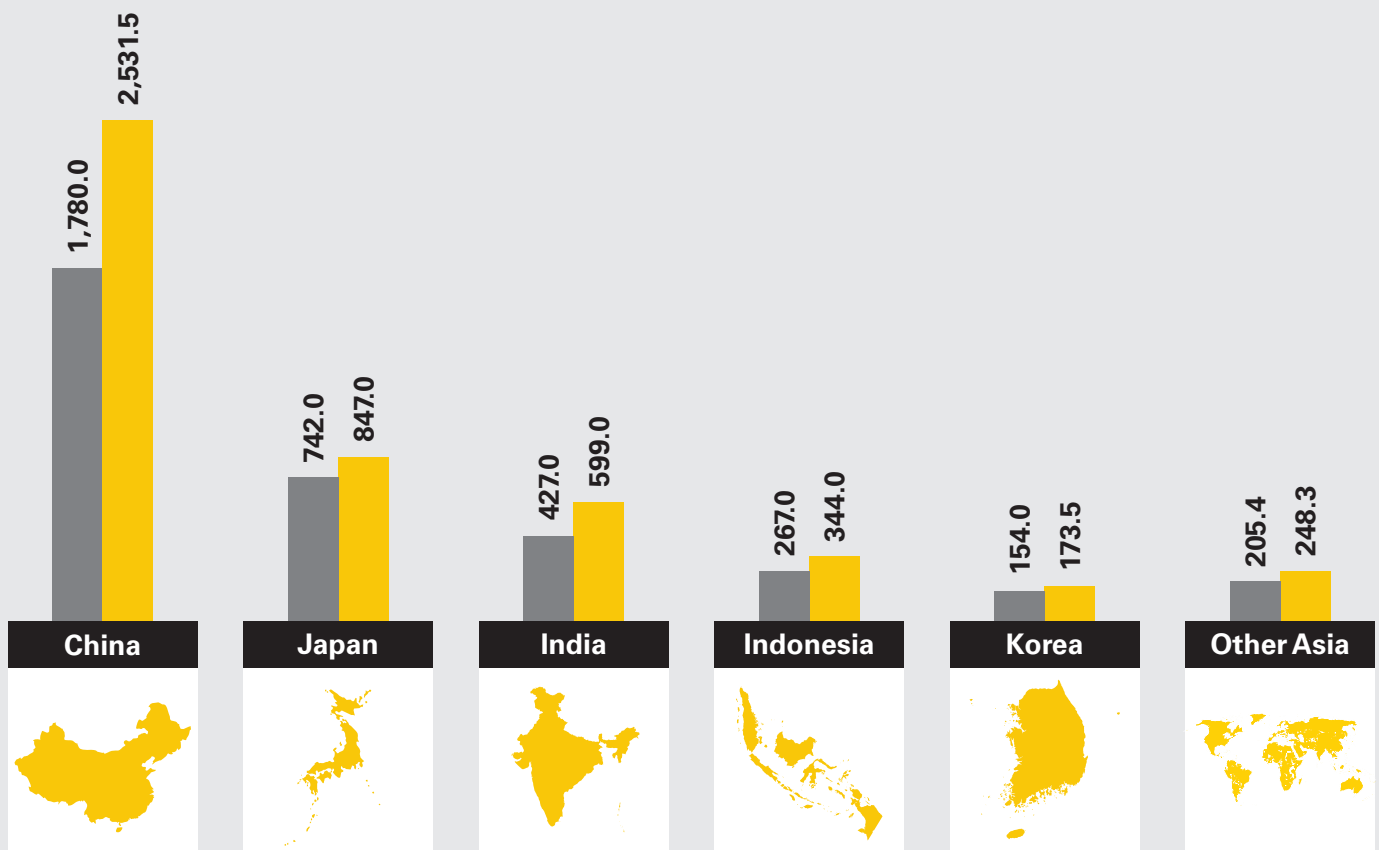
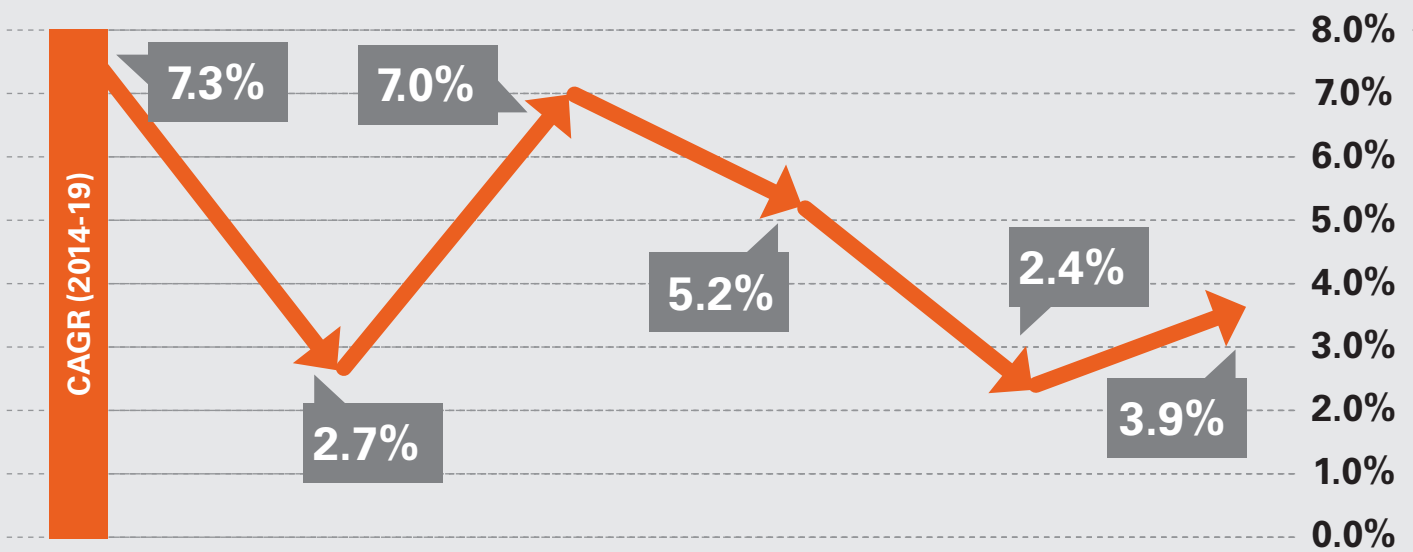
Source: Global Construction Outlook: Executive Summary, IHS Economics, 12 December 2014.

Global construction spending 2013 (US\$8.3 trillion total)



Source: Global Construction Outlook: Executive Summary, IHS Economics, 12 December 2014.

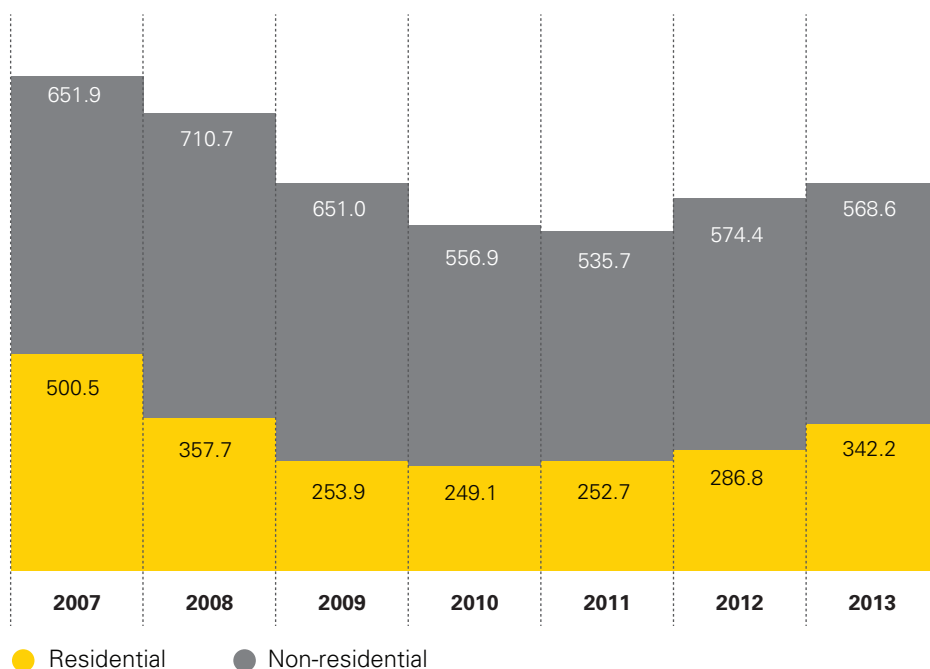
Asian construction spending (US\$ billion)



Source: Asia Construction Outlook 2014, AECOM, April 2014.

2013 2019

US construction spending (US\$ billion)



Source: Construction spending, United States Census Bureau, accessed 12 January 2015.

Just as China will remain the growth leader in Asia, the US will lead construction growth among developed countries. US construction starts for 2015 are predicted to rise 9 percent to US\$612 billion, even stronger growth than was achieved in 2014.⁴⁹ Commercial building is expected to increase 15 percent, led by construction for office buildings, hotels and warehouses. Single family housing is also expected rise 15 percent, driven by greater access to home mortgage loans.⁵⁰ Manufacturing plant construction is predicted to settle back 16 percent following the huge increases

of 42 percent in 2013 and 57 percent in 2014, spurred by massive chemical- and energy-related projects.⁵¹

In Europe, some analysts predict that from 2014 to 2016, Ireland and Poland will witness average growth in construction output of 9 and 6 percent, respectively.⁵² The UK, Denmark and Hungary are also among the fastest-growing construction markets in Europe, with current growth rates of 3 to 4 percent per annum.⁵³ South and Central America, Japan, Africa and other Asia should see steady but moderate growth.

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Conclusion

With a steady stream of innovative, sustainable, high-performing and cost-effective products, construction chemicals production is one of the key growth areas of the global chemical industry. Economic concerns might add uncertainty to long-term forecasts for demand, but one thing is certain – construction chemicals will be essential for building a better world in the 21st century.

⁴⁹ Construction Industry to See More Balanced Growth in 2015 According to Dodge Data & Analytics, <http://construction.com/about-us/press/construction-industry-to-see-more-balanced-growth-in-2015-according-to-DDG.asp>, 6 November 2014.

⁵⁰ *Ibid.*

⁵¹ *Ibid.*

⁵² Sector report, Chemicals, Helvea Baader Bank Group, 4 August 2014.

⁵³ *Ibid.*

KPMG in the industry



Paul Harnick, Head of Chemicals, KPMG in the UK, recently presented at Future of Polyolefins 2015.



Norbert Meyring, Partner, Head of Chemicals Sector, KPMG China and Asia Pacific, was a keynote speaker at the Petrochem China 2014 conference and discussed China's petrochemical industry in the economic recession and provided a regional update.

KPMG Global Chemicals Institute

Look out for our upcoming Reaction 16 webcast, taking place in May, and will discuss chemicals and the global construction industry, featuring Geno Armstrong and Clay Gilge.

Join our Global Chemicals Institute for access to valuable thought leadership and webcasts on key industry topics.

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