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Regions & Locations Guide

For the Chemical and Life Science Industries

- Chemical Parks
- Life Science Clusters
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Investing with an Acronym Strategy

Dear Reader,

"Regions & Locations Guide for the Chemical and Life Science Industry" reports on investment and operating conditions in regional markets, chemical parks and life-science clusters. In this 2014 edition you will again find substantiated market reports and articles on industrial locations. We think this essential information assists potential investors from the global process industry in facilitating investment decisions in important — mature or emerging — industrial regions of the world.

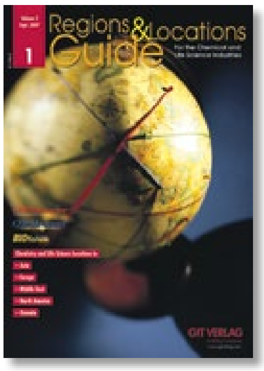
When looking for a site to invest in a production facility or a location to construct an office building or even to set up regional headquarters, companies need to consider several factors. There is a competition among locations for investments but it is not just the growth perspectives of the market, the infrastructure, political stability or the attractiveness of frame conditions that tip the scale in favor of one location. Factors such as innovation, talent development and institutional strength continue to play a defining role in determining the world's most competitive economies, according to the Global Competitiveness Report 2014-2015. The report, issued by the World Economic Forum (WEF), which we present in extracts on pages 4 and 5 evaluates 144 economies and finds that the leading economies in the index all possess a track record in developing, accessing and utilizing available talent, as well as in making investments that boost innovation.

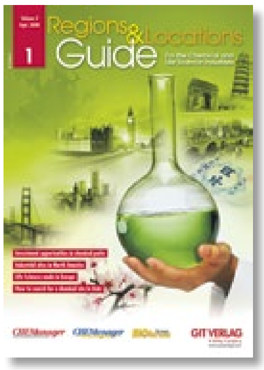
Since the beginning of the new millennium, terms like BRIC, MIST or, most recently, CIVETS were created by the financial community to highlight emerging countries in Asia, Africa and Latin America that are favored for their dynamic economy and growing population. These economies have been attracting a lot of attention and investment. But it is a mature economy that dominates the headlines in terms of investments these days: the USA. As a consequence of falling energy costs due to the U.S. shale gas bonanza, the country's incipient reindustrializing attracts billions of dollars of new foreign investment. But this is not the sole reason for the USA's jump to rank 3 in the Global Competitiveness Report 2014-2015. According to the WEF, the U.S. goes up in the rankings for a second year in a row on the back of improvements in a number of areas, including some aspects of the institutional framework, and more positive perceptions regarding business sophistication and innovation. Thus, when we speak of emerging markets in the form of acronyms, it is not too much beside the point to mention "USA" in the same breath.

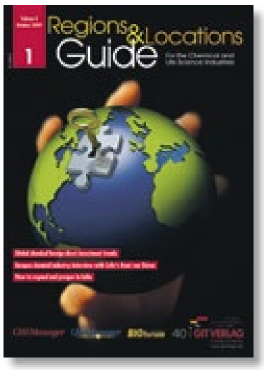
Dr. Michael Reubold

Take the time to study this issue; it will be time well invested.

Dr. Michael Reubold and the Regions & Locations Guide team







Content

Global Competitiveness Index

Global Growth at Risk from Slow Reform Progress; USA Climbs Two Ranks

Innovation, talent development and institutional strength continue to play a defining role in determining the world's most competitive economies, according to the Global Competitiveness Report 2014-2015. The annual report – issued by the World Economic Forum (WEF) – evaluates 144 economies and finds that the leading economies in the index all possess a track record in developing, accessing and utilizing available talent, as well as in making investments that boost innovation.

Top 10 Countries in the Global Competitiveness Index

1 Switzerland	6 Japan
2 Singapore	7 Hong Kong SAR
3 United States	8 Netherlands
4 Finland	9 United Kingdom
5 Germany	10 Sweden

Source: World Economic Forum (WEF) Global Competitiveness Report 2013-2014

According to the report's Global Competitiveness Index (GCI), Switzerland tops the ranking for the sixth consecutive year. Singapore remains second; the United States improves its position for the second consecutive year, climbing two places to third; and Finland (four) and Germany (five) both drop one place compared with last year's ranking. They are followed by Japan (six), which climbs three places and Hong Kong (seven), which remains stable. Europe's open, service-based economies follow, with the Netherlands (eight) also stable and the United Kingdom (nine) going up one place. Sweden (10) rounds out the top 10 of the most competitive economies in the world.

Margareta Drzeniek-Hanouz, World Economic Forum

Americas

The United States goes up in the rankings for a second year in a row on the back of improvements in a number of areas, including some aspects of the institutional framework, and more positive perceptions regarding business sophistication and innovation. As it recovers from the crisis, the U.S. can build on the many structural features that make its economy extremely productive. U.S. companies are highly sophisticated and innovative, and they are supported by an excellent university system that collaborates admirably with the business sector in R&D. Combined with flexible labor markets and the scale opportunities afforded by the sheer size of its domestic economy – the largest in the world by far – these qualities make the U.S. very competitive. However, the macroeconomic environment remains the country's greatest area of weakness.

Latin America finds its major economies still in need of implementing reforms and engaging in productive investments to improve infrastructure, skills and innovation. Overall, the region continues to suffer from strong headwinds related to weak investments, a fall in exports and commodity prices, and tighter access to finance. Building the economic resilience of the region will depend on its capacity to strengthen the fundamentals of its economy by boosting its level of competitiveness. Chile (33) continues to lead the regional rankings ahead of Panama (48) and Costa Rica (51). Brazil drops one position and ranks 57 this year. In spite of the drop of six places, Mexico (61) has adopted important structural reforms in the past year.

Europe

In Europe, several countries that were severely hit by the economic crisis, such as Spain (35), Portugal (36) and Greece (81), have made significant strides to improve the functioning of their markets and the allocation of productive resources. At the same time, some countries that continue to face major competitiveness challenges, such as France (23) and Italy (49), appear not to have fully engaged in this process. While the divide between a highly competitive North and a lagging South and East persists, there is a new outlook on the European competitiveness divide between countries implementing reforms and those that are not.

Switzerland tops the Global Competitiveness Index again this year, keeping its first place for six years in a row. Its performance is stable since last year and remarkably consistent across the board.

Germany's small drop is the result of some concerns about institutions and infrastructure and is only partially balanced out by improvements in the country's macroeconomic environment and financial development. Moreover, Germany's education system is assessed less positively than it was in previous years. Overall, Germany weathered the global economic crisis of recent years quite well thanks at least partly to its main competitiveness strengths, which include highly sophisticated businesses and an innovation ecosystem that is conducive to high levels of R&D innovation.

BRIC Countries and Other Emerging Economies

Some of the world's largest emerging market economies continue to face difficulties in improving competitiveness. Saudi Arabia (24), Turkey (45), South Africa (56), Brazil (57), Mexico (61), India (71) and Nigeria (127) all fall in the rankings. China (28), on the contrary, goes up one position and remains the highest-ranked BRIC (Brazil, Russia, India and China) economy. Russia's weak and inefficient institutional framework remains its Achilles' heel and will require a major overhaul in order to eradicate corruption and favoritism and re-establish trust in the independence of the judiciary. Diversification of the economy will require reinforcing the very small SME (small and medium-size enterprise) sector as well as continued progress toward a stronger and more stable financial system. These challenges prevent Russia – placed at 53 this year – from taking advantage of its competitiveness strengths, which are based on a well-educated population, fairly high levels of information and communication technology use, and its solid potential for innovation.

Asia

In Asia, the competitiveness landscape remains starkly contrasted. The competitiveness dynamics in Southeast Asia are remarkable. Behind Singapore (two), the region's five largest countries (ASEAN-5) – Malaysia (20), Thailand (31), Indonesia (34), the Philippines (52) and Vietnam (68) – all progress in the rankings. Indeed, the Philippines is the most improved country overall since 2010. By comparison, South Asian nations lag behind, with only India featuring in the top half of the rankings.

The region is home to three of the 10 most competitive economies in the world: Singapore, Japan and Hong Kong. Another three economies are featured in the top 20: Taiwan (China), New Zealand and Malaysia (20),

which is the best ranked of emerging and developing Asian nations. At 28, China stands some 40 places ahead of India (71), the other regional economic giant.

India's slide in the rankings began in 2009, when its economy was still growing at 8.5% (it even grew by 10.3% in 2010). Since then, the country has been struggling to achieve growth of 5%. Overall, India does best in the more complex areas of the GCI: innovation and business sophistication. In contrast, it obtains low marks in the more fundamental drivers of competitiveness, such as health and primary education. The country's health situation is indeed alarming: Infant mortality and malnutrition incidence are among the highest in the world; only 36% of the population has access to improved sanitation; and life expectancy is Asia's second shortest, after Myanmar. On a more positive note, India is on track to achieve universal primary education – although the quality of primary education remains poor, and it ranks low in higher education and training.

Middle East And Africa

Affected by geopolitical instability, the Middle East and North Africa depict a mixed picture. The United Arab Emirates takes the lead and moves up seven places to 12, ahead of Qatar (16). Their strong performances contrast starkly with countries in North Africa, where the highest placed country is Morocco (72). Ensuring structural reforms, improving the business environment, and strengthening the innovative capacity so as to enable the private sector to grow and create jobs are of key importance to the region.

Sub-Saharan Africa continues to register impressive growth rates close to 5%. Maintaining the momentum will require the region to move toward more productive activities and address the persistent competitiveness challenges. Only three sub-Saharan economies, including Mauritius (39), South Africa (56) and Rwanda (62) score in the top half of the rankings. Nigeria continues its downward trend and falls by seven places to 127 this year. Overall, the biggest challenge facing the region is in addressing human and physical infrastructure issues that continue to hamper capacity and affect its ability to enter higher value-added markets. Angola – the continent's second biggest oil exporter – ranks 140 overall.

Call for Structural Reforms

"The strained global geopolitical situation, the rise of income inequality and the potential tightening of the financial conditions could put the still-tentative recovery at risk and call for structural reforms to ensure more sustainable and inclusive growth," said Klaus Schwab, founder and executive chairman of the WEF.

Xavier Sala-i-Martin, professor of economics at Columbia University, said: "We see a new kind of decoupling, between high- and low-growth economies within both emerging and developed worlds. Here, the distinguishing feature for economies that are able to grow rapidly is their ability to attain competitiveness through structural reform."

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Potential In Eastern Europe

The CEE and CIS Region Offers Benefits for API Manufacturing

Over the past five years, emerging markets have experienced some of the highest pharmaceutical market growth rates, a trend that is expected to continue. Central Eastern Europe (CEE) and the Commonwealth of Independent States (CIS) countries that, combined, make up Eastern Europe, offer a mix of developed as well as emerging opportunities for many companies looking to expand their global presence.

These countries also provide a cheaper alternative than their western EU counterparts for clinical trials and API manufacturing, while following a similarly defined regulatory pathway. Although the growth potential differs between regions like CEE and nations in the CIS, investment from outside the region is becoming more frequent, thereby allowing companies to gain access to new distribution channels and patient populations that favor branded generic medicines.

CEE versus CIS

Countries that make up the CEE are expected to have limited market growth in the coming years, but the highest rates will most likely come from Romania, which is expected to have a strong market with a compound annual growth rate (CAGR) of 6% in pharmaceutical sales growth. Hungary and Poland will have the lowest expected growth with a 2%-4% increase in pharmaceutical sales. Lastly, the Baltic States will be expected to round out the middle at an estimated increase of 4%-5% growth in pharmaceutical sales.

In terms of manufacturing, the region offers strong biopharmaceutical capabilities in biotech and vaccine production along with a talented pool of chemists due to its extensive history of research that stems from the Cold War. Among countries in the region, Poland and Hungary in particular are looking to expand upon key areas in genomic and preventative medicine and protein engineering by increasing the number of biotech cluster cooperatives, funding and links to academia.

The CIS nations, along with Ukraine, are expected to have the highest growth rates, with a CAGR in pharmaceutical sales at roughly 8%-9%, but the risk associated may prove to be a deterrent for parties interested in these countries. The Russian devaluation of the ruble and Ukraine's hryvnia could increase if ongoing tensions further escalate. It could also increase the cost of imports into these regions and further drive up prices, hindering foreign interest to set up local production.

Some of the most prominent and growing therapeutic areas in the region include oncology, diabetes, antibiotics, as well as the vitamins and minerals segment for many of the CIS countries. In contrast, the CEE will rely less on some of the consumer over-the-counter (OTC) areas but have some notable crossovers as interest in specialty drugs, oncology, diabetes, and asthma/chronic obstructive pulmonary disease medications will continue to increase.

While these countries may have fewer active pharmaceutical ingredient (API) manufacturers than India and China, they do have established companies like Zentiva, Polpharma, Gedeon Richter, Teva's Croatian arm Pliva, and Krka, among others, that are able to supply their markets and others with generics. According to Thomson Reuters Newport Premium, the Czech Republic and Poland have the highest number of companies within Eastern Europe with significant experience supplying API into regulated markets. Although Ukraine has a high number of total API manufacturers, many are designated as local companies supplying to their local and other less-regulated markets, as seen in figure 1.

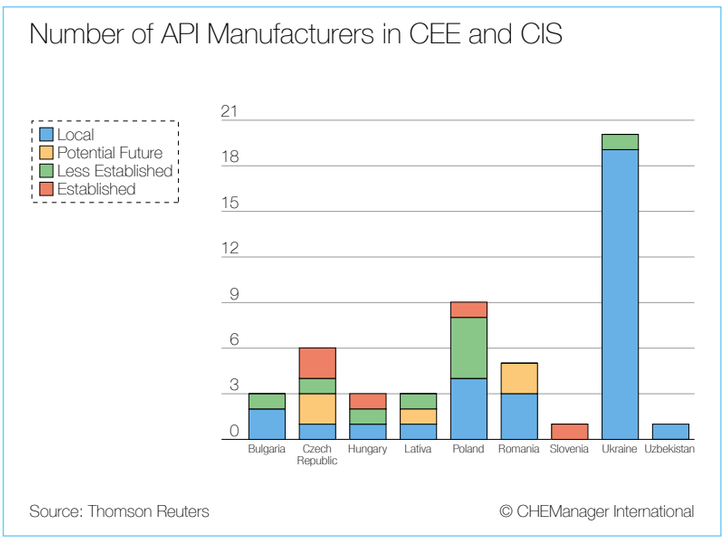
Joshua Gilpatrick, Thomson Reuters

Quality Of Medicines

Variations in how good manufacturing practices (GMP) are interpreted and implemented are important to note, as they may not be the same among this diverse set of nations. However, strong foundations like the Falsified Medicines Directive (FMD), and external organizations, like the Pharmaceutical Inspection Convention and Pharmaceutical Inspection Co-operation Scheme (PIC/S), will further promote quality API production and harmonization in many regions.

Many of the EU member states now require a written confirmation from the country of origin's authorized regulatory agency to ensure that API imports meet EU or equivalent GMP standards. Along with this, last year Poland signed a cooperation agreement to share GMP inspection outcomes with the FDA. Furthermore, the Czech Republic has seen an increase in local manufacturer inspections, which resulted in their State Institute of Drug Control suspending a marketing authorization after a non-compliance report was issued in April.

Recent legislative initiatives in Hungary have shown an increased focus



Acquirer Company/Country	Target Company/Country	Deal Type
Intrexon – US	Codexis – State of the Art Laboratory Operations – Hungary	M/A
Mentholatum – US	Dax Cosmetics – Poland	M/A
Evestra – US	Gedeon Richter – Hungary	D/C
BTG Industries Et Sante – France	Sensilab SKA-Polfa Lodz, Ascaltin & Alugastrin Divisions – Poland	M/A
Cipla Holding – Netherlands	Celeris – Croatia	M/A
Miraphytos Holding – Cyprus	PAO Fitofarm – Ukraine	M/A
GlaxoSmithKline – UK	de Miclen – Slovakia	M/A
Atrium Innovations – Canada	Mucos Pharma – Czech Republic	M/A
Recordati – Italy	Undisclosed Polish Company	M/A
Laboratorios Alcala Farma – Spain	Polpharma – Poland	M/S

Tab. 1: Recent Deals in CEE and CIS (M/A=Merger or Acquisition, D/C=Development/Commercialization License, M/S=Manufacture/Supply)

on quality. Newly passed regulations allow unannounced inspections for monitoring the quality of medicines, as well as a new requirement for authorization holders to keep a minimum stock of certain medications deemed essential to mitigate shortages. In Kazakhstan, even, the State Program of Forced Industrial-Innovative Development is making the updates needed for facilities to adhere to EU GMP mandatory by the end of 2014. This may get postponed however, as Russia has had to extend its locally made API GMP deadline out until 2016.

Recent Investments

Investments into these regions usually take shape in the form of foreign multinationals partnering with local distributors or active ingredient manufacturers (table 1). This is to manufacture the API, commercialize, or license products that are still patented in the US or the rest of Europe. This practice also takes advantage of the regional distribution channels that are already in place. Countries like Lithuania, Ukraine and Belarus provide gateways between Western Europe and Russia that are optimal for securing supply chains between the regions.

Lupin, Dr. Reddy's, Glenmark and Ranbaxy were some of the first Indian companies to pursue entry into the Ukraine and the CIS, and all hold strong positions in these regions. Other Indian companies looking to get more involved in these markets include Macleods and Cadila Pharmaceuticals. Having a local presence can be utilized to try to circumvent any protectionist measures, as well as make tech transfers and registration processes run more seamlessly. There is also considerable importance for Indian companies, including Cipla and Hetero, who have acquired or partnered with local distributors and chemical producers and have already funneled money into the region. For example, Cipla acquired Croatian-based Celeris d.o.o., while Hetero has a joint venture with Russian Makiz Pharma for the tech transfer and API production of its antiretroviral product suite.

Using the skills of local talent at a cheaper cost than their Western counterparts, biopharma parks are getting attention in many of the CEE and CIS nations – including in Debrecen, Hungary, where Teva and Gedeon Richter have set up facilities. There is also an ongoing effort between Lithuania and India to develop a shared park in Lithuania's free economic zone at a plant that will be EU GMP-compliant. This can be done to encourage partnerships, licensing strategies, and shared resources needed to carry out R&D.

However, the potential interest in investing in these countries is juxtaposed by companies looking to also exit these markets. GSK announced it had a few curious buyers for its Romanian plant in Brasov, only to announce later that it would be closing the plant. The driving factors surrounding entry into the CEE and CIS markets are complex, and depending on future growth and generic penetration, the pursuit of these markets could sway in either direction, but the region offers valuable benefits for API and generic medicine production.

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Global Shale and the GCC

The End of Low-Hanging Fruits and High Margins

Innumerable articles have been published around the world on the U.S. shale boom. In addition, its immediate consequences for Gulf Cooperation Council (GCC) countries – such as reductions in liquefied natural gas (LNG) exports from the GCC to the U.S. – have been discussed frequently in the Middle East.

This article highlights analyses of less-obvious interdependencies between the U.S. shale boom, GCC oil and gas businesses, and implications on chemical sites in the GCC, including an assessment of possible risk factors.

A Threat to Chemical Players in the GCC?

Attendees at oil and gas conferences in GCC countries were generally well aware of developments in the U.S., but they voiced diverse opinions on this rather new phenomenon. Some experts tended to be rather relaxed, seeing their business affected but not seriously threatened. Others were more alert to the topic and mentioned vario U.S. risk factors that could have considerable negative effects on GCC countries' oil, gas and chemical businesses. We believe there is no need to panic. Taking interdependencies between the U.S. shale boom and other risk factors into account does, however, reveal possible consequences such as growth obstacles and margin squeezes in GCC countries.

Risk Factor: LNG Exports

Ethane is commonly a byproduct in many gas fields and is consequently extracted at a higher rate if methane production is high. For example, the ethane feedstock used in the Ras Laffan cracker (Qatar) with a capacity of 1.3 million tons of ethylene per year is extracted from the North Field, one of the world's largest conventional gas fields. Only five to 10 years ago, Qatar had planned to export large amounts of LNG to the U.S. and to eastern Asia, and constructed LNG export terminals as well as large vessels to do so.

Then the U.S. shale gas boom started, and the forecasted U.S. methane self-sufficiency by 2020 forced Qatar to change export plans. Qatar's new plan is to increase export volumes to Asia accordingly, mainly to China and Japan, where demand increases are considered high enough to absorb the additional LNG supplies. While China's and Japan's demand extrapolations based on 2013 economic figures might sustain this plan, risk factors remain.

China featured impressive economic growth – until recently, when first signs of a fading dynamic hit the headlines. This effect might be temporary and does not allow conclusions for future development, because China is large, complex and features a unique political and economic system that is difficult to predict.

One risk factor is that mid- to long-term economic development may turn out to be below expectations. Another risk factor is that political decisions limit LNG imports from Qatar – for instance, by import supplier diversification (gas from far eastern Russia, LNG from Australia or U.S.), by domestic shale gas production, and by driving or even subsidizing other forms of energy production.

Oliver Gawad, Stratley

Dr. Sven Bugarski, Stratley

Post-Fukushima Japan has presumably left an energy gap that Qatar might fill by supplying additional LNG. One of the main risk factors concerning Japan is that Japan might operate its nuclear power plants longer than planned. Furthermore, Japan is actively evaluating methane hydrate extraction off its shores. As yet, commercial production is a distant prospect, but it could become one option of hydrocarbon supply in the future.

Risk Factor: Oil Production

Large amounts of gas, especially in Saudi Arabia, are produced as associated gas in oil production. As byproducts, ethane and other gases are produced in volumes tightly correlated to the oil volumes produced. This also means that constraints in oil production limit the ethane gas supply.

The shale/tight oil boom in the U.S. has reduced, and will further reduce, the demand for light oil imports. Upstream companies in the GCC are well aware of this. They argue that, firstly, they can still supply heavy crude to the U.S. (shale/tight oil is mainly light oil) and that, secondly, east Asian demand will grow fast enough to more than compensate for reduced U.S. demand. The degree of the first argument is uncertain, because Canada has abundant heavy crude resources and can, under favorable oil price conditions, at least partly supply the U.S. with cost-competitive heavy crude. Similar to the LNG scenario described above, the second point appears reasonable, but

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bears risks. For the oil, however, the risks are currently more on the supply than on the demand side.

In addition to the revolutionary shale/tight oil production increase in the U.S., Iraq has increased its oil production from 110 million tons per year (2.2 million barrels per day) in 2009 to around 170 million tons per year (3.3 million barrels per day) in 2013. The 2013 Iraqi production value is more than 4% of total global oil production. Forecasts for 2015 (based on data available at the end of 2013) range from 200 million tons to 300 million tons. Furthermore, potential political changes in the wake of the recent elections in Iran might lead to mid- and long-term sanction deregulations and enable Iran to push much larger oil volumes into global markets.

Such large additional volumes, which are not balanced with demand dynamics and OPEC guidelines, either drive global oil prices down or require Organization of Petroleum Exporting Countries including Saudi Arabia to further limit production.

Implications For Chemical Companies

GCC countries, and most notably Qatar and Saudi Arabia, are differently affected by the gas and oil risk factors described above. These risks have the capability of accelerating the regional ethane shortage, which might lead to or worsen underutilization of production assets. Underutilization has already been observed, for example, in 2010 at around 80% for ethane crackers in Saudi Arabia. It is not surprising that there is a tendency in the region to base new crackers on naphtha.

In the light of cheap ethane in the U.S. as well as more naphtha-based ethylene in GCC countries, the cost advantage of these countries' derivatives will shrink significantly compared with the U.S. Shale developments in the U.S. have triggered new technology (e.g., on-purpose dehydrogenation of propane) as well as investments in additives and co-monomers capacities, which further strengthen the U.S. ethylene downstream position compared with GCC countries.

As of today, GCC downstream players have felt hardly any serio U.S. effects from the shale boom, while Europe has started to bear the heavy burden and will continue to do so; industry experts forecast a closure of approximately 10% of total European ethylene capacity. In the longer term, GCC countries will most likely keep their position as the lowest-cost producer – despite a new shale-age market equilibrium, albeit with much less margin differential to the U.S.

Remember that in the foreseeable future, GCC downstream players will still have favorable raw material conditions and will most likely be able to maneuver their businesses reasonably around shale gas-induced market changes in the U.S. and elsewhere. However, the time of abundant low-hanging fruits and extraordinarily high margins in GCC countries is set to end.

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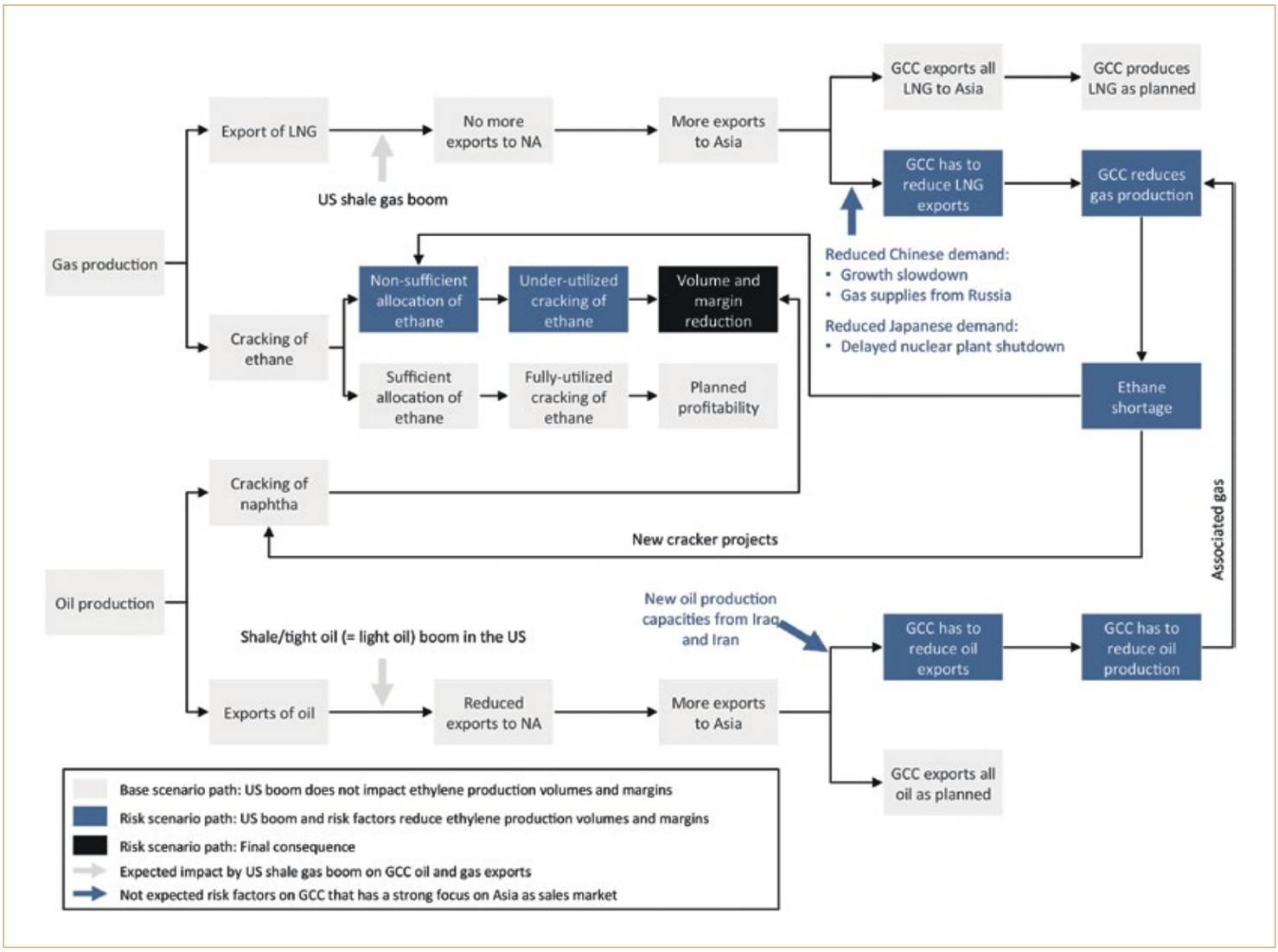


Fig. 1: Visualization of how the US shale boom and subsequent risk factors influence GCC gas and oil operations. Gas production refers predominantly to Qatar and oil production to Saudi Arabia, although some factors might also affect other oil- and gas-producing countries in the region. The chart does not contain all possible scenarios, risk factors and path options, but rather those paths and consequences that are the focus topics of this article.

Repercussions of the US Shale Story

Shale changing the face of petroleum and petrochemical markets

The two words on everyone's lips in recent years in the energy industry have been "shale boom." This article will lay out JBC Energy's view of the future of the U.S. shale boom and its effect on the petrochemical industry.

Cheap and Abundant NGLs

The emergence of hydraulic fracturing in the early years of the 21st century changed the face of the U.S. energy industry. U.S. total liquids production began to increase rapidly from 2008, with crude and NGL production growing by 31% and 33% respectively in the period until 2012.

Although both crude and NGL (ethane, LPG and pentanes plus) output has expanded tremendously, the fact that producers strongly prefer drilling in "wet plays" – which contain a high proportion of NGLs – to maximize returns has led to a collapse in ethane and liquefied petroleum gas (LPG) prices. U.S. ethane prices are currently only a little more than 20% of crude prices, while LPG is around 70% (both on an energy content basis).

The shale boom has not only supported the energy and petrochemical sectors but has also reduced operating costs for steel producers and manufacturers. In terms of feedstock, the competitiveness of ethane and LPG has heavily affected the use of naphtha. According to the Alternative Motor Fuels Act (AMFA), the proportion of naphtha in the U.S. feedstock slate has declined from more than 25% - 30% in 2007 to just more than 10% last year (see figure 1 for our assessment of the U.S. feedstock mix).

Now or Never

This deluge in NGL supplies and the cost advantage of running ethane- over naphtha-based crackers has resulted in a flurry of ethane cracker expansions and projects as well as several planned propane dehydrogenation (PDH) plants. The list of expansion and greenfield sites stretches to 20, while there are plans for five or more PDH facilities.

One thing is clear: Despite the expected growth in U.S. NGL output, the construction of all these plants would curtail the U.S. ethane and LPG surpluses and with that its current cost advantage. Therefore, we expect that this year and next will see the list whittled down. We expect that of the 10 million tons per year (tpy) of ethane-cracker additions planned by 2018, only 5 million to 6 million tpy will come online while only two of the PDH plants are currently firm with start-up dates of late 2015 to early 2016.

Therefore, with additional capacity and the continuation of feedstock switching, we expect U.S. ethane consumption to grow from 990,000 barrels per day (bpd) last year to 1.3 million bpd in 2020 (fig. 1).

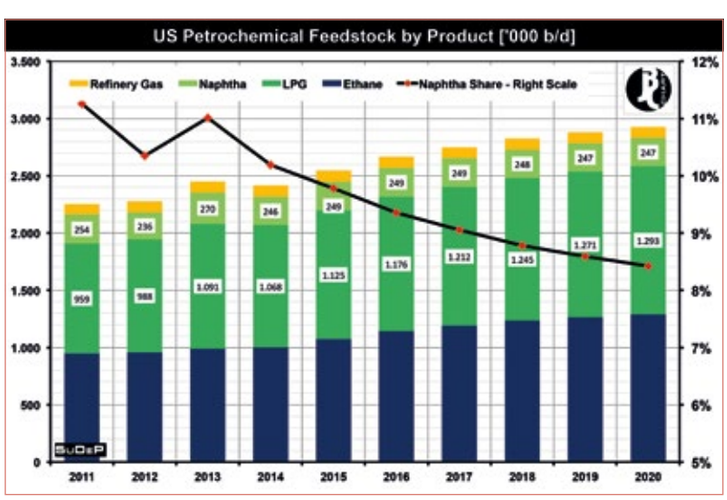
Overbuilding a Real Danger

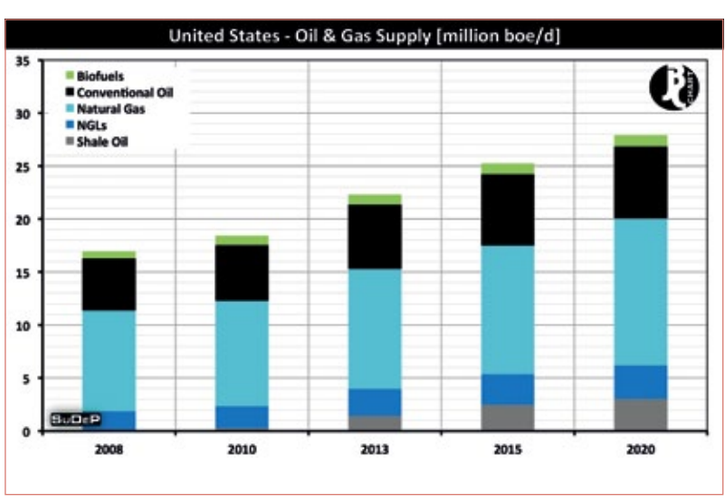
Several global petrochemical players have taken a proactive approach to the emergence of shale and are considering building world-scale crackers on the U.S. Gulf Coast. However, even within North America, competition is emerging, with several companies already carrying out debottlenecking upgrades while others plan to develop new greenfield sites.

Most U.S. ethylene exports head to Canada, South America and increasingly Asia. We would expect U.S. petchem players to continue to tap the South American market, especially considering that Brazilian projects remain bogged down in financial- and construction-management issues. However, one potential issue is that plans for polyethylene capacity lag behind ethylene capacities. Converting ethylene to polyethylene and other derivatives reduces freight costs, as polymers are cheaper and easier to transport.

Wet Shale Plays to Power NGL Output

In terms of crude, despite recent impressive growth, we are more conservative in our outlook than other industry agencies. We believe that the





concentration of the shale oil boom to mostly two plays (Bakken and Eagle Ford) and the high decline rates associated with shale wells will temper supply increases. Production from fracked wells deteriorates rapidly with output declining by up to 60% in the first six months.

However, we remain bullish in terms of NGL production. Firstly, we expect natural gas prices to climb throughout the rest of the decade because of increasing domestic consumption and growing liquefied natural gas (LNG) exports, although prices should remain at below half of international prices. We expect this uptick in prices to incentivize producers to boost investment and production.

Secondly, we expect existing shale wells to continue exhibiting growing output of NGLs, while the recent trend of producers exploiting wetter plays is set to continue.

Together, we see these factors lifting U.S. natural gas production to almost 14 million barrels of oil equivalent in 2020 (see figure 2). As a byproduct of this natural gas production, we expect NGL output to grow impressively for the remainder of the decade, with output expected to hit 3.17 million bpd in 2020 from 2.58 million bpd last year, which will help to drive ethane, LPG and naphtha's share in total U.S. product supply to almost 18% in 2020 (fig. 3).

Additionally, we anticipate U.S. LPG supplies to grow from 1.62 million bpd last year to around 2.1 million bpd in 2020. Over the same time period, we see LPG demand growing by 100,000 bpd mainly due to the start-up of at least two PDH plants along the Gulf Coast in 2015 and 2016. Therefore, we predict that U.S. LPG exports will grow from 330,000 bpd last year to around 690,000 bpd in 2020 – with the majority of this growth by 2015 – while prices should trend upward from current levels, closer to parity with crude. Looking ahead, by the middle of the decade we would expect that some additional terminal capacity such as that planned by Sunoco and Occidental in addition to current firm projects – by Enterprise and Targa – would need to come online to provide relief to the U.S.'s supply overhang.

Ethane Exports Limited by Infrastructure

Still, the future of the well-developed U.S. LPG market differs somewhat from that of ethane. Although ethane can be shipped, it is very expensive and requires special, pressurized ships and it will take several more years before any meaningful trade flows are established. In recent years, any substantial growth in ethane exports has been constrained by a lack of infrastructure and designated cargo ships. However, several firms are beginning to make strides in this respect. In addition to Ineos – which was previously the only firm to have signed an agreement to secure ethane from the U.S. – Sabic and Borealis have completed deals to use U.S. ethane at their European crackers. In Asia, interest is also growing, with India's Reliance Industries recently ordering six very large ethane carriers to transport U.S. ethane to its new Jamnagar cracker, due online in late 2016. It is hardly surprising that firms are interested in cracking U.S. ethane. Despite the costs of shipping, alteration to cracking units and the construction of import terminals as well as related infrastructure, the cost advantage currently is still sufficient to incentivize such deals. At the time of writing the price spread was seen at $450 per tonne (Platts) even though naphtha prices were at a four-year low.

However, one important aspect to note here is that increasing natural gas-linked ethane prices may reduce the attractiveness of ethane exports, although we would still expect that ethane will remain at a sizeable discount to international crude prices. Nevertheless, it is safe to say that fellow European petrochemical players as well as U.S. ethane producers will be monitoring these developments with great attention.

Naphtha Exports Set to Grow

In terms of naphtha, we expect that U.S. petchem players may further reduce the use of the product, but in order to prevent tightness in the aromatics and propylene markets, we expect its use not to fall much lower than the 8%-10% level.

However, as light shale oil output – which is naphtha-rich – continues to grow and refiners alter their set-ups to boost runs of light crude, naphtha production is set for a period of growth.

Along with the addition of several condensate splitters – that produce between 50%-70% naphtha – we expect U.S. naphtha production to reach 455,000 bpd by 2020, up from 290,000 bpd seen last year. This rise would make the U.S. one of the world's largest naphtha exporters along with Algeria, Russia and the Middle East. Although this abundance of supplies may weigh on U.S. naphtha prices, we would expect prices to remain only slightly discounted to international crude prices.

The Race is On

In conclusion, in recent years the U.S. has become a net exporter of total refined products – mostly because of transportation fuels such as gasoline and diesel – while in the coming years we expect that growth will be driven by petrochemical feedstock exports such as LPG and naphtha (fig. 4).

Nevertheless, it should be noted that from 2015/16 onwards we see the recent strong growth in US LPG exports slowing down based on rising domestic demand and less dynamic supply, which will disappoint quite a lot of hopes in Asia and Europe for cheap and abundant LPG supplies. Meanwhile, the expansion of the U.S. ethane cracker fleet will increase pressure on European and Asian naphtha-based crackers, especially Japan, and will have Middle Eastern players – who may see higher ethane prices in the coming years – looking over their shoulders.

However, the bonanza will surely not last long if all the planned projects are completed. Thus we would expect that the sprint to capitalize on the unique cost advantage of the U.S. will see a thinning field as players drop away. Additionally, the capacity of the U.S. downstream petrochemical industry to absorb a flood of ethylene may not be sufficient while a lack of polyethylene capacity may limit the country's ability to tap export markets.

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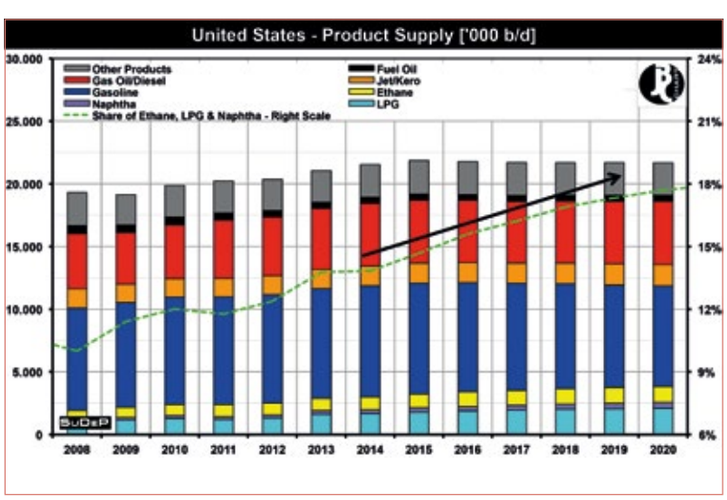

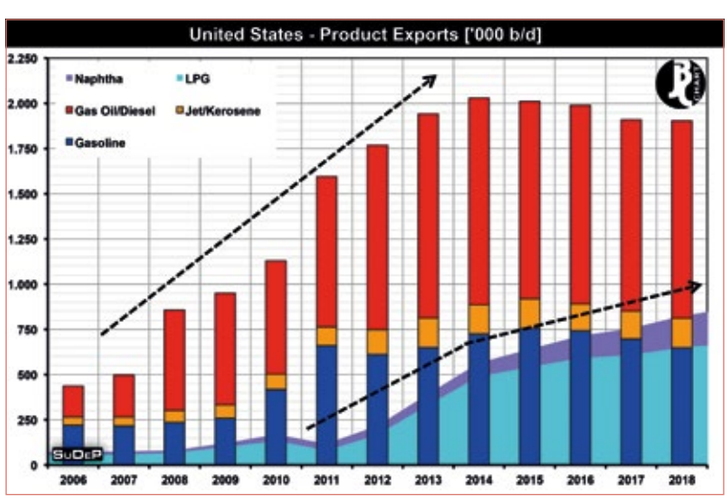

China Tackles Its Major Economic Issues

Government Influence on Chemical Industry in China


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In November 2013, China´s President Xi Jinping announced to give markets a decisive role in economic development. However, in the past the Chinese government – with its historical background in communist economic thought – has not at all been reluctant to direct or at least strongly influence the economy. This obviously affects the chemical industry in China.

Dr. Kai Pflug,
Hong Kong, China

China faces a number of major economic issues. The Chinese government does generally not hesitate to use its available tools to address these issues. What are these issues, in particular those that are related to the chemical industry? What tools are being used to direct the chemical industry? And what are the objectives and desired outcomes?

Objectives In Focus

China´s wealth distribution is highly imbalanced. This does not only apply to individuals within the same regions, but also to average wealth in different regions. Average income in Shanghai is about seven times higher than in the poorest province, Guizhou. In order to promote greater regional equality, China – using the colorful "Go West" slogan – has implemented a massive program to improve the infrastructure in the Western provinces. A "Scheme for Central China to Advance the Region's Raw Material Industry Structure Adjustment, Optimization and Upgrade" announced the promotion of the basic chemicals industry in Central China by building large-scale coal chemical groups. In some areas, companies relocating from Eastern to Western China get a lower rate of corporate tax. Chemical companies may also benefit – BASF is believed to have received state subsidies when setting up their new MDI plant in Chongqing in central China. State-owned chemical companies also heavily invest in some of the more remote provinces, e.g., Xinjiang


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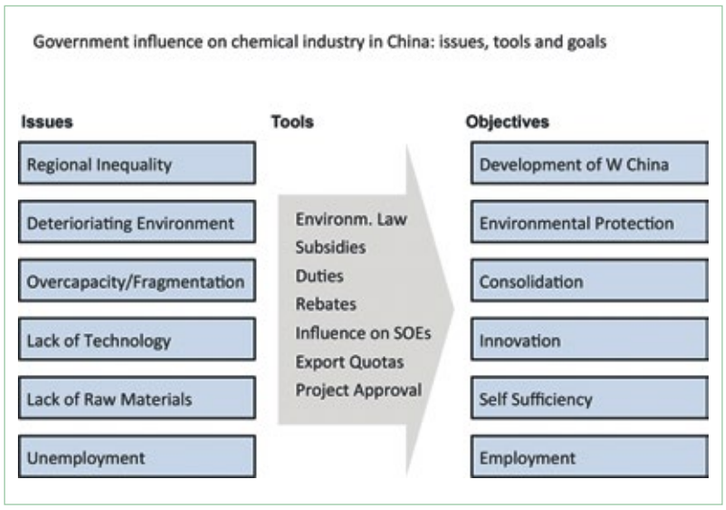
and Inner Mongolia, not only because of the raw materials available there but also as a political tool to expand state presence and create additional jobs in poorer regions. In addition, new projects are approved more easily in Western provinces than in Eastern China.

Environmental issues are getting more and more important to the government, as a consequence both of the increasing severity of pollution and the increased awareness among the newly created middle classes. Consequently, legislation is being implemented on issues such as air pollution and energy consumption. The government also aims to discourage the production of harmful chemicals, e.g., by cancellation of export rebates for particularly polluting chemicals, and regulates the use of some of the more damaging production technologies in areas such as PVC, calcium carbide and chromium salts. Rules for the management of new chemical substances have been tightened. Generally, foreign companies are somewhat less affected by the stricter regulation as they already produce at higher standards, but companies such as Lanxess have recently shifted some of their production away from focal points of environmental protection (such as Wuxi, which is located close to the major and environmentally vulnerable Lake Taihu).

Overcapacity management is an area in which the Chinese government hesitates much less than Western governments to engage in. For example, in 2013, the relevant ministry reduced capacity in a variety of chemical fields such as calcium carbide, ethyl alcohol, monosodium glutamate, and chemical fiber. Generally, the capacities closed were either based on old technology or of a small size, leading to the additional benefit of improving the technology level and average production cost of affected segments. In addition, restraints are placed on foreign companies to enter areas already suffering from overcapacity, such as polysilicone.



Government Activities

Many chemical segments in China show a high degree of fragmentation, which is a concern for the government due to the low profitability of these industries and the low technological standards. Consolidation is therefore a government objective which is pursued by setting entry conditions for specific chemicals, e.g., for ammonia, calcium carbide, fluorite, magnesium, rare earths, soda ash, specifying items such as the plant location or minimum size, the maximum energy consumption or the production process used. For some segments, the consolidation objective is quite specifically aimed at creating globally competitive champions – for example, in the carbon fiber industry, the Ministry of Industry and Information Technology (MIIT) aims to establish two or three internationally competitive carbon fiber groups. Mergers – particularly those that save weaker players from going under – are often actively supported by the government, for example by giving weak state-owned players to stronger players for free.

Segments considered to be strategic are actively promoted by the government (more specifically, the MIIT). Activities include strengthening of R&D support, promotion of foreign investment and accelerating general development in specific areas such as rare earths, specialty glass, functional ceramics, semiconductor lighting materials, high performance membranes, carbon fibers, hydrogen storage, fluoropolymers and nano materials. Also, state-owned enterprises (SOEs) are supported in acquiring assets overseas, in particular in the areas of basic raw materials such as oil and in specialty chemicals.

In July 2014, the government announced that it will continue to reduce restrictions on foreign capital in China's manufacturing industries including the chemical industry. However, so far basic coal chemicals and petrochemical projects can only be done by multinational corporations (MNCs) as part of a JV with a domestic player. In addition, the government also restricts foreign expansion in areas deemed to already be crowded. On the other hand, foreign investment is supported in production of advanced materials as well as in chemical R&D and in establishing regional headquarters. These activities are aligned with China´s goal to continuously modernize its economy, both with regard of the type of materials produced and with regard to the more general shift from production to services.

Finally, social stability is of course a major government goal, which in terms of economic policy translates to avoiding large-scale unemployment. The government generally prevents state-owned enterprises from large-scale lay-offs even if (as in many state-owned entities) the number of workers far exceeds the number necessary to run the business (indeed, mergers involving state-owned chemical companies often include the unspoken condition of not involving massive layoffs).

This discussion shows that indeed – unsurprisingly – the government has a major influence on the chemical industry in China. However, it should also be pointed out that many of the objectives targeted, and tools utilized, are not massively different from those utilized by Western governments. Directing investment via subsidies, controlling the impact of imports via duties, or balancing the interests of production with environmental protection via legislation are all familiar aspects for the chemical industry in the Western world. One main principal difference is the much bigger presence of state-owned enterprises, which can be expected to target non-profit objectives such as avoiding layoffs much more directly than private companies. The other is the lower reluctance of the government to be visible as a strong driver of specific segments of the economy, something that at least conservative Western governments are somewhat more hesitant to admit openly.

Conclusions

The info box below provides a summary of a number of hypotheses aiming to give a qualitative forecast about the future development of government influence on the chemical industry in China.

Hypotheses for future government influence on the chemical industry

Despite the above mentioned objective of giving a bigger role to market forces, it is very likely that the government will remain a major influence on the chemical industry in China. As long as state-owned enterprises keep their current importance (and there are no strong indications otherwise), this influence will be bigger than in the West.

Government policy will keep affecting basic chemicals more than specialty and fine chemicals. This is both due to the larger size of individual basic chemicals companies and their perceived larger importance for China´s self-sufficiency.

The government will continue to promote specific segments of the chemical industry, such as advanced materials. However, the effect of these activities will probably not be much stronger than similar activities of Western governments.

Environmental protection will be pushed further by the central government, however this will be resisted by provincial and lower-level governments.

While for foreign chemical companies it will remain important to understand and anticipate government policy, the overall influence of it on their business is likely to remain at a similar level as now.

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A Growing Chemical Center in Asia

Singapore Remains one of the World's Leading Energy & Chemicals Hubs and is Well-positioned for Future Growth

As a country with almost no natural resources and limited land space of only 710 km² (slightly more than three times the size of Frankfurt, Germany), Singapore's chemical industry is an unlikely success story.

Today, Singapore's chemical industry contributes 37% to the total manufacturing output and is one of the most important economic pillars in the city state. Key to Singapore's reputation as a chemical hub is Jurong Island, (photos below and on the right), made up of seven small islands joined together.

To date, almost 100 leading global petroleum, petrochemicals and specialty chemicals companies have set up subsidiaries there and have invested over €25 billion. With its dedicated „plug and play" infrastructure, Jurong Island enables these companies to enjoy cost savings through shared third-party utilities and services, and at the same time build synergy through product integration.

Chemical companies include BASF, DuPont, 3M, Evonik Industries, Lanxess and Clariant. Besides manufacturing, these companies also have their regional headquarters or research & development functions located in Singapore due to the country's conducive business environment. The World Bank consistently ranks Singapore as one of the easiest places to do business.

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Large Pool of Highly Qualified Employees

Three quarters of the people employed in Singapore's chemical industry are locals. They are particularly appreciative of their employers, as they not only offer the best paid jobs in the production sector but also a large number of positions for highly qualified workers such as technicians and engineers. Specialty chemicals manufacturer Evonik Industries readily taps on Singapore's talent pool of engineers and technicians. Several hundred jobs are occupied by well-trained locals.

Internationalizing in Asia from Singapore

German specialty chemicals group Evonik Industries came into existence in 2007, but its history goes far back. The former company Degussa has been active in Southeast Asia, Australia and New Zealand ever since the 1920s. In 2008, the company set up its first production plant on Jurong Island, producing oil additives. As the company grew in Asia, it was a logical next step to make Singapore its regional office in 2009.

And in 2014, the company set up Evonik's first-in-Asia methionine complex. This plant has an annual capacity of 150,000 metric tons of DL-methionine, which is an important amino acid that is added to modern animal feed. The new methionine complex in Singapore officially came on stream on November 4, 2014 after two years in construction. The company has spent over €500 million on the plant, the most it has ever invested in a single chemical project.

The new system is one of the most modern throughout the world. It will considerably strengthen Evonik's position as one of the worldwide market and technology leaders. The choice of Singapore as the site for the new methionine complex was due not only to the excellently trained people there, but also because of its excellent logistics and its connections with the petro-chemical industry.

In recent years, other German chemical companies have made manufacturing investments on Jurong Island, including Lanxess' combined investments of over €600 million in butyl rubber and neodymium-polybutadiene rubber plants. At the same time, there were expansions to Evonik's oil additives and BASF's anti-oxidants plants. Chemical companies continue to invest in R&D from Singapore, such as Evonik's new innovation center for coating additives, Wacker-Chemie's expansion of the technical center for consumer chemicals, and BASF's joint research with the National University of Singapore in graphenes.

Non-German chemical companies have also benefitted greatly from leveraging Singapore as their key manufacturing hub. ExxonMobil's new, second petrochemical complex is the US energy giant's largest investment here and also Singapore's largest manufacturing investment ever, bringing ExxonMobil's total investment in the city state to well over €8 billion. „But that's not the end of the story," ExxonMobil Chemical's president, Steve Pryor, assured, disclosing that the group was already planning additional specialty plant investments, including for butyl rubber used for tires, and premium resins for adhesives. „ExxonMobil views the Singapore complex as a platform for future growth," he added. Mr Pryor explained that when the company built its first petrochemical complex in Singapore back in 2001 „it marked a strategic shift in our manufacturing footprint to Asia", adding that „it also reflected our belief that Singapore would be the optimal base for serving the market in Asia".

Chemical Industry in Singapore Continues to Transform and Grow

Singapore plans to continue building on its success by attracting even more chemical companies, particularly those focused on green technologies and specialty chemical products. As the world population grows from 7 billion people to a projected 9 billion in 2050, the world's resources, and our ability to feed and fuel this growth, will increasingly come under strain. And solutions (from specialty chemical companies) that allow for greater resource productivity are therefore critical.

Evonik Industries Innovation center Tego in Singapore, which is part of the company's global R&D network, is a good example for developing such solutions. From its Singapore-based location, the company caters to manufacturers in the paint and coating industries in Asia by providing support in the production of environmentally compatible painting systems.

The Singapore government also plans to improve both the competitiveness and sustainability of Jurong Island with a strategic blueprint focused on infrastructure developments and system-level optimization of valuable resources (energy, carbon, water and land).

Jurong Island 2.0: Maintaining Future Competitiveness for Energy & Chemicals Sector

Singapore will continue to support the energy and chemicals industry, ensuring the city state retains its status as a major global hub for the sectors.

Several initiatives are underway to achieve that goal, including the enhancement of the infrastructure on Jurong Island. The Jurong Island Version 2.0 initiative is a key development – the initiative will introduce alternative feedstock sources such as LPG (liquefied petroleum gas) to increase competitiveness and reduce the costs for the plants here. Another strategy is to use waste heat for water desalination to save energy.

To ensure Singapore continues to attract new investments, a new LPG terminal will be built on Jurong Island. The new terminal will allow LPG to be stored and distributed to plants on Jurong Island. Other developments on the island include Tuas Power's Tembusu Multi-Utilities Complex to provide cost-effective utility services for industries and the launch of Jurong Island Terminal last year to reduce dependence on trucking.

These developments will ensure that energy and chemicals companies continue to find Singapore the ideal chemical hub in the region for their future growth strategies.

Successful in Singapore: German Mittelstand Companies

In the last decade, the number of German companies with a presence in Singapore has increased by almost 300%. Today, there are more than 1,400 German companies in Singapore. This is projected to increase further with the conclusion of the Singapore-European Union negotiations on free trade and the growing recognition of South-East Asia as the third engine for growth, next to China and India. The Association of South-East Asian Nations (ASEAN) is expected to be an important growth pillar of the global economy, with manufacturing contributing 20 to 35% of value-added of the GDP of ASEAN economies. This will result in demand of technology and products for the more than 600 million population across South-East Asia.

In order to seize the business opportunities in a fast-growing ASEAN, many German companies have chosen Singapore as their first base in South-East Asia. The need for a trusted, reliable and connected location to manage their regional operations is critical, in order to successfully navigate a diverse Asia with varying regulations, cultures and business conditions.

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Singapore stands out as a trusted and sophisticated business hub.

Dr. Moo An Wee, Singapore Economic Development Board (EDB)

Shared Values

Among the ten ASEAN member states, Singapore stands out as a trusted and sophisticated business hub for German companies, especially the mid-sized German companies – or Mittelstand – to expand into high-growth markets like China, India and rest of South-East Asia. German companies benefit from Singapore's stable political environment, highly skilled workforce and sophisticated infrastructure. The relationship that Singapore and Germany share is one built on mutual trust and respect. Both countries are seen as stable economies that value a pragmatic, partnership-oriented and innovative approach in doing business. It is no surprise that Germany is Singapore's largest trading partner in the European Union, while Singapore is Germany's largest trading partner in South-East Asia.

Made for Mittelstand

Alongside multinational corporations, globally leading mid-sized German enterprises or German Mittelstand Champions have also anchored manufacturing and R&D activities in Singapore. These German Mittelstand Champions view Singapore as a high-value manufacturing and R&D hub. Renowned research institutes and universities, a diverse pool of international talent and strong IP protection create a conducive R&D ecosystem for successful innovation in Asia. The examples on the right-hand page display German Mittelstand companies that have invested in Singapore:

Priming for Growth

As German multinational companies and Mittelstand Champions grow their leadership positions globally and capitalize on the opportunities in South-East Asia, Singapore offers a business and innovation-friendly environment for these German companies. Strategically located in the heart of the rising economies in Asia, Singapore is the ideal partner for German companies to achieve long-term success in the region.

Dr. Moo An Wee
Regional Director, Europe
Singapore Economic Development Board (EDB)

Singapore: Made for Mittelstand

Five Leading Mid-Sized German Enterprises in Singapore

Rohde & Schwarz has been on site in Singapore since 1997. What began as a small presence has become a second company headquarters with sales, research & development and production. For the mid-sized Munich-based electronics company, in family hands since 1993, long-term success counts and that's what it has found in Singapore. In the next five years the Research & Development department is expected to hire 100 new employees.

Dorma established its first overseas plant in Singapore in 1979. Singapore now serves as its regional headquarters for the Far East (ASEAN, Korea, Taiwan, Japan), and a key manufacturing node, supplying close to 50% of global output for particular products.

Thirty-five years ago, the Mannheim-based SME, Pepperl+Fuchs, ventured into the Far East. Today, the automation specialist has deep roots in Singapore, which is home to production, sales and Research & Development.
"When a company wants to set up business in Asia, the first step via Singapore is advantageous," says Jürgen Seitz, Director of Production, Pepperl+Fuchs in Singapore.

Trumpf, founded in 1923, stands for high technology in the areas of machine tools, electronics, laser and medical technology. The family-owned company has been active in Singapore since 1991.

Bauer, an SME founded in Bavaria in 1790, is a global market leader in construction equipment for international foundation engineering. The company has been writing its success story since 1991 in Singapore, where it maintains the headquarters of the Bauer Far East Group and sales office for construction equipment.

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EDB

The Singapore Economic Development Board (EDB) is the lead government agency for planning and executing strategies to enhance Singapore's position as a global business center. For more information, visit www.sedb.com.

Brazil: Growing Chemical Market

Demand is Driven by Increasing Population, Urbanization and an Expanding Middle Class

With a gross domestic product (GDP) of $2.2 trillion in 2013, the World Bank ranks Brazil as the world's seventh largest economy and one of the two economic powerhouses alongside Mexico in the region. Yet it has experienced a slowdown: in comparison to a GDP growth rate of 7.5% in 2010, the Brazilian economy slowed down significantly to 0.9% in 2012, the lowest of the BRICs.

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This year Brazil hosted the 20th FIFA World Cup and in 2016 it will host the Summer Olympic Games. These global events were to stimulate the country's economic development – improving infrastructure, creating jobs and promoting Brazil's global image. Much of the planned investment, particularly foreign direct investments, has not occurred. Despite a fiscal stimulus in advance of the presidential election in October, which, after a tight race, resulted in the re-election of Brazil's left-wing president Dilma Rousseff, GDP growth is only likely to be 2.4% this year. According to the Institute of International Finance, lackluster growth has become the norm rather than the exception.

Vir Lakshman, KPMG

Rita Duran, KPMG

A Growing Middle Class

A key driver of future growth and the advancement of the country's level of prosperity will be Brazil's growing middle class and its growing demand for consumer oriented goods and services. Brazil's total population is expected to grow to 233 million by 2030, a more than 20% increase from 2011 to 2030. The consumption per head is expected to increase by over 50% from 2011 to $6,300 by 2030. The South-East of the country which has 42% of the population, currently accounts for 55% of the GDP, whereas the northeast of Brazil with 28% of the inhabitants only generates 13.5% of GDP. It is expected that new growth regions will open up in the historically under-developed northeast.

Can Production Meet Demand?

Production output will follow demand impacting favorably such sectors as the construction, agriculture, consumer goods and automotive. The construction industry represents approximately 20% of industrial output in Brazil and recorded a CAGR of 13.2% from 2008 to 2012. From 2013 to 2017, a CAGR of 8.7% is expected. Another large sector, automotive, accounts for 5.5% of the country's GDP and 23% of the manufacturing output. In 2013, the automotive sector witnessed a production growth of 9.9% with growth expected to continue. The Chemical industry contributes approximately 3% of the country's total GDP and is expected to grow from a market value of $120 billion in 2013 to $160 billion in 2017, an overall CAGR of 8.3%. Although the industry with its 4500 chemical companies is well challenged to meet the increased demand, growth will nonetheless be hindered due to the expensive raw materials, lack of in-

Chemical complexes in Brazil — Fig. 1

Source: Braskem website, accessed 28 April 2014; Baskem 2013 annual report; Salt Dome: Challenges And Opportunities For OCTG, The Vallourec Oil & Gas online magazine, accessed 28 April 2014

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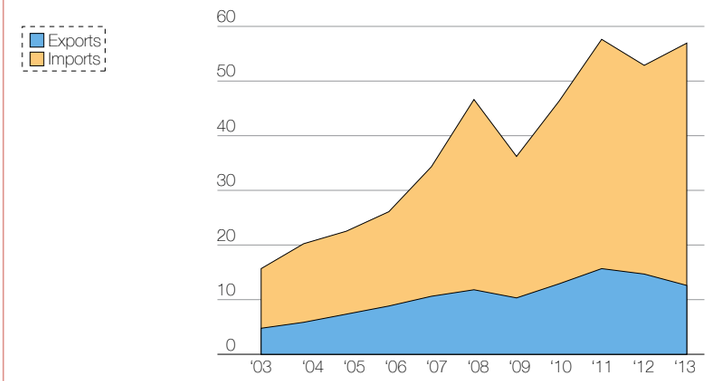
Brazilian trade balance of chemicals — Fig. 2



Source: ABIQUIM 2011
ABIQUIM press release dated 6 March 2014

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frastructure, and the complexity of the legal and regulatory regime. Based on the 2014 World Bank's 'Ease of Doing Business' ranking, Brazil was ranked 116th, behind Mexico (53rd) and China (96th). For the country to grow, the government must work alongside the private sector to overcome these challenges.

The largest local chemical player in Brazil as well as in Latin America (8th worldwide) is Braskem with €18 billion sales in 2013. Major global foreign companies such as BASF, Bayer, Dow Chemicals, Solvay/Rhodia, Lanxess, and M&G Chemicals have plants in Brazil.

A Mounting Trade Deficit with No End in Sight

Although Brazil has raw materials, it is a net importer of chemicals with a record $32 billion negative trade balance in 2013. Brazil produces a limited amount of high-end specialty chemicals, less than 15% of the market value. Higher margin derivatives must be imported to meet Brazil's demand for specialty chemicals products. In 2012, commodity chemicals accounted for over 63% of the total market value of €117.5 billion with thermoplastic resins being the major export item. In light of the current growth impediments, the chemical industry trade deficit is expected to continue growing in 2014. To avoid losing further credibility as a location of choice for investment, Brazil needs to improve its infrastructure, loosen protectionist measures and streamline its administrative process.

Until it does so, the level of investment in Brazil will remain small scale. For example, although BASF plans in 2014 to invest in an acrylic acid, butyl acrylate and superabsorbents plant in Camacari for €500 million, BASF's planned capital expenditures from 2014 to 2018 for the South America, Africa and the Middle East region only accounts for 4% of its total investment funds. This 4% level pales in comparison to the 18% BASF is earmarking for the Asia Pacific region.

Brazil also faces stiff competition from the US, as result of the shale gas boom. To access competitive feedstock, local majors are investing abroad. For example, even Braskem has made some significant investments abroad including an Ethylene XXI JV project with Pemex in Mexico as well as the Appalachian project in West Virginia, US. The Appalachian project includes an ethane cracker, three polyethylene plants and associated infrastructure for water treatment and energy co-generation.

Feedstock Challenges

Expensive Naptha-based crackers: The majority of the crackers in Brazil are primarily naphtha based, with only two capable of using restricted amounts of ethane and propane. The country also has one ethanol-to-ethylene dehydration plant. Despite having the diverse feedstock base, the country is facing cost challenges. While the industry giants are hungry for cost-advantaged feedstock, the shale gas in the north-eastern region and the pre-salt oil & natural gas discoveries have renewed hopes for the industry.

Moving Ahead With Natural Gas and Shale: The country ranks 10th in proven recoverable shale gas reserves with approximately 250 trillion cubic feet (tcf). Despite environmental pressures, Brazil's National Petroleum Agency (ANP) awarded 72 onshore natural gas and shale gas blocks, in December 2013. The outlook of this development is viewed with skepticism as the infrastructure related to pipelines and transportation that supported the US's shale gas success story is lacking in Brazil.

A Sign of Relief with Pre-Salt: The world's largest oil discoveries in recent years have come from Brazil's offshore, pre-salt basins; with total estimated recoverable oil & natural gas reserves standing at over 50 billion barrels of oil equivalent. Brazil's oil & gas giant, Petrobras, plans to invest $73 billion in pre-salt exploration and production activities from 2013 to 2017. The pre-salt development has renewed the hopes of the domestic chemical industry. Furthermore, Petrobras has agreed to supply cheap ethane from the pre-salt reserves to Braskem's cracker at its proposed site, Complexo Petroquímico do Rio de Janeiro (Comperj).

Largest Reserves of Biomass: Brazil has the largest reserves of biomass in terms of sugarcane; the country produced 589,000 tons of sugar cane during the 2012–2013 harvest season. ABIQUIM (Chemical Industry Association of Brazil) envisions that by 2020, 20% to 25% of chemical products will be derived from sugar-cane based feedstock. Moreover, the country ranks second (after the US) in terms of ethanol output and controls approximately 27% of the global fuel ethanol production. Bio-based chemicals technology is at an early stage and domestic and foreign companies are committed to develop the technology.

Since 2010, Braskem has been operating the world's first sugarcane ethanol polyethylene plant with an annual capacity of 200,000 tons in Brazil. Braskem also has other renewable feedstock-based projects in the pipeline including a 30,000–50,000 t/a bio-based polypropylene plant and development of bio-butadiene technology with Genomatica. Among foreign players, Lanxess operates a 10,000-t/y bio-based EPDM (ethylene propylene-diene) rubber plant in Brazil.

Government Moves Needed to Support Investment The 'Growth Acceleration Program II' launched in 2010, has been riddled with delays. The program highlighted total investments of $872 billion from 2011 to 2014, including $526 billion in the areas of logistics, energy and social development. Overall, Brazil is lagging behind its Latin American neighbors in terms of fixed investment.

Shortcomings persist and the lack of infrastructure, particularly transportation roadways, remains a key concern for the industry. Transportation is largely based on trucks, making it hard and very expensive to move goods nationally given the long distances to cover. New trucking legislation has also increased delivery time and costs.

The customs clearance process is bureaucratic and costly with import taxes on some materials (to protect domestic producers). The extent and complexity of the tax system in Brazil is also onerous. The government, under pressure, has offered industry tax incentives in the areas of R&D, employment and production of raw materials. Special incentives also exist for infrastructure development of the chemical industry in the north, northeast and central-west regions (REPENEC) and for the fertilizer industry (REIF) until 2017.

The cost of money is high. Historically, Government's interest rate policy was historically set at low levels with a record low rate of 7.5% in 2012. However, high inflation eventually pressured Brazil's central bank to set higher rates to help regulate inflation.

Growth Remains Fragile

Brazil is a land of opportunity with the right dynamics – a growing market for the chemical industry driven by increasing population, urbanization and an expanding middle class. However, until Brazil comes to grip with its challenges and the government improves its policies and programs, the majority of investment will continue to flow elsewhere.

Fixed investment, percent of GDP — Fig. 3

Source: IMF World Economic Outlook Database 2014 © CHEManager International

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The Formula For Success

The Canadian Province Ontario Leads for North American Foreign Direct Investment

Ontario, Canada, ranked number one for greenfield capital investment in North America during 2013. The results were part of a report by FDI Intelligence, the research division of the Financial Times of London. The province attracted USD 7.2 billion in investment, finishing ahead of Texas and California – places with much larger populations.

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Dr. Terrie Romano, Canadian Consulate Munich

Ontario's diverse and robust economy enabled the province to weather the global recession better than its peers and then rebound much stronger as global markets recovered. Since the recessionary low of mid-2009, job creation in Ontario has been stronger than in most developed economies including the US, the average of OECD countries, and the rest of Canada.

Compelling Business Case

So what are the "magic ingredients" that capture the attention of business leaders and site selectors? There's no single factor that will seal an investment deal. But what Ontario brings to the table is a comprehensive suite of attributes – sector diversity, economic heft and market access – that stands out among its competitors.

Heartland of North American Markets

Ontario is among the top 10 economies in North America, ideally situated with 141 million consumers within a day's drive and efficient access to NAFTA markets. The province is also a leader of industry and commerce within Canada, home to 64% of foreign head offices and accounting for almost 40% of the country's GDP. This economic power drives a range of industry clusters that nurture the concentration of talented workers and integrated supply chain that modern businesses seek. For example, within North America, Ontario is second only to California for information technology companies and in the top five for life sciences companies. Toronto, the provincial capital, is among the continent's top three financial centers.

Business Fundamentals

As the global economy has changed, Ontario has continually evolved to remain competitive. Building the most skilled workforce possible remains an ongoing priority – 64% of Ontario's population has completed post-secondary education, double the OECD average. New ideas flourish in Ontario – the province's R&D tax incentives are among the most competitive in the world. A CAD 100 R&D expenditure by a small or medium-sized business can be reduced to an after-tax cost of about CAD 55, or as little as CAD 43 if working with eligible Ontario research institutions.

Meanwhile, KPMG's Competitive Alternatives study found that Ontario's overall business costs are lower than in the US, UK, France, Italy, Germany, Australia or Japan. Furthermore, Ontario's combined federal-provincial general corporate income tax rate (26.5%) is significantly lower than the US average federal-state rate (39.3%).

Global Economy Driven by Local Relationships

The Ontario government is working hard to ensure that foreign investors continue to be attracted to the province. A big part of this approach is building productive and strategic relationships. It's a skill that Ontario's government has become very adept at – working closely with the business community at home and abroad to bring investment opportunities to fruition.

Here in Germany, the first step in building that relationship is our presence in-market. The government of Ontario has an International Marketing Centre in Munich, part of our network in key global markets. We'd be delighted to provide you with the intelligence and connections you need to do business in Ontario. Ontario offers a world of opportunity for any business seeking to establish or increase its presence in North America. We look forward to working with you

Toronto Skyline

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to make Ontario part of your company's growth plans.

Life Sciences in Ontario

Pharmaceuticals, medical devices, biotechnologies: If this is what you do and you're not in Ontario, you're missing out. The life sciences sector here is thriving, and your firm could be the next success story. The province offers other advantages specifically in the life sciences sector: Innovation takes brainpower. Any innovative business' biggest asset is its people – their intelligence, talent, expertise and initiative. Nearly two-thirds of Ontarians have post-secondary education, placing the province ahead of the US, the UK, Germany, France and Japan in terms of the world's best-educated workforces.

Ontario is a hotbed of life sciences R&D, with seven of Canada's top 10 research hospitals. The networks and synergies you need are already here – and expanding. Why build from the ground up when you can plug into a growing grid of expertise and research capacity?

Ontario's businesses have access to the world's largest healthcare market. In fact, more than half of the pharmaceuticals produced in Canada are exported, primarily to the US For life sciences firms, this proximity is a significant advantage because Canada is actively working to increase collaboration between regulatory agencies in the US and Canada. The federal government is exploring ways to streamline decision-making, improve efficiencies and reduce costs for pharmaceutical manufacturers.

The Bottom Line

Ontario offers a stable and growing economy, proximity to key markets, an innovative business climate, established infrastructure, low business costs, a deep talent pool, and an outstanding quality of life.

www.investinontario.com

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Life Sciences in Ontario: An Industry Snapshot

- Ontario's life sciences industry is home to more than 1,600 firms, more than CAD 39 billion in revenues, and more than 51,000 workers
- Eight of the world's 10 largest pharmaceutical firms conduct research in Ontario
- 58% of Canadian life sciences R&D spending is here
- Across the province, Ontario's 24 academic research hospitals invest CAD 1.2 billion in R&D, generate more than CAD 3 billion of spin-off economic activity and employ 15,000 researchers and staff
- 35,000 science, technology, engineering and math majors graduate from Ontario's 44 universities and colleges every year
- More than 5,200 clinical trials are underway in Ontario at any given time

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Growth in Africa

Key Sectors Drive Movement in Sub-Saharan Chemicals Market

Africa is set to enter a growth cycle. Although Asia is anticipated to continue dominating the global chemicals industry with expected market-share growth from 32.3% in 2010 to 40.4% in 2020 (fig. 1), Africa, along with the Middle East, will also experience growth in the chemicals segment.

This has been predicated by significant increases in gross domestic product growth and foreign direct investment (FDI) in parallel with decreased conflict and foreign-debt-to-GDP ratio since the early 2000s, writes Avril Harvey, team leader for Chemicals Materials & Food at Frost & Sullivan. The average African GDP growth in 2013 was 4.8%.

A number of influencers will contribute to this significant growth within the chemicals sector, namely mega trends, construction and economic growth.

Mega (Macro) Trends

Frost & Sullivan defines a mega trend as a long-term global transformation process. Mega trends arise from changes that influence business, economy, society, cultures and personal lives, thereby defining our future world and its increasing pace of change. These trends not only affect all key organizational functions but also allow companies to predict market direction and future demand and to respond to opportunities and threats.

One of the key mega trends that will influence chemicals sectors in Africa is increasing urbanization. By 2020, about 43% of people on the African continent will live in urban areas. Infrastructure development will also play a significant role, as it is estimated that $810 billion will be required in the next five years to upgrade, rehabilitate and expand Africa's infrastructure, whereas just more than half of that amount is being spent now.

These key mega trends will act as drivers on specific African industries. Increasing urbanization, for example, will have a strong effect on the development of infrastructure in Africa. Development and high growth are expected in electricity, road and rail, health care, water sanitation, and port infrastructure. A total of $363 billion has currently been spent on infrastructure projects (based on active projects in 2011), with the bulk of this in the transport and energy sectors.

Construction

The mega trend of increasing urbanization gives rise to a subtrend of construction, driving greater demand for building materials, paints and coatings, and construction chemicals in key African countries. South Africa is the leader in investment into infrastructure development; however, Nigeria, Mozambique, Kenya, Angola and Zambia also represent high value growth opportunities.

Revenue from infrastructure chemicals is anticipated to grow from $416.8 million to $453.6 million by 2015 in South Africa and from $62.6 million to $75.1 million in Kenya, with the bulk of these chemicals being coatings (fig. 2).

Other sectors driven by mega trends that represent growth opportunities in Africa are mining and agriculture. Revenues from mining chemicals are forecast to grow at a compound annual growth rate (CAGR) of 4%, and agrichemicals are expected to increase in value from $1.1 billion to more than $5 billion by 2020.

Economic Growth on the Continent

Much of Africa's growth has been dependent on resource extraction and, in particular, oil exports. This trend is expected to continue over the medium term. However, during the long term, many African countries are likely to become more diversified, with growth expected in the manufacturing, agricultural and services sectors. Diversification is the key to unlocking Africa's potential and growing middle class. Per capita incomes have grown substantially in the last 10 years, but this growth is expected to be insignificant compared with the growth that is predicted over the next 10 years due to beneficiation activities and the diversification of economic activities.

Some of the most diversified economies in Africa are in northern and southern Africa, including Egypt, South Africa and Namibia (fig. 3). A number of countries, such as Kenya, Mozambique, Madagascar and Rwanda, are transitioning into more diversified economies and growing GDP per capita, thus representing attractive expansion and investment destinations in Africa.

Africa is not without challenges – such as crime and corruption, lack of skills and some difficult business environments. However, companies have managed to overcome the risks by tailoring their strategies and adapting their business models to successfully tap into the unique market environment.

Companies wishing to enter the African market in key industry sectors, such as mining and agriculture, need to tailor their strategies accordingly to best drive growth through geographical expansion and mergers and acquisitions.

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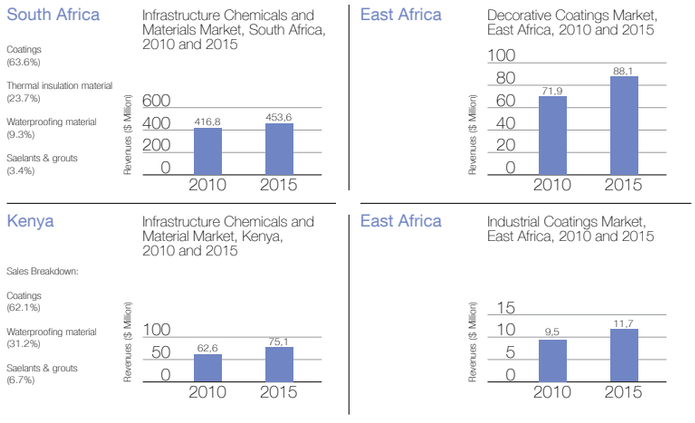
Infrastructure Chemicals and Materials Market & Decorative and Industrial Coatings Market — Fig. 1



Source: Frost & Sullivan analysis

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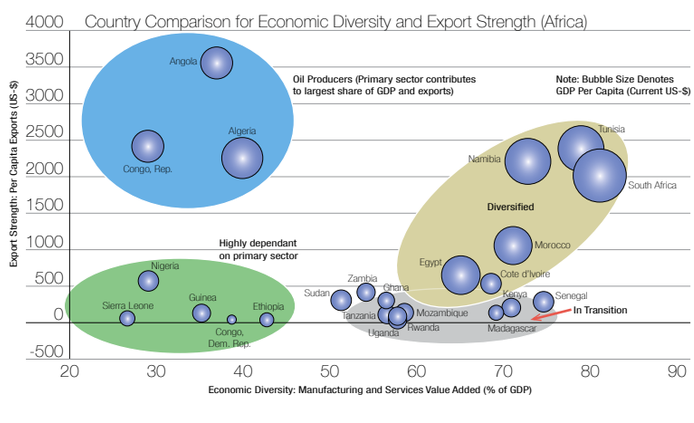
Geographic Expansion and M&A are Key Growth Processes Followed to Access Opportunities — Fig. 2



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