

Chemicals Practice

# China's chemical industry: New strategies for a new era

China looks set to remain the fastest-growing major chemical market, but important changes are under way. To succeed in this next stage of development, players will need to embrace a new set of strategies.

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**China's fast-growing chemical industry** has been the largest in the world by revenue since 2011, and its growth rate continues to outpace by far other major chemical-producing regions. But this colossal size should not be seen as a sign of stability. On the contrary, China's chemical industry is in the midst of a profound, rapid transition.

China's growth in chemicals over the past two decades has been characterized by rapid investment and intense competition and fragmentation across large numbers of segments. This has particularly been the case where production technology has been widely available and where access to raw materials and financing has been easy to obtain. This combination has led to rampant overcapacity in many sectors.

But the market and the industry are now moving into a new phase of development. There's a shift toward specialty-chemical growth, reflecting consumer-demand trends and the rising sophistication of China's industrial output, while consolidation has started to take a grip in certain sectors. These trends are all helping the value-pool growth prospects for parts of the industry. In the meantime, money for investment is harder to come by, and the government is imposing new, stricter environmental regulations on the industry. To succeed in this next stage of China's chemical-market development, players will need to embrace a new set of strategies.

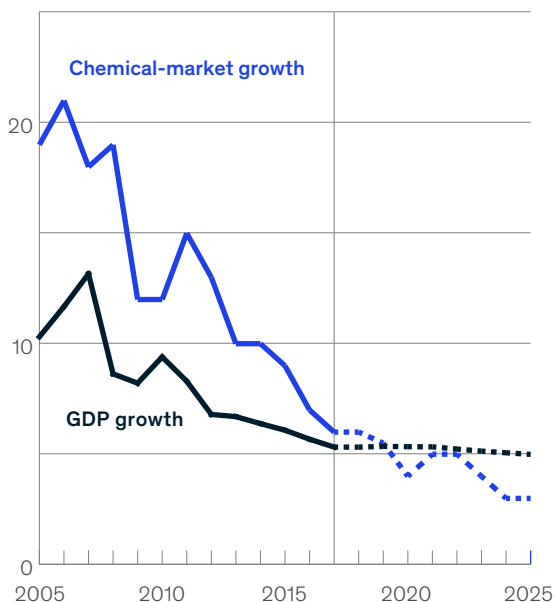
### China's new chemical-market dynamics

China's chemical market has contributed half of the growth of the world chemical market over the past two decades. Increasing economic turbulence since mid-2018, related to China's economic slowdown and US-China trade relations, adds new uncertainties to the short-term outlook. While the chemical market's growth rate is expected to slow as the country's overall economy matures, we expect that, in the medium term, the growth rate will remain significantly positive (Exhibit 1).

Exhibit 1

**China's chemical-market growth has slowed as the country's GDP growth has decelerated, and the trend is projected to continue.**

**China's chemical-market growth and GDP growth compared, %**



Source: Asian Development Bank; China Petroleum and Chemical Industry Federation; Citigroup; Deutsche Bank; Economist Intelligence Unit; Goldman Sachs; IHS Markit; JPMorgan Chase; Merrill Lynch; UBS; World Bank; McKinsey analysis

The enormous base that China's chemical industry now constitutes—around \$1.5 trillion of sales in 2017, amounting to nearly 40 percent of global chemical-industry revenue—means that, even at lower overall growth rates, the growth of absolute volume is still very large. To get a sense of that potential, consider that, at 5 percent growth per year, China will be adding the equivalent of the annual sales of Brazil's or Spain's chemical industries. Projections suggest that China will provide over half of the global chemical industry's growth over the coming decade, underlining its importance.

Five trends are spurring the changes in China's chemical-market dynamics. Three are fueling the industry's expansion and diversification, and two are imposing new constraints.

**Industrial policy and consumer trends stimulating demand for more specialty products**

As China's economic policy shifts more to consumption-driven growth from that of investment—and, within that consumption, toward more sophisticated products—the result is likely to lead to additional growth in specialty-chemical demand. For example, as markets for higher-end personal-care products grow, they are likely to bring with them demand for more sophisticated specialty surfactants and additives, as well as more expensive fragrances. Similarly, Chinese consumer trends will offer new opportunities. For example, the rapid growth in online ordering of food is likely to increase demand for packaging materials, potentially raising demand for innovative products such as biodegradable polymers.

At the same time, the Chinese government's Made in China 2025 policy is prioritizing a number of high-tech industries for development. The strategic directions it indicates could stimulate certain end markets, such as aerospace, electronics, electric vehicles (EVs), and batteries, which could, in turn, create opportunities for expanding production in China of a range of more sophisticated chemical products. Take EVs: electric-car sales in China are projected to rise at a 25 percent compound annual growth rate through 2030. By that date, 12 percent of all cars running in China would be EVs, and the country would account for more than half of worldwide electric-car sales. Other examples include coatings and new materials for high-speed trains, and advanced composites for use by the country's expanding aerospace industry.

**Upgrading innovation and technological capabilities to strengthen the industry**

An embrace of R&D is under way across the chemical industry, from sector giants, such as Sinochem

with its “In science we trust” slogan, to start-up companies working in a wide array of leading-edge areas, such as enzymes, catalysis, nanomaterials, and battery materials. China's chemical-R&D spending is now among the world's leaders. The structure of China's chemical-industry R&D has also changed, moving from one in which initiatives were under government direction to one primarily driven by individual companies within an ecosystem of collaboration with government research institutions and universities—and that has a strengthened regime to protect intellectual property.

China's chemical-technology capabilities are rapidly advancing. There are many examples of Chinese companies gaining technological parity with Western companies. One in the petrochemical field has been Wanhua Chemical, which has developed its own methylene-diphenyl-diisocyanate (MDI) technology. Wanhua is now the world's largest MDI producer in what had historically been a close-knit sector dominated by a handful of Western companies due to isocyanates chemistry's challenging technology-entry barriers. Another example is Kingfa Science & Technology, which started out as a supplier of lower-end products, such as plastics for TV-set cases, but has now become an engineering-resin supplier to the top auto OEMs. Kingfa is also one of the small group of producers in the world making high-tech engineering resins, such as polyether ether ketone and polyamide 10T. In the fast-growing lithium-ion-battery area, Shanshan Technology has established a leading presence in cationic- and anionic-anode materials, electrolytes, and separation membranes, with a top three position in all segments.

There are some segments in which the Chinese chemical industry is starting to get a technology edge over multinational companies (MNCs). This has been the case in a number of fermentation-based products, including monosodium glutamate, vitamin C, and xanthan gum. In all of these, Chinese companies are now the leading producers in the world, based on better-performing technology, and

they have continued to achieve process and quality improvements. Development of new materials is another example of Chinese players being well-placed. Cathay Industrial Biotech, for example, has established a leading position in bio-based nylon 5,6, a polymer with wide potential application.

As a general statement, there is now a huge array of Chinese companies that have access to many of the most up-to-date technologies (or at least the almost most up-to-date technology) with which they can be very competitive with MNCs, backed up with concerted application-development efforts.

#### **Opening the industry up to new investors**

Prior to 2015, petroleum refining in China had been treated as a strategic national industry to be controlled by state-owned oil companies. Naphtha crackers had also been under their control, and MNCs could only have a 50 percent stake. Since that date, however, refining and upstream petrochemical investments have been opened up to MNCs and more broadly to Chinese privately owned enterprises (POEs) to establish wholly owned operations.

Several POEs are aggressively investing upstream into building-block petrochemical production, reshaping China's petrochemical industry. Our analysis shows there are nine POE-backed projects accounting for over half the 20 million metric tons per year of new ethylene capacity being planned in China. For example, Hengli Petrochemical is moving upstream into oil refining to source raw materials for its purified terephthalic acid and polyester production. At the same time, a number of MNCs are planning wholly owned investments, including an integrated petrochemical complex by BASF and a refinery-petrochemical complex by ExxonMobil, both announced for Guangdong province.

#### **Tightening of financing availability**

The industry is also operating under new constraints. The Chinese government's policy to tighten credit across the country's economy has been a particular handicap for the capital-intensive chemical industry that has in the past benefited from low-cost capital to expand capacity.

Bank loans are harder to get: China's main bank supervisor decreed in 2014 it would control investment in oversupplied industries, including parts of the chemical industry, and this led banks in 2015 to tighten rules governing eligibility to loans in oversupplied sectors. Banks have shifted over the past year to demand more collateral, terminate loans prematurely, and refuse to renew loans, putting chemical companies at a further disadvantage for borrowing. Chemical enterprises also get charged an above-market-average interest rate. Further limiting options has been the stricter monitoring of companies using mutual-guarantee borrowing—a mechanism used in some provinces whereby groups of companies could guarantee each other's loans while, in effect, putting them all at risk should one go bankrupt.

At the same time, the Chinese government is restricting the releases of new bonds—traditionally, a major source of funds for POEs—and private lending is becoming more regulated. Equity financing remains out of reach for most chemical companies: domestic investors are increasingly selective, while chemical companies are not seen as sufficiently attractive to be candidates for IPOs outside China. The Chinese government's policy to continue to rein in debt suggests that the financing outlook for the chemical industry will remain challenging in the coming years.

This has already had significant consequences. Annual chemical capital expenditures had risen rapidly in the 2010 to 2015 period, when China's chemical demand was growing at more than 10 percent a year, more than doubling to reach 1.61 trillion renminbi in 2015. Spending peaked in 2015 and fell back 7 percent, to 1.5 trillion renminbi, by 2017 (Exhibit 2).

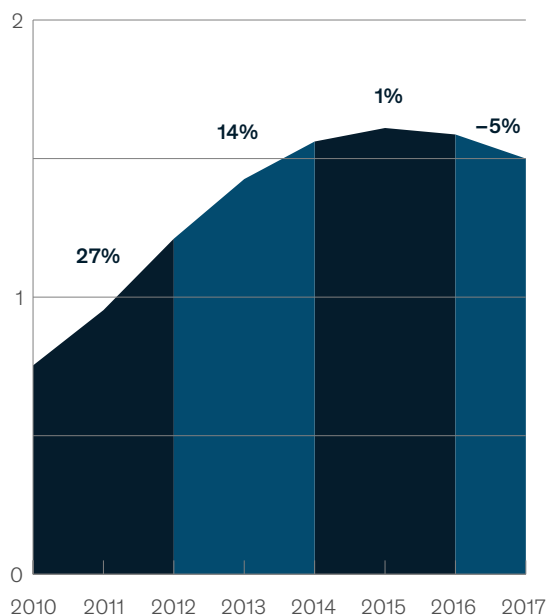
#### **New environmental regulations leading to restructuring**

China's chemical buildup over the past two decades had prioritized growth over environmental quality. The 13th Five-Year Plan for environmental protection published in 2016 enshrining "clear waters and lush mountains" as a national policy has marked a sharp

Exhibit 2

## Pressure on financing has led the chemical industry to pull back on capital expenditures.

Total capital expenditures of the Chinese chemical industry, trillion RMB, % change



Source: China Petroleum and Chemical Industry Federation; Wind

shift, as China's authorities have started to address environmental degradation.

New national pollution-control standards are being enforced by a system of requirements for production permits and a push to relocate chemical production to special chemical parks. The 2018 ban on imports of plastics waste, which has disrupted Western countries that had relied on exporting to China, is part of the same new policy.

The environmental policy aims to move chemical production from its current configuration, in which many tens of thousands of plants are scattered across mixed urban industrial and residential areas, to a new one based on specialized chemical-

production zones where wastewater- and hazardous-waste-treatment infrastructure can be centralized and shared. While a number of regions—for example, Shanghai—have long enforced tight standards, most of the country's industrialized regions have been facing serious chemical-pollution issues.

The new environmental regulations are having only limited impact on the big upstream petrochemical and chemical intermediates and polymer plants, most of which are built with appropriate emissions controls and waste-treatment facilities. The severe impact is on the thousands of smaller plants that make all the specialty chemicals, from coatings and dyestuffs and pesticides to food ingredients and surfactants, used by Chinese manufacturing and agriculture and by Chinese consumers. These are typically privately owned operations often lacking appropriate waste-management capabilities and located in urban areas. The moves to shut down out-of-compliance plants have affected large numbers of these small operations, but the impact on overall chemical output has been less severe. In Shandong province, for example, the government closed 25 percent of all the chemical companies operating in the province during 2018, but this affected only 5 percent of output.

Looking ahead over the next three to five years, we expect China's environmental authorities to continue to push enforcement energetically in the designated "radical change" regions, which account for nearly 50 percent of China's chemical production, as well as push for improvements in the "moderately strengthened" enforcement regions (Exhibit 3).

This is likely to cause continuing disruptions in specialty-chemical markets. The impact can be substantial: environmental enforcement during 2017 and 2018 shut down 30 to 40 percent of all Chinese production capacity for monosodium glutamate and certain dyestuffs and pesticides. This supply curtailment led to significant price increases in these sectors in China—for disperse dyes and glyphosate pesticide, a near 50 percent price increase.

## Three levels of environmental rules and enforcement are emerging across China—with an overall trend to much higher standards for the chemical industry.

Share of China's chemical-industry output<sup>1</sup> represented by regions under each category of rules and enforcement, %



<sup>1</sup>Total GDP created by chemical industry in 2015.

<sup>2</sup>China Petrochemical Yearbook 2016, China Petrochemical Consulting, November 2016; expert interviews; press search; McKinsey analysis.

Source: McKinsey analysis

While the new regulations are likely to force restructuring across significant portions of the industry, they could also present the potential for higher profitability for the companies that are able to manage under them and can absorb the higher operating costs that compliance will entail. Even after making the environmental investments, they can continue to have a highly competitive global cost position and then compete in a less-crowded field.

### Survival of the fittest, China style

What do these new dynamics mean for the chemical industry's evolution and future value-pool growth in

China? Our analysis suggests that the evolution of the country's different chemical-industry segments is likely to continue to follow broadly the pattern it has shown over the past two decades. This consists of a phase of massive overinvestment and oversupply as state-owned enterprises (SOEs)—often with MNC partners—and POEs rush to move in and produce chemicals that have historically been in short supply in China due to either lack of feedstock or lack of access to process technology. This phase is eventually followed by a shakeout and subsequent consolidation. In that latter stage, profit margins and investment returns for participants stabilize at a sustainable level.

A number of segments—ranging from commodities, such as soda ash, to specialties, such as vitamin C and monosodium glutamate—have reached that phase. However, there is an impressive list of chemicals for which the battle to ascertain the winner is still very much under way (Exhibit 4).

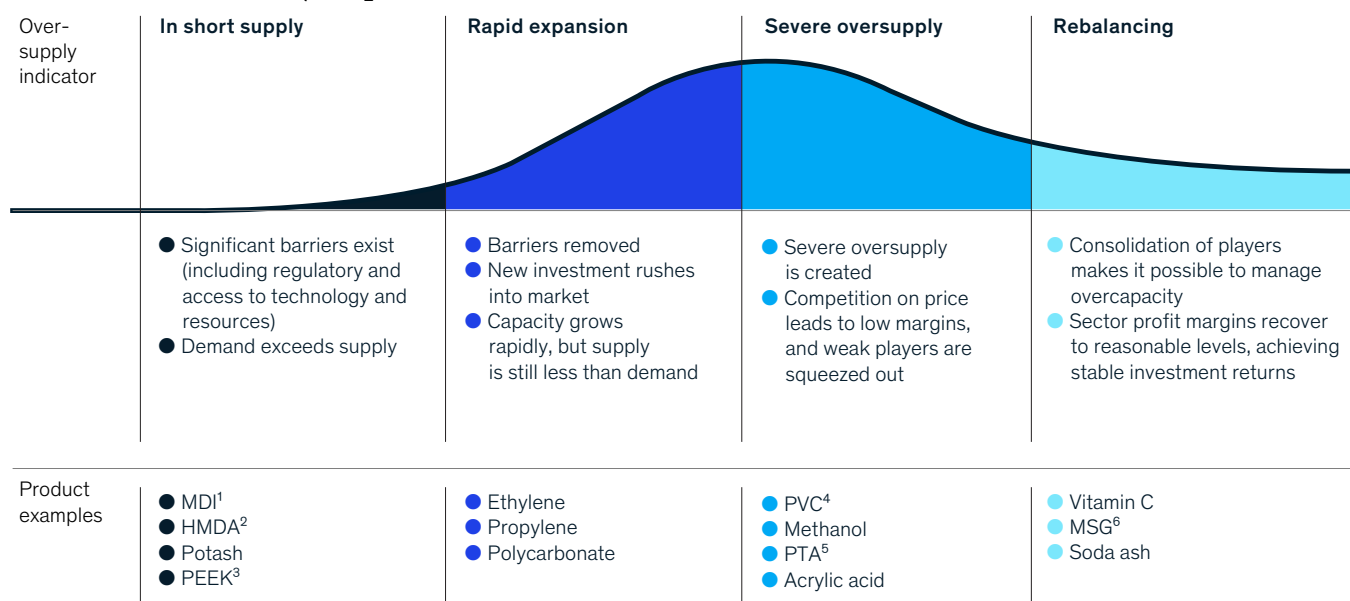
The polyester-fiber market provides a good example of this pattern of market evolution and how it affects a segment's value pool over time (Exhibit 5). Our analysis suggests that the long-term trend for the polyester-fiber value pool is one of growth as China's demand continues to expand, but the trend line includes downs as well as ups. Demand that outstripped supply in the early 2000s generated high margins and attracted many new entrants. Severe overcapacity resulted, and a shakeout ensued. Our analysis suggests that polyester fiber has entered the rebalancing phase shown in

Exhibit 4. The segment's value pool is below its previous peak, but the top ten companies' consolidation moves have already improved their profitability over other participants and continued to grow their profits. Our projections suggest that consolidation is likely to continue and polyester-fiber demand will expand further. This could lift the value pool to new heights, and the leading players would continue to take the largest share of it. As similar market dynamics play out in many other chemical segments, there is clearly scope for their value pools to evolve in a similar way.

It's important to underline that there are still important segments of the chemical industry—notably ethylene and propylene—for which China's demand continues to outstrip domestic production capacity. Our projections suggest that even with the investments that have been announced, ethylene

Exhibit 4

**While many chemicals in China are currently in oversupply or soon will be, the trend toward consolidation is likely to prevail.**



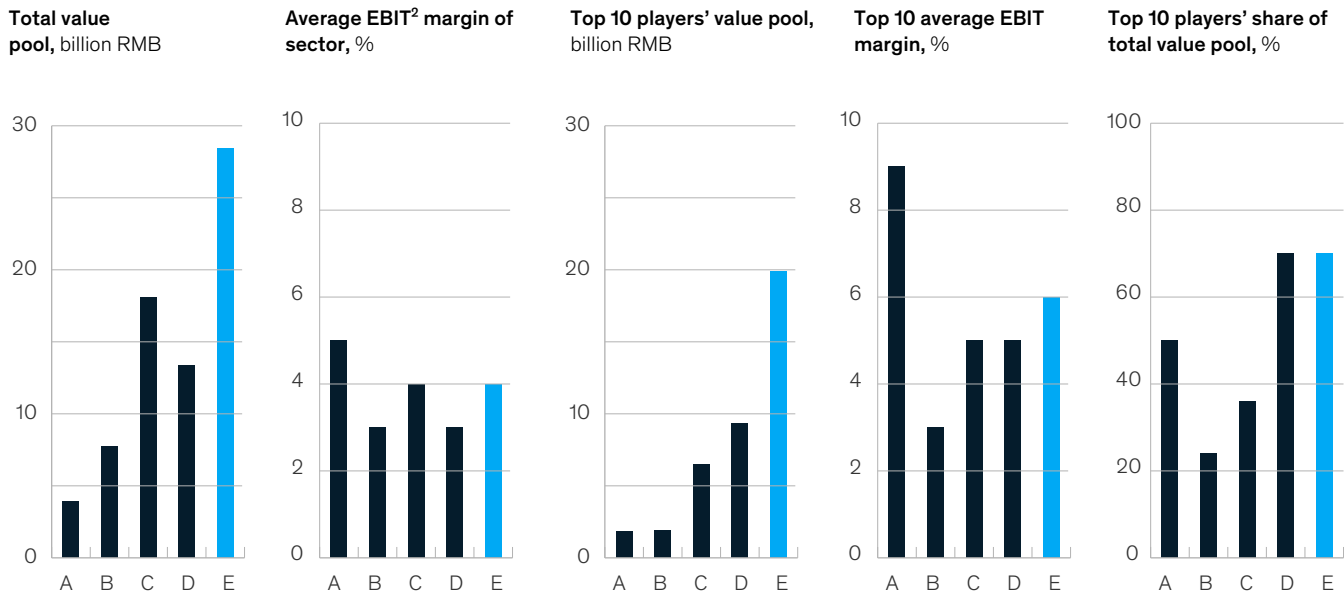
<sup>1</sup> Methylene diphenyl diisocyanate. <sup>2</sup> Hexamethylenediamine. <sup>3</sup> Polyether ether ketone. <sup>4</sup> Polyvinyl chloride. <sup>5</sup> Purified terephthalic acid. <sup>6</sup> Monosodium glutamate.

Source: IHS Markit; McKinsey analysis

Value pools in China’s chemical industry: In polyester, the top ten players have consistently increased their profits, outpacing the rest of the field.

Phases in the development of the Chinese polyester-fiber sector

- A. 2000: Demand outstrips supply
  - B. 2005: Rapid capacity buildup, with many new entrants
  - C. 2012: Consolidation gets under way
- D. 2017: Getting supply and demand in balance
  - E. 2023: Market projection assumes scenario of continued demand growth<sup>1</sup>



<sup>1</sup>Market projection assumes scenario of continued demand growth in China's polyester-fiber market supporting increased production of fiber, accompanied by further consolidation among producers, which might lead to top 10 producers achieving higher profitability.

<sup>2</sup>Earnings before interest and taxes.

Source: IHS Markit; press search; McKinsey analysis

production will continue to lag demand in 2023. However, the rules opening the petrochemical segment to new players means that capacity is likely to continue to build up, which suggests that these segments will also head for a consolidation stage.

It remains to be seen how long chemical segments for which proprietary technology has so far limited the number of entrants, such as certain nylon intermediates and isocyanates, will remain in this state: the extremely entrepreneurial character of the Chinese chemical industry and the inventiveness of its process engineers may challenge this

situation in China. Polycarbonate is an example of a market segment that, until recently, had been undersupplied domestically, but investments in new plants using China-developed technology are tripling capacity and could push polycarbonate into severe overcapacity by 2022.

How will the new environmental regulation and more limited availability of finance affect the industry’s evolution in China? Paradoxically, the new constraints may be a blessing in disguise for an industry that is grappling with how to adapt to the new market dynamics.

This is an industry in which demand-growth rates had been so high that building a new plant every two years had often been a key to success, but it now confronts growth rates at half these levels. There is not going to be the same need for new plants, and so limited funding will present less of a challenge and even help restrain some overly enthusiastic companies from contributing to more overcapacity. Meanwhile, capacity closures forced by environmental regulations will be less disruptive in a moderately growing market than in one growing at more than 10 percent a year.

At the same time—and perhaps most important—this change in the growth climate will help to push chemical-company-management teams to ensure that their operations are truly profitable. Instead of being able to hide behind new borrowing, companies will need to set a course toward high-quality, profitable growth.

### **How players in China's chemical industry can position themselves for the new era**

Faced with the changes in China's market, how should the major groups of players position themselves?

#### **State-owned enterprises: Diverging fortunes—and roles?**

SOEs have led China's chemical-industry development over the past two decades, but it is important to look at this group more closely to see how future developments may unfold. Best known are the central SOEs, while the group of SOEs owned by provincial governments are sometimes overlooked. A number of players in this latter group have, in fact, followed a more dynamic and entrepreneurial trajectory than has the central-SOE group.

One example is the previously mentioned MDI maker Wanhua, of which the majority owner is Shandong province. Wanhua's path to MDI leadership started 40 years ago making synthetic leather, and it

now has impressive profitability and aggressive expansion plans, including a world-scale MDI project on the US Gulf Coast.

Another company, Shanghai Huayi, diversified from producing chlor-alkali and fine chemicals to production of tires and entry into fluorochemical manufacturing. It has a slate of projects, including a coal–chemical complex in Qin Zhou, to sustain its growth in the medium term. Another successful player is SDIC Xinjiang Luobupo Potash, which is developing a high-quality and low-cost potash resource in Xinjiang province. This new output will help reduce the country's large potash imports, typifying the opportunities that continue to present themselves in meeting the chemical needs of China's huge market.

The major central SOEs, meanwhile, are continuing with their historic mandate from the Chinese state to provide a stable supply of basic chemicals. They are participating in the current wave of investments to double China's ethylene capacity, with Sinopec's four cracker projects making it the biggest investor overall. With the central SOEs' large sizes, they are also well equipped to fulfill another part of their mandate from the government: maintaining steady employment.

At the same time, however, new challenges are emerging for these companies. Maintaining the scale of their operations will need to be balanced with pressure to improve profitability by starting to retire their less-competitive older production assets. They must navigate this while facing increasing competition for their refining and petrochemical business from aggressive new-entrant POEs.

Some of these companies also face underlying questions about their long-term strategies. While they have been successful in the goal of providing basic-chemical supply, that focus may have left some of these companies less well positioned in the kinds of specialty-chemical businesses needed to serve China's next stage of economic development. Unlike in basic chemicals, these kinds of technologies are not usually available for licensing.

Some SOEs struggle with centralization, siloed organizational structure, and layers of bureaucracy that may handicap them in developing a strong specialties segment. Such specialties businesses typically move at a fast pace and depend on cross-functional collaboration among R&D, manufacturing, and sales functions to succeed. Should the SOEs be able, however, to overcome these organizational challenges and develop the necessary functional excellence, their scale would represent a strength to draw on.

#### **Privately owned enterprises: A drive to professionalize business**

Chinese private-sector chemical companies are also on the cusp of an important shift. They are moving from the buccaneering days of China's peak chemical-market growth to ones of more discipline—a shift enforced by new financial and environmental constraints and the evolution toward a higher level of maturity in the market.

The challenge facing the many companies in this group is to professionalize their operations in all dimensions. Large numbers of these companies are still run by their founders, who are still very much in the driver's seat as executive chairs, even if they have public shareholders. At the biggest of these companies, the founders are now billionaires.

This drive to professionalize covers business processes, for which they need to embrace best business practices on decision making, strategy selection and execution, as well as hiring and training. It also includes building up their innovation and technology capabilities.

There is a consciousness among POE leaders that the stakes here are high. Companies are increasingly engaging in strategies to roll up and consolidate major sectors of the chemical industry—as is being seen, for example, in sectors such as dyestuffs and polyester fiber. In this new phase of the industry's development, the players that have already professionalized their operations, are used to working with banks to secure financing, and can

take regulatory and environmental compliance and government relations in stride, will be best placed to seize opportunities and move to dominate their sectors.

The differing fortunes of POEs, central SOEs, and provincial SOEs highlight the dynamics that are playing out in the market. A number of POEs and provincial SOEs are continuing to find very-high-growth opportunities, while most of the central SOEs are achieving lower growth rates, at under 10 percent per year (Exhibit 6).

#### **International companies: Facing an uphill struggle**

It's not easy to find an example of a chemical MNC that has managed to gain a market share in China that is the same as its market share in the global market, a fact that encapsulates the challenges that MNCs have consistently encountered as China's chemical market has ballooned.

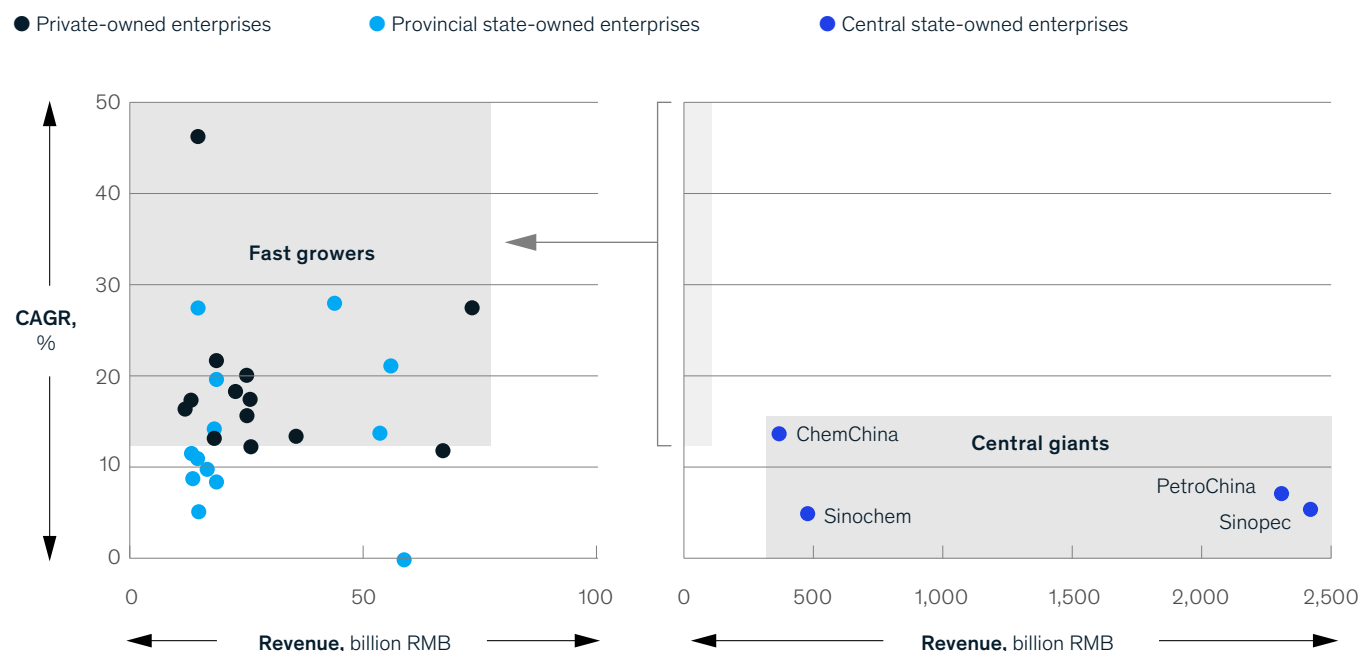
Historically, MNCs have often entered new geographical markets by making acquisitions, but this has not been feasible in China. This was because SOEs couldn't be acquired by foreign companies, while Chinese POEs were either too ambitious to be acquired or too small to be worth acquiring. Instead, MNCs have had to rely on direct investment, but they have run into challenges there.

In the first round of large investments by MNCs in China starting 20 years ago, their entry was through joint ventures with Chinese SOEs, allowed on the condition that the MNCs brought chemical-process technologies needed in China. The lack of majority control tended to put a cap on the scale of moves. In addition, where MNCs have been able to own fully their Chinese subsidiaries in more downstream chemicals, MNCs' conservative decision-making processes designed to avoid high-risk moves have made it difficult to make the aggressive capacity expansions typical of the entrepreneurs leading Chinese POEs. As a result, MNCs have been, in effect, shielded from making big mistakes in China—but also from capturing fast growth.

Exhibit 6

## Leading players in China's chemical market fall into two main categories: Fast growers and central giants.

Compound annual growth rate (CAGR)<sup>1</sup> compared with revenue<sup>2</sup>



<sup>1</sup>CAGR calculated as 2008–17 10-year average, except for Hengli (2016–17), Qixiang (2008–16), and Yuntianhua (2013–17).

<sup>2</sup>For the central giants, revenues cover all activities of the companies, not just chemical activities.

Source: Wind; McKinsey analysis

Since the change in rules in 2015, MNCs have been able to make wholly owned investments in upstream petrochemical plants. The size and importance of the Chinese market means that it cannot be ignored by MNCs that want to continue to be leading players in the world chemical market. This has been clearly reflected in recent announcements of major investments by MNCs that see opportunities in China. These include the large investments that BASF and ExxonMobil are considering in wholly owned petrochemical complexes in Guangdong in southern China. By building ethylene crackers, they should be able to establish a base in C<sub>2</sub> and C<sub>3</sub> chemistry—just in time, before that window of opportunity closes as domestic companies expand operations. Other major investments under

consideration, such as Invista's proposed \$1 billion adiponitrile investment at an as yet undetermined location in China, are part of the same pattern.

A further challenge is that some MNCs are failing to undertake product development tailored to the Chinese market's needs. As a result, they are finding themselves relying on their original offerings, which were developed for Western markets. Chinese competitors, meanwhile, are increasingly making inroads, resulting in a narrowing area of opportunity. On top of that, MNCs are still contending with the basic cultural barriers to doing business in China, notably in hiring and keeping hold of the best local Chinese employees. The Chinese government's decision to open up the petrochemical market can

be interpreted as a sign of its confidence that local companies have gained strong-enough positions against international ones and will maintain a lead.

To summarize, MNCs need to be ready to deal with further headwinds in the coming years and build into their expectations the idea that future chemical-market growth is likely to be more incremental, as they fight to maintain market share against Chinese players and to win scraps of market share from other MNCs. But MNCs that have the flexibility to make the necessary moves—such as tailoring solutions for the local market and participating in the industry's consolidation trend—should be better placed.

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The shifts under way in China's chemical industry are on a massive scale that mirrors that of the industry itself. Players in the world's largest chemical market must make the adaptations necessary to ensure success at growth rates that are less than half of what they have been seeing in the recent past. At the same time, they must adjust to a world of scarcer financing and tighter environmental regulation. The factors driving success will vary among the different groups of players in the industry, but in all cases, they will need to be informed by a readiness to adapt rapidly and innovate to meet the needs of the market.

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