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NAVIGATING THE TERRITORY OF EXTREMES

ANDREAS GOCKE

YVES-PIERRE WILLERS

HUBERT SCHÖNBERGER

VALUE CREATION IN CHEMICALS 2016
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EXECUTIVE SUMMARY

The chemical industry was once a top value creator, generating a five-year total shareholder return (TSR) above that of every other industry in BCG's annual Value Creators ranking. Today, the industry is one of the more challenged. Its median TSR from 2011 through 2015, the period we considered in this year's study, was 9.5%, considerably below the 12% median of the 28 industries we tracked.

Yet some chemical companies are performing very well. Indeed, we find an enormous disparity between the best and the worst performers of the 189 chemical companies in our global sample: a spread of 94 percentage points, larger than the spread in any other industry in our study. This disparity indicates that the chemical industry has become a territory of extremes. Whereas variations in performance among individual companies were once attributed primarily to a company's subsector and the location of its headquarters, this is no longer the case. There are still significant differences in median TSR among subsectors and regions, but those differences are shrinking.

We believe that the primary factor in individual company performance today is the choice of business model. There are several distinct options. We find that the top TSR performers tend to develop highly differentiated business models, and these models tend to be market-based, rather than asset- or technology-based. The top performers also tend to practice serial M&A; embrace complexity as a source of differentiation and, hence, competitive advantage; and deviate from industry best practices, instead developing opportunities outside of industry trends.

Here is where the chemical industry stands today:

Several powerful trends are shaping the industry, shifting value among regions and business models.

- The so-called shale gas revolution—the rapid expansion of natural gas and oil capacity due to advances in production technology—has improved the competitive position of many chemical manufac-
turing sites in North America. Simultaneously, regions such as the Middle East and Southeast Asia have lost some of the competitive advantage that was based on feedstock cost.

- The cooldown of Chinese GDP growth, the extensive buildup of manufacturing overcapacity in China, and the move of chemical companies in this region from commodities toward higher-value-added specialty chemicals have also had a tremendous impact.

**TSR varies broadly by region.**

- Companies headquartered in North America, one of the five regions in our study, had the strongest performance, generating a median five-year TSR of 12%. Those headquartered in emerging markets (excluding Greater China, which in our analysis includes People’s Republic of China, Hong Kong, and Taiwan) had the worst, 2%, despite a powerful TSR of 24.1% for South Asia.

- While global expansion by individual companies has had little effect in itself, exposure to emerging markets (including Greater China) has affected regional performance more than any other factor.

- Companies that once relied on strong local franchises—such as sales within related conglomerate subsidiaries, strong commercial ties to a local customer with large global market share, or subsidized feedstock—are more challenged today than those that had to adjust their portfolios early on toward global competitiveness because they could not rely on favorable local positions.

**TSR also varies among subsectors.**

- Of the industry’s five subsectors—base chemicals and basic plastics, multispecialty, focused specialties, industrial gases, and agrochemicals and fertilizers—focused specialties was a clear outperformer, with a median TSR of 17.7% over the past five years. Within this subsector, three clusters—paints and coatings, food ingredients, and personal care and hygiene—were the top performers.

- The most challenged subsector was base chemicals and basic plastics, with a median five-year TSR of 0.1%. All clusters in the subsector—the vinyl chloride chain, petrochemicals, fibers and intermediates, and synthetic rubber—had a TSR below the industry median.

**Return on capital employed (ROCE) confirms focused specialties’ outperformance.**

- Focused specialties had a global average ROCE of 12.3% over the past ten years, the highest of all subsectors. This outperformance held across regions, including Greater China and other emerging markets. In contrast, the base chemicals and basic plastics subsector underperformed, earning a global average ROCE of only 6.3%.
• By region, ten-year ROCE varied from 11.7% for companies headquartered in emerging markets to 11.1% for those headquartered in North America, 9.2% for those in Europe, and just 6.2% and 5.5%, respectively, for those headquartered in Greater China and Northeast Asia.

The choice of business model may determine corporate performance more than any other top-management decision.

• Chemical industry business models tend to be asset-based, involving large sites and other assets that offer a scale advantage; technology-based, with differentiated manufacturing processes; or market-based, involving, for instance, a technical sales force.

• In this year’s sample, companies with market-based business models outperformed the industry, earning a median TSR of 18%. We believe that the market-based model offers important lessons about value creation.

Chemical companies need to balance business resilience and portfolio coherence.

• In a world where proprietary knowledge is less protected than it once was, large, forward-looking chemical companies need to ensure the resilience of their core business by embracing complex businesses as a source of competitive differentiation.

• At the same time, broadly diversified companies whose portfolios are not coherent often have processes and systems, an organization design, and a management philosophy that do not serve all businesses.

• Achieving portfolio coherence requires ensuring that all businesses and functions in the portfolio share processes, standards, and capabilities. It requires adjusting and transforming existing businesses and functions so that they benefit equally from being part of the same company.

• Chemical companies must develop an “always on” transformation mindset, continually rethinking and adjusting their business models. This mindset is, and increasingly will be, the best approach to balancing the need for resilience and coherence and the need for superior value creation.
The chemical industry has disappointed shareholders looking for value creation every year since 2011, according to The Boston Consulting Group’s analysis of five-year total shareholder return (TSR). Although the industry placed a strong fourth in TSR among 27 industries in the period from 2007 through 2011, it has fallen fairly steadily since then, moving to 21st of 28 industries from 2011 through 2015, the period we considered in this year’s Value Creators study. (See Exhibit 1.) This is
comparable to the industry’s performance from 2010 through 2014, when chemicals ranked 20th of 27. Although the chemical industry did not fall in the ranking, it did not make any progress, either. (See the sidebar “How We Measure Value Creation: The Components of TSR.”)

Yet chemical companies that have been able to adapt, developing differentiated business models, have generated excellent returns. While the industry as a whole generated a median TSR of 9.5% in the most recent five-year period—compared with 13% from 2010 through 2014—the top ten companies gener-

**HOW WE MEASURE VALUE CREATION**

**The Components of TSR**

Total shareholder return (TSR), which accounts for the change in share price and any other effects on shareholders’ net wealth in a given period, is the product of multiple factors. Readers of BCG’s Value Creators series are likely familiar with our methodology for quantifying the relative contribution of the various components of TSR. (See the exhibit.) The methodology uses the combination of revenue (that is, sales) growth and change in margins as an indicator of a company’s improvement in fundamental value. It then uses the change in the company’s valuation multiple to determine the impact of investors’ expectations on TSR. Together, those two factors determine the change in a company’s market capitalization. The model also tracks the distribution of free cash flow to investors and debt holders—in the form of dividends, share repurchases, and repayments of debt—in order to determine the contribution of free-cash-flow payouts to a company’s TSR.

All those factors interact—sometimes in unexpected ways. A company may increase its earnings per share through an acquisition but create no TSR if the acquisition erodes the company’s gross margins. In addition, some forms of cash contribution (for example, dividends) have a more positive impact on a company’s valuation multiple than others (for example, share buybacks).

TSR is a useful way to assess value creation, but it is inherently backward-looking. As such, it is not a reliable predictor of future returns.

**TSR Is the Product of Multiple Factors**

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**Source:** BCG analysis.

**Note:** Share change refers to the change in the number of shares outstanding, not to the change in share price.
ated a 40% median TSR, only one percentage point below the median top-ten TSR in 2010 through 2014. In contrast, the bottom ten performers generated a median TSR of –20%.

This disparity within the industry is further evidenced by results from the very best and worst performers. At the top, we find a median TSR of 69% from 2011 through 2015—a level that was surpassed in just five of the 28 industries, four of which had an industry median much higher than the chemical industry’s. At the bottom, we find a median five-year TSR of –25%—a result exceeded by the worst performers in only five other sectors.

The spread of 94 percentage points between the top and the bottom is the largest of the 28 industries we studied. The chemical industry, more than any other, has become a territory of extremes in TSR performance.

The Importance of Business Models

We believe that these extremes reflect a fundamental industry trait: chemical companies can choose among multiple business models, each with its own outlook for growth and profitability. This is true not only for the industry as a whole but also for subsectors and individual clusters. In fact, the choice of business model may determine the performance of a company more than any other top-management decision.

Companies in a subsector—despite an apparently similar coverage of chemical backbones, technologies, and customer industries—realize enormous differences in value creation. The top-performing fertilizer company, for example, achieved a median TSR of 26% over the past five years, while the worst-performing achieved a median TSR of –21%. The top flavor and fragrance company generated a median TSR of 38%; for the worst, it was 0.8%. And the top paint and coating company attained a median TSR of 38.4%, while for the worst it was only 8.9%. We believe that these differences must be the result of the variety of business models in play among otherwise similar companies.

Even within a cluster in the chemical industry, such as rubber processing chemicals, one can identify as many as half a dozen business models, each offering very different outcomes in terms of growth and profit margins. Some companies in this cluster try to cover the full range of chemistries and functionalities—both tire and nontire—using owned manufacturing assets, including key intermediates. Others focus on chemistries for which they have a clear knowledge advantage, limiting themselves to the role of reseller in other product areas. Still others concentrate on the formulation of additive packages, with a strong focus on nontire rubber processing.

Our Research

Our 2016 analysis of TSR in the chemical industry included 189 companies, 70 of which have headquarters in Greater China (which in our analysis includes People’s Republic of China, Hong Kong, and Taiwan) and other emerging markets. Not all are pure-play chemical companies, but all do the majority of their business in chemicals. For a company to be included in the analysis, at least 25% of its shares had to be publicly traded for the entire five-year period, and its market valuation had to be at least $1 billion as of December 31, 2015. The same criteria applied to our 10- and 20-year analyses, which included fewer companies because of the continual breakups and portfolio restructurings in the chemical industry, especially in Europe. The 10- and 20-year analyses are particularly useful because they show the performance of long-term capital investments. (See Exhibit 2.)

The choice of business model may be the biggest factor in a company’s TSR performance.

This year, for the first time, we excluded many Chinese companies from our sample in an effort to ensure that we compared similar entities. In China, a large number of state-owned and private entities listed on the stock exchange are not independent businesses. Rather, their operations are closely inter-
woven with—and under the de facto managerial and operational control of—an unlisted holding company, which may own only a minority share in the entity. In these cases, the reported financial data, to our observation, do not always reflect the operational performance of the total business.
THE FORCES DRIVING TODAY’S SHIFTS IN VALUE CREATION

In the past five years, several trends have affected the performance of chemical companies around the globe. These trends have also shifted value creation among regions and from commodity-driven to specialty-chemical-based business models. Among the trends we have observed, the biggest impact has come from the following:

- **The Shale Gas Revolution.** The enormous growth of natural gas and oil production in the United States, fueled by innovation in drilling technology and exploration, has improved the competitive position of both new and existing US-based chemical assets. It has also eroded the relative advantage of the Middle East and has put pressure on chemical companies based in Europe and Southeast and Northeast Asia, primarily those in the base chemicals subsector.

- **The Cooldown of Chinese GDP Growth.** This slowdown, and the resulting decrease in commodity demand, has substantially decreased demand in China for imported chemical commodities. Demand has also decreased for fertilizers, agrochemicals, mining chemicals, and oilfield chemicals, which supply ingredients to commodity industries.

- **Overcapacity in China.** The considerable overcapacity in the base chemical, agrochemical, fiber, and fertilizer clusters in China has eroded prices there and in adjacent regions, and has squeezed margins for Chinese companies and for international companies with assets in China. It has also created global margin pressure, as companies in China with overcapacity have sought to access export markets under the country’s “one belt, one road” policy, which is meant to open up advantaged markets to Chinese companies. As a result, base chemical and polymer companies from other emerging markets have been feeling particular pressure.

- **Rising GDP Growth in South and Southeast Asia.** Some emerging markets, in particular India and other parts of South and Southeast Asia, are now experiencing much higher GDP growth, a trend that benefits especially the local chemical companies that have adjusted their offerings to the specific needs of their home countries.

- **The Move Toward Higher-End Chemical Products in China.** Having declared their intention to increase consumption and employ much more of the population in higher-paid positions, Chinese chemical companies have begun to move their portfolios from commodities to higher-value-added specialties.
The difference in TSR performance among regions was not as great from 2011 through 2015 as it was from 2010 through 2014, yet we still observe striking regional—and subregional—variation. (See Exhibit 3.) A primary reason is that chemical companies typically have a strong position as suppliers to local industries—such as automotive in Germany, electronics in Japan and South Korea, and cosmetics in France. Despite the chemical industry’s global footprint, therefore, many chemical companies are heavily affected by their local economies and the types of industries that flourish in them.

**EXHIBIT 3 | TSR Varies Widely by Region**

<table>
<thead>
<tr>
<th>Location of headquarters</th>
<th>Median TSR, 2011–2015 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Asia</td>
<td>24.1</td>
</tr>
<tr>
<td>Nordic countries</td>
<td>17.5</td>
</tr>
<tr>
<td>Switzerland</td>
<td>15.5</td>
</tr>
<tr>
<td>Japan</td>
<td>13.4</td>
</tr>
<tr>
<td>United States</td>
<td>12.2</td>
</tr>
<tr>
<td>Central and Eastern Europe</td>
<td>12.0</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>11.7</td>
</tr>
<tr>
<td>China</td>
<td>10.4</td>
</tr>
<tr>
<td>Australia</td>
<td>7.6</td>
</tr>
<tr>
<td>Western Europe</td>
<td>7.5</td>
</tr>
<tr>
<td>Canada</td>
<td>1.6</td>
</tr>
<tr>
<td>Germany</td>
<td>0.1</td>
</tr>
<tr>
<td>South Korea</td>
<td>-1.7</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>-5.6</td>
</tr>
<tr>
<td>ASEAN</td>
<td>-5.9</td>
</tr>
<tr>
<td>Latin America</td>
<td>-7.8</td>
</tr>
<tr>
<td>Total</td>
<td>9.5</td>
</tr>
</tbody>
</table>

Sources: Company reports; S&P Capital IQ; BCG analysis.
Note: N = 180 companies. Western Europe here comprises Belgium, France, and the Netherlands.
Exposure to the emerging markets, including Greater China, has also had a tremendous impact in recent years.

**Regional Variation**

We studied the performance of companies headquartered in five regions. (See Exhibit 4.)

- **North America.** The 37 companies in our sample headquartered in North America achieved a median TSR of 12% from 2011 through 2015, the highest of the regions in our analysis. Their success reflects three factors: large-scale investments in opportunities related to shale gas; their ability to refocus portfolios toward higher-end specialties faster and more decisively than some global peers; and, for companies such as Ecolab and Solenis (formerly Ashland Water Technologies), the ability to develop strong service-based business models for pulp and paper customers.

- **Northeast Asia.** The 46 companies headquartered in Japan and South Korea, which make up our Northeast Asia region, generated a median TSR of 10%, but there were clear differences between the two countries. Companies headquartered in Japan achieved a TSR of 13.4%, compared with –1.7% for those in South Korea.

Many Japanese chemical companies have developed singular competitive advantages despite subscale manufacturing assets, the high cost of manufacturing infrastructure, and product portfolios that are often unfocused compared with those of their global peers. In nearly every chemical segment, Japanese companies generally concentrate on high-end product grades and the development of innovative—and often unique—manufacturing processes. Some Japanese companies are even able to create a “segment of one” position, in which they are the sole supplier or have a large market share in highly sophisticated grades within a product category. This position sometimes shields Japanese companies from the margin-eroding impact of Chinese overcapacity.

### EXHIBIT 4 | North America Leads, Emerging Markets Trail

<table>
<thead>
<tr>
<th>Region</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
<th>Average</th>
<th>Total # of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>–18</td>
<td>27</td>
<td>12</td>
<td>10</td>
<td>37</td>
</tr>
<tr>
<td>Northeast Asia</td>
<td>–25</td>
<td>38</td>
<td>10</td>
<td>11</td>
<td>46</td>
</tr>
<tr>
<td>Greater China</td>
<td>–22</td>
<td>40</td>
<td>10</td>
<td>9</td>
<td>42</td>
</tr>
<tr>
<td>Europe</td>
<td>–17</td>
<td>48</td>
<td>8</td>
<td>11</td>
<td>36</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>–20</td>
<td>69</td>
<td>2</td>
<td>7</td>
<td>28</td>
</tr>
</tbody>
</table>

Sources: S&P Capital IQ; BCG analysis.

Note: Greater China here includes People’s Republic of China, Hong Kong, and Taiwan.
In contrast, while South Korean chemical companies have more integrated and scale-efficient manufacturing sites, they are challenged by other factors. First, some South Korean conglomerates are experiencing the erosion of historically captive markets as the country steadily reduces trade tariffs, thus giving customers more purchasing options. Second, South Korean chemical companies have a high exposure to Chinese customers, and many of them have a relatively unsophisticated product offering. As a result, they are more vulnerable than Japanese companies to the effect of Chinese overcapacity, currently discernible in lower-end products in nearly every chemical segment.

High exposure to emerging markets challenges value creation in chemicals.

- **Greater China.** The 42 companies headquartered in Greater China also achieved a median TSR of 10%. Their results were aided by the extraordinary momentum of the Chinese stock market in 2015 (although the market has since experienced a broad correction). Perhaps surprisingly, a focus on higher-end specialty chemicals helped several companies in China perform strongly in 2015, somewhat offsetting the impact of falling oil prices and overcapacity on their regional peers.

- **Europe.** The 36 companies headquartered in Europe achieved a median TSR of 8%, but there were striking differences among subregions (see again Exhibit 3). While chemical companies based in Nordic countries (17.5% median TSR), Switzerland (15.5%), and the United Kingdom (11.7%) performed above the global median of 9.5%, companies based in Germany had a median TSR of just 0.1% for this period.

In the United Kingdom and other countries that have a relatively narrow industrial base—and therefore a relatively low demand for chemicals—chemical companies may need to adjust their portfolios more rigorously to create globally competitive offerings.

- **Emerging Markets.** Companies headquartered in emerging markets are once again at the bottom of the TSR ranking, including those based in Latin America (−7.8%), ASEAN (−5.9%), and Saudi Arabia (−5.6%). The one outlier is South Asia: companies headquartered in India and Pakistan generated a median TSR of 24.1% from 2011 through 2015. Their performance clearly illustrates that GDP growth in the emerging markets of South Asia is fueling value creation opportunities for companies with a strong presence there, as it once did in China. In addition, Indian companies seem to have a particular ability to develop differentiating business models, often in response to domestic challenges.

In other emerging markets, particularly the Middle East, many companies that built success on a low-cost, and sometimes subsidized, feedstock base have expressed the intention to lower their dependency on this advantage and move instead into higher-value chemical products. By doing so, they hope to trigger investment by processing industries and create new regional employment opportunities. However, three recent disruptions have complicated this effort: the partial loss of the feedstock advantage to North America, the cooldown of Chinese commodity demand, and commodity overcapacity in China, suspending the one-belt, one-road strategy and challenging the market franchises of many of the region’s emerging-market players.

The Emerging-Markets Factor

Global chemical companies are affected by much more than the conditions in the countries where they are headquartered, of course. Their stories—and the data—are far more complex. Over the past ten years, we have observed the importance of one factor in particular: exposure to emerging markets.
We believe that global expansion in general has had very little effect on TSR. Of the 170 companies that publicly reported the share of revenues originating in their home region and elsewhere, we find little difference in TSR between the ten with the highest revenue share from their home market and the ten with the lowest; both groups generated TSRs below the average of all reporting companies in 2011–2015.¹ (See Exhibit 5.)

However, when we look at emerging-markets revenue share, we find that expansion into the emerging markets and Greater China has had a tremendous effect on TSR. Of the 99 companies not headquartered in the emerging markets and Greater China that reported their revenue share by region, the ten with the lowest share in emerging markets attained a healthy average TSR of 20%. In contrast, the ten companies with the highest revenue share in emerging markets realized a TSR of only 5.3%, well below the 10.6% average for this group.

We find that companies that earn a high proportion of revenue in emerging markets have been challenged by three factors affecting value creation:

- These companies often attract local competitors, which have an advantage when it comes to local commercial practices. For example, companies based in emerging markets and in Greater China, in particular, tend to have easier access to public-sponsored debt. Moreover, companies with a high revenue share in emerging markets have a greater risk of losing intellectual property and know-how as key talent leaves to join local competitors.
- Many companies that do business in emerging markets, particularly in China, have found it difficult to establish a local high-performance commercial organization that retains its employees over the long term.
- Customers in emerging markets are often price sensitive and lack experience building long-term relationships that reward excellent service and consistent quality.

### Exhibit 5 | High Exposure to Emerging Markets Hurts TSR

<table>
<thead>
<tr>
<th>HOME-MARKET EXPOSURE</th>
<th>EMERGING-MARKET EXPOSURE¹</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average TSR, 2011–2015 (%)</strong></td>
<td><strong>Average TSR, 2011–2015 (%)</strong></td>
</tr>
<tr>
<td>The 170 companies that report home-market share</td>
<td>The 99 companies that report emerging-market share</td>
</tr>
<tr>
<td>The 10 companies with highest home-market share</td>
<td>The 10 companies with highest emerging-market share</td>
</tr>
<tr>
<td>The 10 companies with lowest home-market share</td>
<td>The 10 companies with lowest emerging-market share</td>
</tr>
<tr>
<td>9.1</td>
<td>10.6</td>
</tr>
<tr>
<td>6.7</td>
<td>5.3</td>
</tr>
<tr>
<td>7.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

**Sources:** Company reports; S&P Capital IQ; BCG analysis.

**Note:** N = 189 companies.

¹Excluding companies headquartered in emerging markets. Emerging markets here include Greater China (People’s Republic of China, Hong Kong, and Taiwan).
Only companies willing to reconsider the emerging-markets business model and develop locally competitive offerings have an opportunity to succeed—and gain positive returns on the enormous investments they have made.

NOTE
1. We have refined our 2015 analysis of emerging-market exposure to shift from BCG estimates to reported revenue shares, as 170 of our 189 companies now report the share of revenue originating in their home region and that originating elsewhere.
THERE IS NO PERFECT categorization scheme for an industry as complex as chemicals. To better understand this multifaceted landscape, BCG has divided it into five subsectors and about 150 segments within those subsectors. For our 2016 analysis, we have grouped these segments into 18 clusters. While some companies are active in multiple clusters, we have allocated, as far as possible, each of the 189 companies in our sample to the cluster in which it generates the majority of its revenue. We have also created a “diversified” cluster within the multispecialty subsector in recognition of the fragmentation of some companies’ portfolios, especially in that subsector.

In this year’s report, we examine the following chemical subsectors and clusters (see Exhibit 6):

- **Base Chemicals and Basic Plastics.** The 41 companies in this subsector generate a large share of their revenue from cracking products and basic derivatives, such as polyolefins, solvents, and surfactants. A few also have sizable specialty chemical businesses. This subsector realized a median five-year TSR of 0.1%, although in Europe the TSR was 12.0%, above the overall industry median of 9.5%.

  The four clusters in this subsector had the lowest TSR of all chemical clusters from 2011 through 2015. (See Exhibit 7.) Petrochemicals and polymers came in lowest, with a –1.1% median TSR. Companies focusing on the vinyl chloride chain realized a median TSR of 0.0%, the fibers and intermediates cluster generated 5.3%, and companies focusing on the synthetic rubber industry generated the only TSR approaching the industry median, at 9.1%.

  The buildup of Chinese overcapacity, which accompanied the slowdown of global growth, is the main reason for these relatively poor results. However, a few companies have avoided the subsector’s value creation meltdown. Westlake, for example, with its focus on scale and a cost advantage in feedstock, expanded its margins by increasing the share of revenue from specialties—that is, refined and more-sophisticated PVC grades. As a result, the company was somewhat better protected from the cyclical overcapacity that hit the commodity grades so hard.

- **Multispecialty Chemicals.** The 53 companies in this subsector have highly diversified portfolios and earn a substantial portion of their revenue from specialty chemicals. Compared with companies in the focused specialties subsector, discussed below, multispecialty companies serve a broader range of industries and cover more functional applications. Nearly
all dedicate a significant part of their business to so-called semispecialties, or narrow commodities, while some are also active in petrochemicals, agrochemicals, and pharmaceuticals.

Multispecialty chemicals realized a five-year median TSR of 8.8%, slightly below the industry median. The subsector underperformed the overall industry in Europe and in China from 2011 through 2015 but performed slightly better than the industry in North America and Northeast Asia.

The multispecialty chemicals subsector comprises three clusters: diversified materials, diversified additives and functional materials, and broadly diversified chemicals. The first two achieved TSRs of 10.1% and 12.0%, respectively, slightly above the overall industry. The third cluster, the broadly diversified chemicals companies, realized a TSR of 7.5%.

- **Focused Specialties.** This subsector consists of 55 companies that operate primarily in the areas of coatings, adhesives, flavors and fragrances, construction, chemical distribution, and electronic materials. All tend to focus on relatively sophisticated products that serve a narrowly defined industry or have a narrowly defined functional application.

The subsector as a whole clearly outperformed the rest of the industry during the past five years, generating a median TSR of 17.7%, nearly twice the industry median. In fact, focused-specialty chemical companies outperformed companies in all other subsectors in all regions.

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**EXHIBIT 6 | The Focused-Specialties Subsector Outperforms All Others**

<table>
<thead>
<tr>
<th>Subsector</th>
<th>EMERGING MARKETS</th>
<th>EUROPE</th>
<th>GREATER CHINA</th>
<th>NORTHEAST ASIA</th>
<th>NORTH AMERICA</th>
<th>Total market capitalization ($billions) and TSR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base chemicals and basic plastics</td>
<td>-5.9</td>
<td>12.0</td>
<td>3.9</td>
<td>-2.2</td>
<td>1.9</td>
<td>292 0.1</td>
</tr>
<tr>
<td>Multispecialty</td>
<td>NA</td>
<td>5.0</td>
<td>8.6</td>
<td>10.6</td>
<td>10.8</td>
<td>455 8.8</td>
</tr>
<tr>
<td>Focused specialities</td>
<td>25.8</td>
<td>16.4</td>
<td>17.9</td>
<td>18.0</td>
<td>18.5</td>
<td>307 17.7</td>
</tr>
<tr>
<td>Industrial gases</td>
<td>NA</td>
<td>6.8</td>
<td>NA</td>
<td>10.9</td>
<td>10.3</td>
<td>142 9.1</td>
</tr>
<tr>
<td>Agrochemicals and fertilizers</td>
<td>7.6</td>
<td>5.0</td>
<td>10.4</td>
<td>NA</td>
<td>5.1</td>
<td>216 9.4</td>
</tr>
</tbody>
</table>

**Total market capitalization ($billions) and TSR (%)**

- **5-year TSR**

  - < 0%
  - 0%–10%
  - 10%–20%
  - 20%–30%
  - TSR median

  Circle size represents market capitalization

Sources: S&P Capital IQ; BCG analysis.

Note: N = 189 companies. NA = not applicable. Greater China here includes People’s Republic of China, Hong Kong, and Taiwan.
We have defined eight clusters in this subsector. Six of those clusters were at the top of the TSR ranking, and only one cluster was below the industry median. Paints and coatings had the highest TSR, at 20.9%. Pharma ingredients realized an 18.6% median TSR; food ingredients 17.5%; electronic chemicals 16.8%; personal care and hygiene 16.6%; adhesives, tapes, and construction chemicals 14.0%; and inks and pigments 11.7%—all above the overall industry median of 9.5%. The only outliers in the focused-specialty chemicals group were companies in the mining and oilfield cluster. Because of the decrease in demand related to falling commodity prices, these companies achieved a median five-year TSR of only 7.7%.

- **Industrial Gases.** This highly consolidated subsector comprises just eight companies. Even those that engage in other businesses derive the overwhelming share of their revenue from industrial gases. As a result, there is no reason to break this subsector into clusters. The five-year performance was 9.1%, slightly below the industry median of 9.5%.

- **Agrochemicals and Fertilizers.** Thirty-two companies in our sample generate all or most of their revenues from either agrochemicals or fertilizers, although this group includes some companies with substantial, but minority, specialty chemical operations. Mining is also an important activity for some. Although this subsector has suffered from the cooldown of commodity demand, it achieved a median TSR of 9.4% owing to the slightly stronger performance of companies headquartered in Greater China. Looking separately at agrochemicals and fertilizers, agrochemicals achieved a five-year median TSR of 10.3%, while fertilizers, particularly hard hit by a deterioration in potassium and phosphate prices, earned a median TSR of 3.5%.

---

**EXHIBIT 7 | The Top-Performing Product Clusters Are in Focused Specialties**

<table>
<thead>
<tr>
<th>Clusters</th>
<th>Median TSR, 2011–2015 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paints and coatings</td>
<td>20.9</td>
</tr>
<tr>
<td>Pharma ingredients</td>
<td>18.6</td>
</tr>
<tr>
<td>Food ingredients</td>
<td>17.5</td>
</tr>
<tr>
<td>Electronic chemicals</td>
<td>16.8</td>
</tr>
<tr>
<td>Personal care and hygiene</td>
<td>16.6</td>
</tr>
<tr>
<td>Adhesives, tapes, and construction chemicals</td>
<td>14.0</td>
</tr>
<tr>
<td>Additive and functional chemicals</td>
<td>12.0</td>
</tr>
<tr>
<td>Inks and pigments</td>
<td>11.7</td>
</tr>
<tr>
<td>Agrochemicals</td>
<td>10.3</td>
</tr>
<tr>
<td>Engineered, HP material, functional products</td>
<td>9.4</td>
</tr>
<tr>
<td>Industrial gases</td>
<td>9.1</td>
</tr>
<tr>
<td>Synthetic rubber</td>
<td>7.7</td>
</tr>
<tr>
<td>Mining and oilfield</td>
<td>7.5</td>
</tr>
<tr>
<td>Diversified</td>
<td>5.3</td>
</tr>
<tr>
<td>Fibers and intermediates</td>
<td>3.5</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>0.0</td>
</tr>
<tr>
<td>Vinyl chloride and PVC</td>
<td>-1.1</td>
</tr>
<tr>
<td>Petrochemicals and polymers</td>
<td>-0.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9.5</strong></td>
</tr>
</tbody>
</table>

---

**Base chemicals and basic plastics** | **Multispecialty** | **Focused specialties** | **Industrial gases**  
---|---|---|---

**Sources:** Company reports; S&P Capital IQ; BCG analysis.  
**Note:** The industrial gases subsector includes only eight companies and so has not been divided into clusters.
While TSR reflects investors’ expectations of the future performance of an industry, average return on capital employed (ROCE) can provide insights into how well a company has performed in the past. To gain more insight into past value creation in the chemical industry by subsector and by region, we looked at average ROCE over the past ten years, using data available for 133 of our 189 companies.

By Subsector
From 2006 through 2015, the focused-specialties subsector outperformed, generating an average ROCE of 12.3%. (See Exhibit 8.)

The base chemicals and basic plastics subsector underperformed in all regions over the past ten years, generating a global average ROCE of 6.3%. In contrast, agrochemicals and fertilizers excelled as expected as a result of the commodity cycle, with an ROCE of 11.4%. Multispecialties earned an average ROCE of 7.3%, only minimally better than that of base chemicals and basic plastics.

By Region
The 11.7% ROCE of companies headquartered in emerging markets was the highest in the world over the past ten years, approached only by companies headquartered in North America, at 11.1%, and nicely ahead of European chemical companies, at 9.2%.

In contrast, chemical companies in Greater China and those in Northeast Asia (which tend to be heavily exposed to Greater China) had the lowest ROCE globally, at 6.2% and 5.5%, respectively. These figures reflect four primary challenges: ineffective capital allocation; the increase in overcapacity; product offerings that lean toward less sophisticated, refined, or customized product grades; and, finally, a rapid buildup of the workforce, which makes it difficult to ensure consistent product and service quality. These issues have resulted in a highly competitive market for the standard range of chemical products, leading to extremely low prices and profit margins. Companies headquartered outside Greater China and North Asia have generally been less exposed to the Chinese market and have been more profitable as a result.

The chemical industry has been highly profitable in China in the past, especially prior to 2008, and could become so again with suffi-
cient consolidation. The dye industry, an early mover in this direction, may be a good prototype. In the 1980s and 1990s, this industry—dominated by European, Japanese, and US companies—was suffering from low margins because of competition from many small companies, especially in Asia, that benefited from rapid replication of product formulas. In the face of this competition, most established players exited the dye market and divested their assets. Two companies in China began to buy these distressed assets in an effort to counter the intense competition from local “fast replicators.” These two closely linked companies—Zhejiang Longsheng, one of our ten-year top performers, and Zhejiang Runtu—are now the global market leaders in dyes and two of the most profitable operators in the chemical industry, with average earnings before interest and taxes of 21.7% and 15.2%, respectively, over the past five years. One of their main profitability levers has been price-based margin expansion. If other Chinese chemical companies took similar advantage of outbound M&A, they might also achieve global coverage in their segments and improve their profitability.

**Over Time**

When we compare the chemical industry’s subsectors on the strength of their short-term and long-term TSR performance, we gain a number of revealing insights. For example, one might be tempted to argue that the relative strength of focused specialties is a short-term phenomenon resulting from the recent depression in commodities prices. However, when we compare the five-year median for this subsector with the ten-year median, we see only a slight difference.

**Short-Term and Long-Term Underperformers.** Most companies in the base chemical and basic plastics subsector underperformed in both the short term and the long term, including those in petrochemicals and polymers, the vinyl chloride chain, and

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### Exhibit 8 | Focused Specialties Has Outperformed All Other Subsectors in Return on Capital Employed

<table>
<thead>
<tr>
<th>Subsector</th>
<th>Base chemicals and basic plastics</th>
<th>Multispecialty</th>
<th>Focused specialties</th>
<th>Industrial gases</th>
<th>Agrochemicals and fertilizers</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMERGING MARKETS</td>
<td>6</td>
<td>NA</td>
<td>16</td>
<td>NA</td>
<td>13</td>
</tr>
<tr>
<td>EUROPE</td>
<td>8</td>
<td>8</td>
<td>13</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>GREATER CHINA</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>NA</td>
<td>7</td>
</tr>
<tr>
<td>NORTHEAST ASIA</td>
<td>5</td>
<td>7</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>NORTH AMERICA</td>
<td>9</td>
<td>10</td>
<td>12</td>
<td>10</td>
<td>14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Revenue CAGR &lt; 0.8x annual GDP growth</th>
<th>Revenue CAGR 0.8x to 2.0x annual GDP growth</th>
<th>Revenue CAGR &gt; 2.0x annual GDP growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTH AMERICA</td>
<td>6.3</td>
<td>7.3</td>
</tr>
<tr>
<td>EMERGING MARKETS</td>
<td>11.7</td>
<td>9.2</td>
</tr>
<tr>
<td>EUROPE</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>GREATER CHINA</td>
<td>11.1</td>
<td></td>
</tr>
</tbody>
</table>

**Sources:** S&P Capital IQ; BCG analysis.

**Note:** N = 133 companies; comparison is to nominal GDP of home country. Greater China here includes People’s Republic of China, Hong Kong, and Taiwan. NA = not applicable.
synthetic rubber. The same is true for many in the broadly diversified multispecialty subsector, in which companies tend to follow specialty chemical strategies—often associated with large M&A transactions—in a fairly synchronized way. Yet the TSR figures suggest that, despite those efforts, most fail to deliver comparatively superior shareholder value.

The primary reason is that all of these short-term and long-term underperformers have faced the same challenge—a rapid dilution of entry barriers due to the massive entry of China-based competitors over the past ten years. This situation may become even more challenging in light of China’s clearly defined ambition in its 13th five-year plan to enter high-performance and high-purity chemicals, advanced materials, and specialty grades of petrochemicals, which are the only remaining high-margin categories in the industry for European and American companies.

Short-Term Underperformers with a Better Long-Term Performance. For companies involved in mining and oilfield specialties and in the fertilizer subsector, long-term has been better than short-term performance, a clear sign of the impact of commodity price erosion. The fibers and intermediates cluster within base chemicals and basic plastics, although still performing well in the longer term, has been similarly affected in the short term by overcapacity.

Long-Term Underperformers with a Better Short-Term Performance. The most distinctive cases in this category are the electronic chemicals and the adhesives, tapes, and construction chemicals clusters within the focused-specialties subsector. These two clusters have underperformed in the long term, because investors have often considered them to be too cyclical. Their better short-term performance can be explained by the fact that both have been among the least affected by overcapacity in China. In addition, their businesses are benefiting at times from the low feedstock prices triggered by overcapacity.

Short-Term and Long-Term Overperformers. Three clusters in the focused-specialties subsector have excelled in both time horizons: food ingredients, paints and coatings, and personal care and hygiene. (See Exhibit 9.) We do not believe that their consistently strong performance is happenstance; instead, we argue that these clusters have offered the best opportunities for building resilient and

---

**EXHIBIT 9 | Paints and Coatings, Pharma Ingredients, and Food Ingredients Are the Most Successful Clusters**

![Median TSR, 2011–2015: 9.5%](image)

**Median 10-year TSR (%)**

- Mining and oilfield
- Fibers and intermediates
- Petrochemicals and polymers
- Dyed vinyl and PVC
- Diversified

**Median 5-year TSR (%)**

- Engineered, HP material, functional products
- Personal care and hygiene
- Agrochemicals
- Pharma ingredients
- Additive and functional chemicals
- Inks and pigments
- Adhesives, tapes, and construction chemicals
- Electronic chemicals

**Median TSR, 2006–2015: 9.9%**

**Sources:** Company reports; S&P Capital IQ; BCG analysis.
adaptive business models. Those models have been based on customers’ sensitivity to quality, such as in food ingredients; on proprietary distribution channels and strong brands, such as in paints and coatings; or on service-based, customized client offerings, such as those offered in personal care and hygiene.

How do the three focused-specialty clusters differ from other clusters in this subsector? (See Exhibit 10.) Consider the following characteristics:

- **High Gross Margins.** The three focused-specialty clusters operated at an average gross margin of more than 25.0% for the past ten years; food ingredients has the highest gross margin of all chemical clusters, at 43.4%. (In contrast, some more-challenged chemical clusters have had a gross margin of below 20% over the same period.) This high gross margin reflects, to some extent, the stronger pricing power that prevails in these clusters. All three benefit from ongoing innovation and a relatively high share of products customized to specific clients or applications. These three clusters have also managed to create a virtuous cycle: the high gross margin acts as a buffer through periodic downturns and allows management to have more stable, value-based pricing; to maintain a level of commercial and service resources during downturns; and to follow steadier commercial strategies. All this, in turn, improves gross margins. By comparison, businesses with thinner gross margins tend to reflect commodity cycles in their pricing behavior and to adjust the cost base of their commercial operations in a less stable way in an effort to secure their margins.

- **High R&D and SG&A Costs.** The three clusters had combined R&D and SG&A expenditures that ranged from 17.9% to 23.3% over the past ten years, compared with under 15% for most of the other chemical clusters. In our view, these high spending levels reflect the fact that successful companies in those clusters have created powerful customer-centric business models in which technical service, sales forces, and application

---

**EXHIBIT 10 | Three Focused-Specialty Clusters Stand Out**

<table>
<thead>
<tr>
<th>10-YEAR AVERAGE</th>
<th>Additive and functional chemicals</th>
<th>Adhesives, tapes, and construction chemicals</th>
<th>Agrochemicals</th>
<th>Diversified</th>
<th>Electronic chemicals</th>
<th>Engineered, HP material, functional products</th>
<th>Fertilizers</th>
<th>Fibers and intermediates</th>
<th>Food ingredients</th>
<th>Industrials</th>
<th>Inks and pigments</th>
<th>Mining and oilfield</th>
<th>Paints and coatings</th>
<th>Personal care and hygiene</th>
<th>Petrochemicals and polymers</th>
<th>Pharma ingredients</th>
<th>Synthetic rubber</th>
<th>Vinyl chloride and PVC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue growth (%)</td>
<td>5.1</td>
<td>6.5</td>
<td>12.9</td>
<td>1.2</td>
<td>14.5</td>
<td>9.6</td>
<td>11.0</td>
<td>4.8</td>
<td>9.9</td>
<td>4.7</td>
<td>10.3</td>
<td>14.2</td>
<td>6.3</td>
<td>5.3</td>
<td>7.0</td>
<td>2.3</td>
<td>1.5</td>
<td>6.3</td>
</tr>
<tr>
<td>Gross margin (%)</td>
<td>21.1</td>
<td>31.7</td>
<td>36.3</td>
<td>22.0</td>
<td>23.9</td>
<td>23.5</td>
<td>31.5</td>
<td>17.1</td>
<td>43.4</td>
<td>34.4</td>
<td>22.2</td>
<td>35.0</td>
<td>31.5</td>
<td>26.1</td>
<td>15.1</td>
<td>23.5</td>
<td>17.5</td>
<td>16.9</td>
</tr>
<tr>
<td>EBITDA (% of revenue)</td>
<td>13.7</td>
<td>14.7</td>
<td>18.6</td>
<td>13.8</td>
<td>20.6</td>
<td>15.5</td>
<td>25.2</td>
<td>11.9</td>
<td>25.8</td>
<td>23.4</td>
<td>14.4</td>
<td>17.5</td>
<td>15.1</td>
<td>15.1</td>
<td>14.9</td>
<td>14.3</td>
<td>12.6</td>
<td>5.8</td>
</tr>
<tr>
<td>EBIT (% of revenue)</td>
<td>8.8</td>
<td>9.9</td>
<td>14.6</td>
<td>8.9</td>
<td>14.0</td>
<td>12.1</td>
<td>19.9</td>
<td>6.4</td>
<td>21.3</td>
<td>15.1</td>
<td>10.5</td>
<td>14.1</td>
<td>12.1</td>
<td>11.1</td>
<td>9.6</td>
<td>8.6</td>
<td>12.1</td>
<td>8.4</td>
</tr>
<tr>
<td>R&amp;D cost (% of revenue)</td>
<td>0.8</td>
<td>0.7</td>
<td>2.8</td>
<td>2.5</td>
<td>1.9</td>
<td>1.0</td>
<td>0.1</td>
<td>0.4</td>
<td>4.6</td>
<td>0.6</td>
<td>0.3</td>
<td>0.5</td>
<td>1.0</td>
<td>0.9</td>
<td>0.4</td>
<td>1.1</td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>SG&amp;A cost (% of revenue)</td>
<td>11.5</td>
<td>17.1</td>
<td>19.6</td>
<td>12.4</td>
<td>11.5</td>
<td>10.5</td>
<td>10.8</td>
<td>8.5</td>
<td>18.7</td>
<td>20.1</td>
<td>13.5</td>
<td>16.5</td>
<td>22.4</td>
<td>17.0</td>
<td>5.3</td>
<td>14.7</td>
<td>6.6</td>
<td>15.2</td>
</tr>
<tr>
<td>Capex (% of revenue)</td>
<td>9.8</td>
<td>4.1</td>
<td>6.3</td>
<td>6.0</td>
<td>14.7</td>
<td>6.8</td>
<td>13.5</td>
<td>9.5</td>
<td>4.6</td>
<td>11.9</td>
<td>7.5</td>
<td>6.5</td>
<td>5.4</td>
<td>4.5</td>
<td>11.4</td>
<td>11.6</td>
<td>8.0</td>
<td>13.4</td>
</tr>
</tbody>
</table>

Sources: S&P Capital IQ; BCG analysis.
development labs represent barriers that can be more difficult for a new entrant to overcome than even large-scale manufacturing assets and embedded technology.

- **Low Capex Ratios.** Over the past ten years, these three clusters had among the lowest capital expenditures (expressed as a percentage of revenue) on average of all chemical sectors. The increased volatility of demand due to greater global economic uncertainty has created an advantage for low-capex businesses. They are more flexible in adjusting their asset structure to fluctuations in demand, and they have less need to make big bets on growth rates through large-scale investments in manufacturing.
EVEN THOUGH THE INDUSTRY’S overall five-year TSR is below that of previous periods and ranks relatively low among the industries we tracked, some chemical companies are flourishing. In fact, when only the ten companies with the highest TSR in each industry sector are considered, it becomes clear that the chemical industry has had some of the best five-year returns. The median TSR for the top ten chemical companies was 40% from 2011 through 2015, which would place this group sixth among the 28 industries we studied.

These top performers are headquartered in multiple regions. Perhaps not surprising, seven are focused-specialty chemical companies, while two are from the agrochemical subsector and one is a base chemical company. (See Exhibit 11.)

**EXHIBIT 11 | Top Value Creators Are Spread Across Regions and Subsectors**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PI Industries</td>
<td>India</td>
<td>Asia Paints</td>
</tr>
<tr>
<td>2</td>
<td>Hexpol</td>
<td>Sweden</td>
<td>Pidilite</td>
</tr>
<tr>
<td>3</td>
<td>Boai NKY</td>
<td>China</td>
<td>CF Industries</td>
</tr>
<tr>
<td>4</td>
<td>Frutarom</td>
<td>Israel</td>
<td>Zhejiang Longsheng</td>
</tr>
<tr>
<td>5</td>
<td>Nippon Paint</td>
<td>Japan</td>
<td>Guizhou Jiulian</td>
</tr>
<tr>
<td>6</td>
<td>Guangdong Sky Dragon</td>
<td>China</td>
<td>Biocause Pharm.</td>
</tr>
<tr>
<td>7</td>
<td>Chr. Hansen</td>
<td>Denmark</td>
<td>Shangying Global</td>
</tr>
<tr>
<td>8</td>
<td>Ciech</td>
<td>Poland</td>
<td>W.R. Grace</td>
</tr>
<tr>
<td>9</td>
<td>Grupa Azoty</td>
<td>Poland</td>
<td>Kaiping Chemical</td>
</tr>
<tr>
<td>10</td>
<td>SK Kaken</td>
<td>Japan</td>
<td>Synthos</td>
</tr>
</tbody>
</table>

Sources: S&P Capital IQ; BCG analysis. Note: Base = base chemicals and basic plastics; Multi = multispecialty; Focus = focused specialties; Gas = industrial gases; Agro = agrochemicals and fertilizers.
Although not all in this group have made similar business model choices, we see four recurring themes among them.

**Strong Serial M&A Capabilities.** In past reports, we have pointed out that “always on” M&A has been a characteristic of many successful companies, such as those on our top-ten list. In contrast, “single bet” M&A—a long spell of low M&A activity followed by a very large acquisition—has been a major source of value destruction.

Some top performers seem to embrace complexity as a competitive advantage.

In the flavor sector, for example, Frutarom, a global company based in Israel, is a serial acquirer of mostly smaller entities. It has built a strong reputation on its ability to integrate those companies and use them as a foothold to enter new locations. In just three years, from 2012 to 2015, the company successfully conducted 22 acquisitions—nearly one every six weeks. Its management is known for delivering the expected synergies: year after year, the company’s M&A deals have not only fueled above-average growth (more than 13% per year in the ten-year period since 2005) but also expanded the EBITDA margin—from 6% in 2005 to nearly 20% in 2015.

In another example, Hexpol, a Swedish polymers group, has built an international operating network through M&A-fueled growth. The company has shown strong acquisition and integration capabilities in a cluster of the chemical industry that is typically highly localized in its management style and customer interaction—a characteristic that generally indicates above-average integration risks. On the capital markets today, Hexpol has a reputation as a successful acquisition machine on a path to above-average growth.

While seven of the ten companies on our list have pursued growth through M&A for the past ten years, all ten have refrained from using M&A for large-scale consolidation and have mostly refrained from moving into adjacent areas through M&A. Instead, they have kept their M&A moves within the boundaries of their existing businesses.

**Ability to Embrace Complexity.** In an industry that produces about 40,000 distinct products, complexity is an ever-present concern. Management and investors worry that the industry’s fragmentation of products, customers, and raw materials will dilute capital and resource allocation, as well as management attention, and threaten to strand organizational initiatives. These issues weigh heavily on diversified multispecialty companies in particular. In their continual effort to reduce complexity, they outsource client groups to distributors, shut down smaller sites, prune their product offerings, consolidate country organizations into regional structures, and establish global suppliers. These initiatives may resolve short-term financial challenges, but in the long term they may not create value.

In contrast, some top performers seem to embrace complexity—even using it as a source of competitive advantage. Frutarom, for example, targets smaller food-processing companies as potential customers instead of looking to large global food companies, as its peers do. Its unusual customer focus creates more complexity in the commercial organization, but it also offers an advantage. Frutarom’s smaller customers are less capable of developing proprietary scientific capabilities and taste formulas. They are therefore willing to pay a premium for the innovation, service, and product development support they receive from Frutarom.

Grupa Azoty, based in Poland, provides another example. The company produces a wider range of fertilizer products than its European peers, including not only standard phosphate, potassium,
ammonium nitrate, but also ammonium sulfate and ammonium sulfate nitrate. Thanks to its diversified product mix—combined with economies of scale—Azoty is the supplier of choice to Poland’s scattered and fragmented farming industry. Through its in-house service and logistics capabilities, the company also helps shelter fertilizer prices in Poland from global market forces.

- **Differentiated Business Models.** Management teams tend to spend a lot of time in the quest for best practices, perhaps even more in emerging markets than in mature ones. Yet several of our top performers have developed successful business models generally considered to deviate from industry best practice. These business models have allowed companies to shield themselves from competition in a way that models more dependent on scale or proprietary manufacturing technologies would not.

The business model for PI Industries, for example, differs from the Indian agrochemical market’s traditional focus on generics. Instead, it concentrates on in-licensing less competitive agrochemicals active ingredients from global agrochemical companies (“originators”). The company has been helped in this effort by its reputation for protecting the intellectual property of licensing partners.

Christian Hansen, a global leader in cultures for the dairy industry, is another good example. While cost pressure and margin dilution are issues in multiple segments of the food ingredient industry, Christian Hansen has avoided these by developing a service-centric business model, partnering with its customers to improve their productivity. The company’s cultures may not differ from its competitors’, but the service element of the business model reduces the likelihood that customers will switch simply because of cost.

- **Tendency to Act Against Trends.** Commercial strategies in chemicals tend to follow industry trends; companies in each subsector tend to make similar choices and decisions. Yet a number of this year’s top performers seem to have acted deliberately against such trends. Nippon Paint, for example, unlike most of its peers in paints and coatings, expanded its position early in the fragmented Chinese refurbishment market for interior paint. Its peers, by contrast, have long relied on the exterior and interior paint market, which sells directly to project developers. As the new-construction market in China slows, Nippon’s strong position has created a significant competitive advantage for the company.

For large and diversified chemical companies, it may be more challenging to identify the kind of opportunities that have enabled the top performers to excel. Yet these four themes—strong, always-on M&A; the ability to build entry barriers based on complexity; distinct and differentiating customer-centric business models; and anticyclical tactics—should form the foundation of any business unit strategy discussion in diversified chemical companies.

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**Note**

ON THE BASIS OF our observation of the industry over the past year, we suggest that all chemical companies—across chemistries, subsectors, and even clusters—are applying one of four basic business models, each of which has yielded very different results. (See Exhibit 12.) Yet this year’s top performers have shown us that chemical companies need to differentiate their approach from that of their competitors in order to gain a competitive advantage.

- **Market-Based Business Models.** This category includes all companies that focus on competitive differentiation based on customized solutions, advantaged distribution channels, superior technical-service networks, agile supply chains, or faster

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**EXHIBIT 12 | Market-Based Business Models Outperform**

<table>
<thead>
<tr>
<th>Business Model</th>
<th>Median TSR, 2011–2015 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market-based</td>
<td>18</td>
</tr>
<tr>
<td>Asset-based</td>
<td>4</td>
</tr>
<tr>
<td>Technology-based</td>
<td>9</td>
</tr>
<tr>
<td>Diversified portfolio</td>
<td>8</td>
</tr>
</tbody>
</table>

**Sources:** Company reports; S&P Capital IQ; BCG analysis.
**Note:** N = 189 companies.
innovation cycles. Companies that predominantly follow such business models had a median TSR of 18% from 2011 through 2015.

• **Asset-Based Business Models.** This category comprises companies that rely on manufacturing scale, feedstock positions, superior capex management, or investment timing. Companies in this group had a fairly depressed median TSR of 4% from 2011 through 2015.

• **Technology-Based Business Models.** Companies in this category rely on differentiating manufacturing technologies such as process development capabilities, superior production and maintenance concepts, and catalyst research. These companies achieved a median TSR close to the five-year industry median of 9.5%.

• **Diversified Portfolio.** This category comprises companies with portfolios that contain a relevant and visible share of all three of the above business models. These truly diversified companies generated a median TSR of 8% for the five-year period, slightly below the industry median.

**Lessons from Market-Based Models**

The market-based business model has been the primary source of value creation in the chemical industry in recent years, while the asset-based business model has trailed. One could perhaps argue that this outcome is a coincidence—that the poorly performing basic and polymer and multispecialty subsectors are simply more suited to the asset-based business model, while focused specialties may offer more visible and accessible options for the market-based model. However, we find that the lessons of superior value creation from the market-based business model are worthwhile for the management teams of almost every chemical business.

These lessons include the need to support—and even favor—smaller-volume, high-margin products as well as customized technology solutions, investments in small but flexible assets, rapid customer delivery, and the buildup of in-house sales organizations in midsize countries such as Indonesia and Colombia, not just in the largest markets, where every company has a presence. Each of these elements can create market-based advantages for any player.

**Companies without the mindset for a market-based business model risk failure.**

We believe that companies lacking the mindset to chase the opportunities offered by a market-based business model run a higher risk of failure than they did in the past. This is particularly true given the sometimes unseen opportunities that digitalization offers for increased flexibility and enhanced customization capabilities, whether in the supply chain, customer service, or product development.

**Distinct Approaches**

Having looked at the individual business models, we assessed whether value creation depends on how a particular business model is applied. (See Exhibit 13.)

**Market-Based Business Model.** In companies that primarily follow a market-based business model, we found three distinct approaches: an industry and applications focus, a custom-synthesis focus, and a formulation focus.

• Companies with an industry and applications focus have built their business models around bundles of chemical ingredients that serve certain customers, such as the paper industry, or functional needs, such as biocides. These companies achieved a median TSR of 10% from 2011 through 2015.

• Companies that focus on custom synthesis develop and manufacture customized ingredients or formulations on behalf of another company. This is an approach with great importance for pharmaceutical ingredients and agrochemical intermediates. These companies had a median five-year TSR of 13%.
Companies with a focus on formulation concentrate on blending chemicals to create customized solutions for specific customer industries, such as coating companies, and have, at most, limited in-house chemical operations. These companies had the highest median five-year TSR of those with a market-based business model, at 19%.

Asset-Based Business Model. Within companies that follow an asset-based business model as a priority, we found several distinct expressions based on the companies’ products. We note that one unanswered question is whether swings in the commodity cycle of the underlying feedstock explain in part the observed performance of this business model.

For the period 2011–2015, the TSR of the fertilizer industry was below the industry average: phosphate and potash players had a median TSR of –17%, ammonia- and nitrogen-focused companies had a median TSR of 8%.

Companies focusing on core petrochemicals differed by their share of downstream operations. Those with a relatively high share of C1 processing realized a low TSR over the five-year period, at 4%, as did companies with a relative high share of C2 and C3 processing, at –1%. These results were heavily influenced by the underperformance of emerging-market players. Companies with a focus on C4 processing were only slightly weaker in their TSR than the market average, at 8%, while companies with above-average exposure to C6-based intermediates generated a median TSR of 13%.
Navigating the Territory of Extremes

Time to Refocus

All of the above results reflect the general saying that “the age of the molecule is over.” This is factually incorrect; nonetheless, in an increasing number of chemical industry segments we have seen that new levels of performance come less from the identification of new molecules and more from the refinement and sophistication, or combination, of existing ones. Examples can be drawn from any segment, including the emergence of metallocene polyolefins, the above-average growth of blended engineering plastics and co-polymers (as opposed to base resin), and the development of composite materials. For today’s companies, this trend means continually rethinking their position in the chemicals value chain and the focus of their R&D activities.

Two possible challenges to this kind of refo cusing include the following:

- New opportunities for value-added offerings often emerge at the edges of a company’s existing customer base. Sometimes the functional layer that will be in the best position to capture such opportunities is not well defined. In addition, executives often face the risk that new offerings will be seen by sales and other market-facing organizations as posing challenges to the current customer base, rather than offering opportunities for growth and margin expansion.

- R&D organizations tend to focus resource allocation on existing, profitable core products and processes. New value-added offerings pose the risk associated with any new venture, and they may require additional scientific skills and other resources.
What lessons from our findings can help chemical companies shape their portfolios and business models? First, while boards and executives in the industry have accelerated the speed of divestitures and acquisitions in recent years, our data indicate that these actions have not automatically delivered the hoped-for results. (See Exhibit 14.) Neither the chemical companies that made an above-average number of acquisitions nor those that sold assets have outperformed the market. The lesson we derive from this may be that companies need to balance the tradeoff between the resilience and coherence of the portfolio and the choice of business model. That is, they must consider whether they

Exhibit 14 | M&A and Portfolio Transformation Do Not Necessarily Create Value

<table>
<thead>
<tr>
<th>Companies with Major Acquisitions</th>
<th>Companies with Major Divestitures</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSR, 2011–2015 (%)</td>
<td>TSR, 2011–2015 (%)</td>
</tr>
<tr>
<td>Minimum</td>
<td>−25</td>
</tr>
<tr>
<td>Maximum</td>
<td>38</td>
</tr>
<tr>
<td>Median</td>
<td>9</td>
</tr>
<tr>
<td>Average</td>
<td>9</td>
</tr>
<tr>
<td>Total # of companies</td>
<td>72</td>
</tr>
<tr>
<td>Minimum</td>
<td>−5</td>
</tr>
<tr>
<td>Maximum</td>
<td>21</td>
</tr>
<tr>
<td>Median</td>
<td>9</td>
</tr>
<tr>
<td>Average</td>
<td>6</td>
</tr>
<tr>
<td>Total # of companies</td>
<td>23</td>
</tr>
</tbody>
</table>

Base chemicals and basic plastics • Multispecialty • Focused specialties • Industrial gases
Agrochemicals and fertilizers

Sources: S&P Capital IQ; BCG analysis.
are adequately diversified and whether they are keeping complexity under control through shared processes, standards, and capabilities.

Given the complexity of the chemical industry, excessive diversity can make it hard for leaders to allocate resources among businesses in a way that creates value. It also makes it harder to anticipate emerging opportunities.

Nonetheless, the volatility of regional demand and relative feedstock cost, the potential damage from the loss of proprietary know-how, and less-than-stable customer industries suggest that an excessive focus in one area could also be an overly risky approach—and may be even more so in the future.

An always-on transformation mindset is the true differentiator.

From our perspective, the best response to this dilemma is a continual rethinking and adjusting of the business model by the management team. One could believe that corporate transformation is a singular, massive event, but in our view the opposite is true. Or one may believe that transformation is primarily about changing the composition of the portfolio. As noted above, however, this approach has not guaranteed success.

In our view, the true differentiator is—and will be even more so in the future—the ability to have an always-on transformation mindset. Digitalization, emerging players, and feedstock price volatility are just a few of the reasons why chemical companies today need to reevaluate, reenergize, and continually adjust the boundaries of their activities, of their functional layers, and of their operating model.

Note that the ability simply to identify parts of the portfolio as noncore and divest them is not a differentiator. Rather, companies should rethink the operating model for each business unit, adjust its capabilities, and abandon non-value-creating manufacturing, supply chain, and commercial ways of operating before their peers make such moves. Each unit should rapidly embrace opportunities to equip the workforce with new and differentiating capabilities, digitize processes, and, most important, reject the embedded operating rules and norms of the past.

We suggest two guiding practices to shape the transformation of chemical companies:

- **Achieve business resilience.** While key proprietary know-how about core chemical manufacturing processes was once a powerful and sustainable source of competitive advantage, this is less and less the case. Proprietary knowledge is often not as protected as it used to be from both legitimate and illicit access by new competitors. This would seem to present a challenge to companies in clusters, such as paints and coatings, that rely heavily on proprietary knowledge. Yet in recent years, an increasing number of paint and coating companies have filled the ranks of our top value creators. In our observation, this is because success in this space stems from a steady accumulation of expertise in batch processing and in recipes for combining raw materials that meet customers’ needs. In addition, the small-lot, high-SKU production inherent to the paint business is a barrier to new entrants, as there is less risk of failure due to the loss of any one piece of knowledge. We believe such a barrier can often be created by embracing a number of product varieties, customers served, and go-to-market approaches within one business. Being a frontrunner in the digitalization of processes and offerings is also an option for successfully embracing complexity as a source of competitive differentiation.

- **Achieve portfolio coherence.** The diversification of chemical companies’ portfolios remains a trigger for underperformance, given the real risk of resource misallocation. Divesting can be an option for improving value creation, but we have seen that reducing diversity for its own sake is a risky move. Instead, we recom-
mend creating a portfolio in which all businesses have similar success factors and a coherent set of capabilities. Such portfolio coherence can serve as the basis for a number of successful operating models. As market uncertainties increase and the pace of technological change accelerates, the strong link between a coherent set of capabilities and the business portfolio will be a key success factor in building a company’s resilience.

The challenge is not, in our view, to have several highly diverse businesses in one company—coating ingredients and engineering plastics, for example—as long as these businesses have similar operating models. Portfolio coherence is lost when the coating ingredient business is focused on the development of custom grades and highly differentiated dispersions, while the engineering plastics unit is focused on large-volume grades, with limited capability in small-volume blends and compounds. In this situation, the businesses would require different approaches to engineering standards, go-to-market capabilities, the operating models of country organizations, and even the standards applied in the R&D stage-gate process.

The solution to such a lack of coherence in the portfolio, as noted earlier, is not necessarily a divestiture of assets. There is a risk in divestiture of overly focusing the portfolio—reducing the number of chemistries, technologies, customer industries, and underlying customer trends supporting the company’s revenue growth. In this world of high volatility and unexpected disruption along nearly every macroeconomic, geopolitical, and technological parameter, this kind of focus can result in a sudden and massive erosion of the revenue base. Instead, companies should transform their businesses and functions to ensure that they operate within shared capabilities and processes. This is a truly differentiating approach.
In the next few years, chemical executives will need to confront major global challenges—whether political, economic, or ecological—along with a secular slowdown in growth. Opportunities and risks will emerge from unexpected short-term volatility more often than from long-term trends. In addition, pressure from activist investors will increase in the new normal of low returns. When shaping the portfolio, therefore, the tradeoffs involved in balancing resilience and coherence will be highly complex and sophisticated. We suggest ten probing questions to assess a chemical company’s ability to balance these tradeoffs:

• Does your company’s competitive advantage rely on a few core technologies, or are the sources of advantage spread across multiple differentiating features?

• Are the capabilities and management approaches of the business units in your portfolio highly divergent, or do they have similar operating models that enable portfolio coherence?

• Do your unified processes and shared platforms embed compromises for the sake of corporate consistency, or do you consider them the best possible approach for each business in your portfolio?

• Would your key talent in customer-facing functions of one business unit easily become as successful in other business units?

• Do your central technological functions excel in expertise and value-added support for all manufacturing operations in a similar way?

• Do you frequently hear, “We should not compete against our customers,” or do you see a regular emergence of value chain moves and new business models and ventures?

• Does your business focus purely on the development of product variations, or does it regularly develop successful value-added customer offerings?

• Do you implement best-practice sharing across your operations by imposing them from the top down, or do you implement them through resilient, self-directed, internal business activities?

• Has your operational management moved to digital but remained otherwise unchanged? Or does it have a thorough digitalization agenda with a clear ambition to increase the effectiveness of the go-to-market model, the flexibility of assets, the agility of the supply chain, and the customization of the product offering?
• Does the leadership have an always-on transformation mindset, or is there a quest for extended periods of stability?

Shaping the portfolio is an enormous challenge, perhaps greater in chemicals than in any other industry. Balancing the key tradeoffs of resilience versus coherence and refraining from simplistic solutions will remain essential tasks for executives. Creating value may come less from large-scale portfolio shifts than from granular and constant efforts to elevate functions and operations to a higher level of capability, along with a strong emphasis on the opportunities that digitalization offers to every function and operation.

Shifting the business to the most advantageous positions and deploying the full opportunities of customer-centric business models will require a readiness to challenge the approaches and rules of the past, and the ability to adjust more rapidly than the competition. These will be, we believe, the primary differentiating traits of value creation champions in the years to come.
NOTE TO THE READER

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For Further Contact
This report was sponsored by the Industrial Goods practice. BCG works with its clients to deliver solutions to the challenges discussed in this report. These clients include some of the largest and most successful chemical companies in both developed and emerging economies. If you would like to discuss the insights contained within this report or learn more about the firm’s capabilities in the chemical industry, you may contact the authors or your local BCG team.

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