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End market alchemy
Expanding perspectives to drive growth in the global chemical industry

Global Manufacturing Industry group
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Why end markets? Why now?

The global chemical industry experienced an encouraging recovery after the unprecedented challenges of the economic crisis in 2008–2009. Several chemical companies reported record earnings in 2010 as demand rebounded and improvement actions took hold. Although welcome, this brief upturn could be a short lived peak as uncertainties about the future have resurfaced. Always an industry with many variables at play, the global chemical industry is preparing to take on more challenges ahead.

Since 2000, the industry's growth rate has declined by half, while oil-based raw material costs have steadily climbed.[1] Significant reductions have been made in overhead and fixed costs to offset as much lost profit as possible. Yet the industry as a whole is nearing a point of diminishing returns in terms of cost reduction being a major value driver (particularly without structural change); some companies in the industry have come full circle and are now examining the role and importance of certain costs in enabling growth, or in limiting growth when not spent. This presents a dilemma in a competitive and rapidly changing world and has inspired the Deloitte Touche Tohmatsu Limited (DTTL) Global Manufacturing Industry group to analyze critical questions focused on innovation and growth. Central to this debate are issues about the role of end markets and the opportunities or risks they present to future growth and other questions such as the following:

- Do customers in end markets, when better understood, offer opportunities and strategies to chemical companies for growth and economic value? Which markets offer the greatest promise?
- How can a company better understand end market complexity?
- Are there instructive examples of innovative approaches to customers and markets inside and outside the global chemical industry?

A DTTL Global Manufacturing Industry group study entitled *The chemical multiverse: Preparing for quantum changes in the global chemical industry* reported that megatrends present challenges requiring new solutions — products, services, and know-how — developed as a direct response to unmet needs in existing or developing end markets.[2] In some cases, new solutions were neither the domain of an existing industry nor easily classified by type of company. *End market alchemy: Expanding perspectives to drive growth in the global chemical industry* seeks to understand if and how chemical companies are going to tackle the potential new demand, and how much deviation from traditional asset and value chain driven product development would be needed to be successful (see sidebar "About the research"). It can be posited that new business models are anchored in a greater focus on systems and solutions thinking, open innovation, and consumer and cultural awareness. DTTL's Global Manufacturing Industry group examines how such an updated, market-focused growth model would take committed chemical companies beyond the more traditional industry role as purveyors of liquids and solids.

Summary of the analysis

To address the question of how the global chemical industry can play a more active role in developing growth

1 DTTL Global Manufacturing Industry group, "The decade ahead: Preparing for an unpredictable future in the global chemical industry," 17 December 2009, www.deloitte.com/thedecadeahead.

2 DTTL Global Manufacturing Industry group, "The chemical multiverse: Preparing for quantum changes in the global chemical industry," 16 November 2010, www.deloitte.com/thechemicalmultiverse.

About the research

DTTL Global Manufacturing Industry group conducted primary research of 60 interviews and questionnaires with end markets and chemical industry executives from around the globe in order to develop this report, *End market alchemy*. Secondary research was conducted by exploring both company-specific and market trends. Approximately 10 years of financial information for 230 chemical companies and 3,000 end market companies was compiled and assigned to industry groups and end markets segments. The analysis also includes 16 end markets encompassing 55 segments including personal care, health care, household, nutrition, apparel and textiles, transportation, mining and metals, machinery, automotive, construction and infrastructure, electronics, paper and packaging, commercial printing, energy, water, and agriculture.

Source: DTTL Global Manufacturing Industry group.

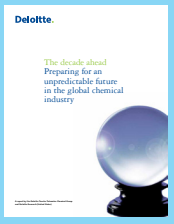
opportunities, it is important to take a broader view of the end markets and understand the landscape at a granular level. The DTTL Global Manufacturing Industry group anticipates future strategic plans will include models that take into account changing dynamics and trends in key end markets, as well as potential new solutions that will enable growth and value creation.

For example, it is clear that a number of end markets are experiencing rapid changes as megatrends such as green/sustainability, resource scarcity, and urbanization continue to raise new issues and challenges. As society and businesses address these challenges, migration of value can be faster and more dramatic than ever before: disruptive solutions enter the scene, technologies converge, and interdisciplinary approaches push the frontiers of existing markets, all in response to an unprecedented number of unmet needs. It is not a coincidence that the DTTL Global Manufacturing Industry group reports end markets seem to be experiencing increased volatility in traditional products and markets, enough to impact the performance and positioning of global chemical industry players.

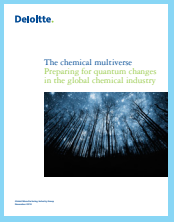
The research in *End market alchemy* has four key themes:

1. End markets have gone through dramatic change from both a profitability and a growth perspective. Not all end markets rebounded after the economic crisis in 2008–2009; some markets need to reset and are still in transition. The pace of change has also increased across all major end markets.
2. New market segments and those with the highest consumer intimacy were the most profitable. Companies committed to serving consumers and/or providing new solutions tended to invest heavily in understanding their customers' needs, differentiating themselves in the customers' eyes and disrupting the status quo.
3. The convergence of technologies and new market demand creates opportunities for collaboration along the value chain and among industries. Solving challenges that arise from megatrends is not the domain of any given industry — including the global chemical industry.
4. A value network approach that links adjacent markets and gaps in the overall market's ability to provide solutions for unmet needs can enable early detection of new customer segments and potential untapped value.

The Chemical 2020 series so far: This study in context



The decade ahead is the first report in the Chemical 2020 series and examines the performance of 231 publicly traded chemical companies over 10 years. The analysis shows that regardless of segment, chemical companies dealt with margin pressure, increased cyclicality, and reduced investment in research and development (R&D), sales and marketing. It noted fewer breakthrough innovations, and documented a period of global overcapacity in the wake of the economic crisis in 2008–2009. It questioned the formula for future success and discussed three scenarios for navigating the uncertainty the industry faced in 2009. Surprisingly, the report documented that over one-fourth of the 231 companies analyzed did not earn the cost of capital, which became a point of specific investigation in the second report in the Chemical 2020 series, entitled *The chemical multiverse*.



The chemical multiverse, the second report, sought strategies and solutions that could address the challenges raised in the first report. With traditional segmentation into commodity, integrated, and specialty industries proving inadequate as a basis for deciding the best strategies for the next decade, *The chemical multiverse* looked deeply into the various chemical companies' starting point for the decade based on their performance over the previous 10 years and their current ability to invest in future opportunities. The report also identified nine strategic drivers that could be pursued and combined in order to strengthen performance and improve competitiveness in a changing global environment. *The chemical multiverse* also introduces the megatrends that are being examined in more depth in this report, *End market alchemy*.

To read the first two reports, please visit **www.deloitte.com/thedecadeahead** and **www.deloitte.com/thechemicalmultiverse**.

Source: DTTL Global Manufacturing Industry group.

DTTL's Global Manufacturing Industry group found that certain active solution providers had the most ideal intimate relationships and creative business models. These providers placed greater emphasis on industrial marketing, value pricing, collaborative innovation, and differentiated and integrated supply chain management.

Expanding perspectives

Taking a broader view of end markets is increasingly relevant as the pace of change in these markets accelerates. Companies are responding to the changes, as evidenced by a rise in the frequency and intensity of collaboration among players with complementary skills

who are attempting to assemble the requisite diverse capabilities to develop new solutions and manage risk. These situations present opportunities for chemical companies to rethink, redesign, and reinvent their market approaches, which can result in a portfolio of business models tailored to specific end market requirements.

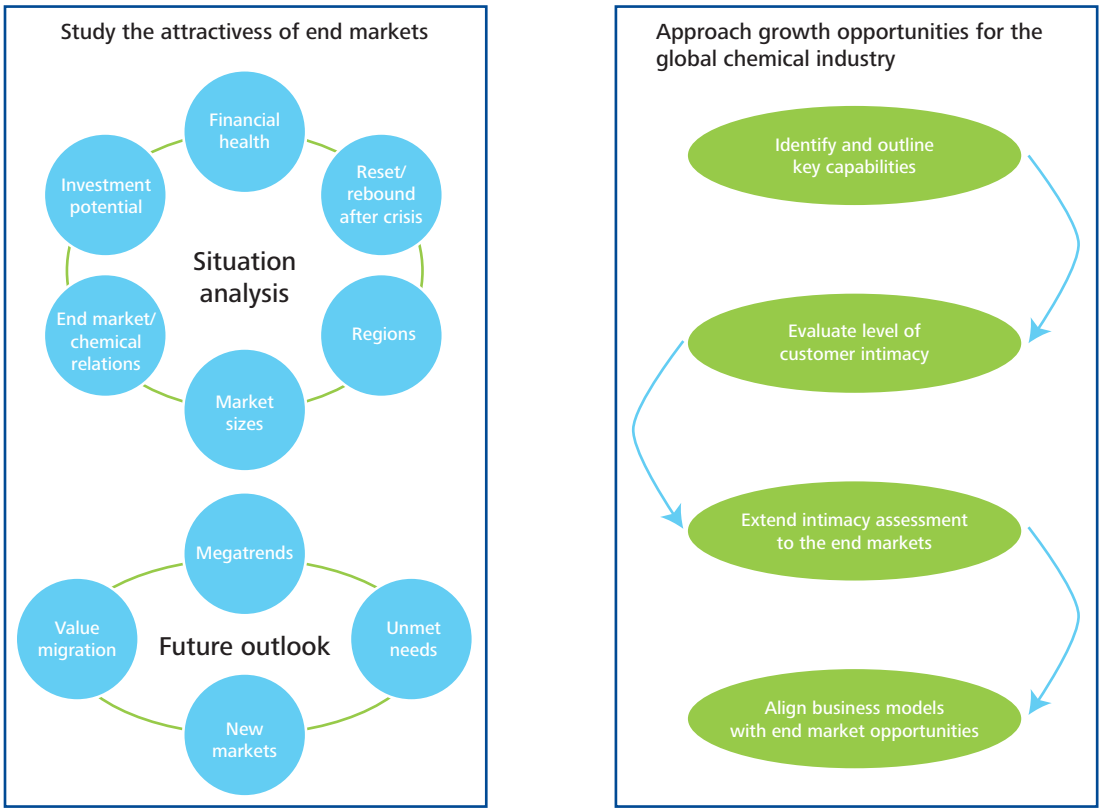
This collaboration and new market thinking is apparent in a type of food technology, known as nutraceuticals, which combines food and pharmaceutical products.[3] It is also visible in the recent upstream integration of NEC, a leading global electronics maker combining with bioplastic technology to develop shape memory and recyclability.

3 Nutraceuticals.com homepage, accessed 17 October 2011, www.nutraceuticals.com.

End market alchemy examines the importance of end markets to the global chemical industry and the shift that is occurring those markets. It is the third in the Chemicals 2020 series of reports (see sidebar "The Chemical 2020 series so far: This study in context"), which expressly considers how changing trends and revolutionary business models address new and different market opportunities (see Figure 1) and profitability challenges in the global chemical industry. The report has three sections:

1. **Analysis of end markets:** Looks closely from different angles at the current situation in major end markets and end market segments. Included is an analysis covering the performance and attractiveness of 16 end markets with 55 segments (see Figure 2). It examines if and how specific end markets rebounded after the economic crisis in 2008–2009 and highlights the markets that are resetting, factors in regional developments, and trends in margins over time.

Figure 1: Approach for the study: Analyzing end markets to create more value



Source: DTTL Global Manufacturing Industry group.

Figure 2: End markets and segments

End market	Segment
Personal care	• Hair care • Skin care • Cosmetics • Dental hygiene • Personal hygiene • Cosmeceuticals • Fragrances
Health care	• Equipment (medical devices) • Supplies (disposables) • Pharmaceuticals, biotechnology
Household	• Non-durable household goods • Home furnishing • Household appliances • Housewares
Nutrition	• Packaged foods and meat • Beverages (distillers, brewers, and soft drinks) • Nutraceuticals
Apparel and textiles	• Apparel and textiles • Leather
Transportation	• Aircraft manufacturing • Ship and boat manufacturing • Railway manufacturing
Mining and metal	• Precious metals (gold) • Iron ore for steel • Base metals (nickel, lead, zinc, and copper) • Aluminium
Machinery	• Construction machinery • Other machinery

End market	Segment
Automotive	• Passenger cars • Trucks and buses • Tires and rubbers
Construction and infrastructure	• Residential (housing) • Non residential buildings • Infrastructure
Electronics	• Global electronic equipment and instruments • Global semiconduct and electrical components • Office electronics • Consumer electronics • Cables • Television
Paper and packaging	• Printing and writing • Packaging (plastic) • Packaging (paper) • Fiber (pulp) • Toiletries
Commercial printing	• Commercial printing (cartridges)
Energy	• Oil and gas • Energy/Electrical utilities • Wind • Solar • Battery
Water	• Water utilities (water treatment)
Agriculture	• Pesticides • Fertilizer • Agriculture products

Source: DTTL Global Manufacturing Industry group.

2. **Seizing end market opportunities:** Concentrates on factors that can affect the outlook for end markets. It defines and analyzes megatrends that are likely to have a significant effect on end markets. Behavioral patterns of specific end markets and migration trends in industry value chains are discussed. This results in the definition of various unmet needs that could present growth opportunities for the global chemical industry.

3. **Evaluation of end market approaches:** Discusses various methods of addressing different market opportunities. It closely considers how the starting point of a chemical company influences its choices. It also looks into the attractiveness of certain opportunities and presents one important measure of the attractiveness of the major end markets to the global chemical industry. Finally, six different business models are defined that incorporate key capabilities necessary to succeed.

Analysis of end markets

The current situation: End market performance

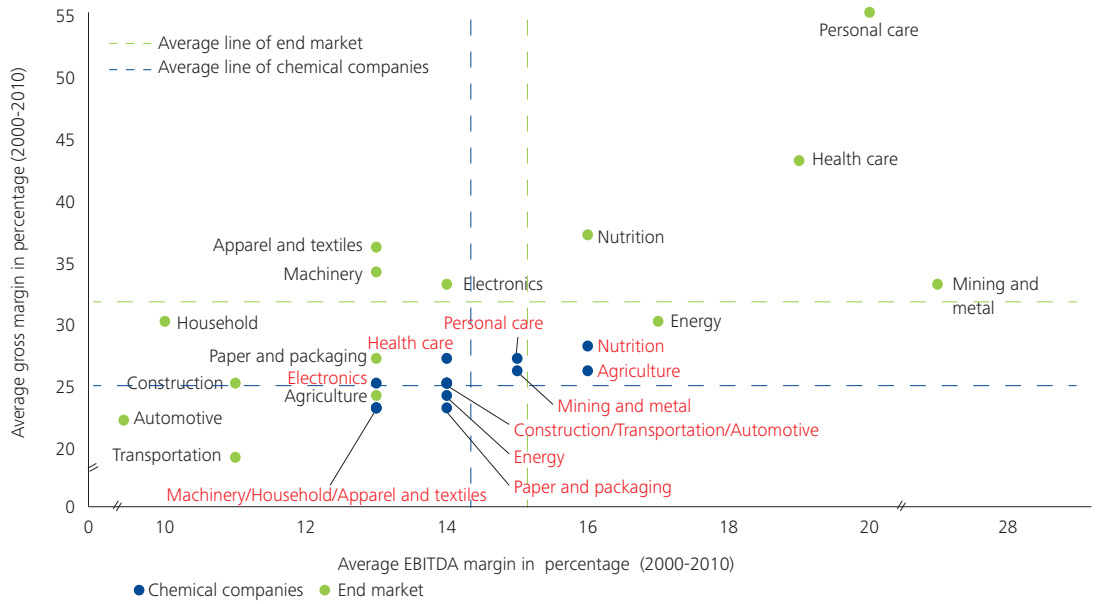
The DTTL Global Manufacturing Industry group analyzed the performance of over 3,000 companies in 16 major end markets and 55 segments over the last decade. This analysis is intended to provide insight into the financial health of the various end markets. It highlights trends that were either held in common with or different from those observed in the global chemical industry during the same 10-year period.

A major finding of this analysis is a heterogeneous picture of performance, as some end markets lost margin while others were more stable. Only a quarter of the end markets analyzed grew in gross margins (personal care, mining and metal, water, and construction and infrastructure). In the same period, gross margins of the global chemical industry were also under pressure and declined more than 300 basis points.

A plot of the 10-year average gross margin versus the average earnings before interest, taxes, depreciation, and amortization (EBITDA) margin (see Figure 3) for the 16 end markets studied and the chemical companies supplying those end markets shows that the chemical industry's average EBITDA margin of 14.1 percent compares favorably to the 14.7 percent average of the end markets, whereas the average gross margin of the end markets is much higher (33 percent) than that of the global chemical industry (25.6 percent). Note that a comparison of global chemical industry gross margins with those of its end markets is not particularly meaningful, but showing how close EBITDA margins of the end markets are to those of the global chemical industry reveals how much more end market companies invest in R&D and in selling, general, and administrative (SG&A) expenses.

Companies in highly competitive end markets that have a lower potential to differentiate themselves (such as transportation, agriculture, and construction and infrastructure), or that are more regulated and have higher asset intensity, had lower gross margins. Not surprisingly, those companies had higher cost bases and did not invest as much in marketing as those in end markets such as life sciences and consumer products.

Figure 3: EBITDA margins and gross margins (2000–2010)



Notes:
Red color differentiates end market supplier from chemical companies.
*EBITDA margin = EBITDA/revenue

Source: Capital IQ data and DTTL Global Manufacturing industry group analysis.

Companies in the life sciences end markets (i.e., nutrition, health care, personal care, etc.), which have relatively high customer intimacy and business models relying on product differentiation, tended to be more profitable. With innovative marketing, life sciences companies were able to sustain good margins based on a perception of greater value. Examples are companies that follow consumer trends such as designer bottled-water products, premium brands of clothing and textiles, and products that lead or follow fashion.

Almost obsessively, the global chemical industry has been driving down costs for the last 20 years. It reduced average SG&A costs by 7.5 percent[4] from 2005–2010 to offset other pressures on profitability. With little room now left to cut costs, what will the industry do? Will it follow most of its strategic leader companies and establish positions on one or two megatrend frontiers? Will chemical companies be able to take advantage of market and technology opportunities by managing their own resources? What has become clear is that a systematic focus by chemical players on their end markets is an encouraging approach to help sort through future issues and scenarios.

Analyzing global end markets

DTTL's Global Manufacturing Industry group has uncovered several factors and key elements that became apparent and important during the analysis of end markets. Overall end market and segment sizes, drivers of growth, current financial situation, outlook by region, end market segment performance, and the propensity for megatrends to influence all of the above are among the most decisive factors. Once the key factors were identified, they were matched against the individual company's skills and ability to serve those markets, and an assessment was made of how well aligned with the needs of other end markets the company's performance and capabilities were. The outcome of the analysis showed wide variation from one end market to another (see Figure 4).

Figure 4 presents common key factors considered in an evaluation of end markets and the global chemical industry itself. The key factors in this synopsis show wide variation and can form the basis of a model for chemical companies to start to bring additional depth and understanding to their own strategic assessments; they can also help to generate insights during the assessment of growth opportunities.

Figure 4 ranks the top 14 end markets in descending order by the size of revenues the global chemical industry has in those markets. Color coding depicts how the 14 end markets fared in the economic crisis in 2008–2009 by region. It also distinguishes between end markets currently in reset mode, those that have rebounded, and those that were largely unaffected. The figure segments these reset, rebound, and unaffected designations by region and color codes them by the range of growth expected through to 2014.

Figure 4 reveals some interesting insights:

- Eight end markets accounted for 93 percent of global chemical industry revenues in 2009
- The growth outlook across most end markets and regions is greater than 5 percent based on 2009 data
- The automotive and construction end markets in North America and the paper and packaging industry globally are the only end markets that have not rebounded to pre-crisis levels
- Life sciences end markets (i.e., nutrition, healthcare, personal care, etc.) are the only ones that remained stable during the crisis across every region
- Negative growth occurred in 7 out of 14 end markets in the 2008–2009 economic crisis

Demand growth in one end market typically leads to demand growth in supporting and adjacent markets. For example, the outlook for growth in the construction market is in the Asia-Pacific region is positive.[5] This is driven in large part by the expectation that a large middle class will emerge in China. Growth in the construction market has boosted demand in other markets, such as mining and metals. This significant increase in demand by China has resulted in greater competition for basic resources such as oil, metals, and wood and is a driver for rising commodity prices. Growth in China, led in large measure by construction, has fuelled the global economy but has also resulted in over capacity of apartments and the vacancy

4 DTTL Global Manufacturing Industry group analysis.

5 Davis Langdon, "World Construction 2011," accessed 18 October 2011, www.davislangdon.com.

rate for the nation's private, commercial housing stock is between 25 and 30 percent.[6]

The world experienced shifts in demand from one region to another over the last two decades as manufacturing and services moved to lower labor-cost markets. Further compounding this was the investment by certain "developing" countries in significant new production capacity. Yet the labor-cost advantages that were responsible for a significant transition of production assets have proved to be temporary. For example, China's labor costs have been rising in its apparel and textile industry, which has experienced a 30 to 40 percent cost increase

6 Economy Watch, "200 Million Empty Apartments? China's Complex Property Market," 21 December 2010, www.economywatch.com.

Figure 4: End market current situation, size and revenue, and outlook

End market	End market size and chemical revenue from end market		Current situation (reset/rebound/stable)				Outlook (2010-2014)				
	Chemical revenue (US$ billion)	End market size (US$ billion)	North America	Europe	Asia Pacific	Latin America	Global	North America	Europe	Asia Pacific	Latin America
Construction	695	8,016	Reset	Reset	Stable	Stable	10–15%	5–10%	5–10%	10–15%	5–10%
Electronics	371	2,458	Rebound	Rebound	Stable	Stable	5–10%	0–5%	0–5%	5–10%	0–5%
Household	159	800	Stable	Rebound	Stable	Stable	0–5%	0–5%	0–5%	0–5%	5–10%
Agriculture	142	1,772	Stable	Stable	Stable	Rebound	5–10%	5–10%	0–5%	5–10%	10–15%
Paper and packaging	130	702	Reset	Reset	Stable	Reset	0–5%				
Automotive	128	1,932	Reset	Reset	Stable	Stable	5–10%	0–5%	5–10%	5–10%	10–15%
Health care	113	1,368	Stable	Stable	Stable	Stable	5–10%	0–5%	0–5%	5–10%	15%
Energy	113	3,833	Rebound	Rebound	Rebound	Rebound	5–10%	5–10%	5–10%	10–15%	5–10%
Transportation	61	1,023	Rebound	Rebound	Stable	Stable	0–5%	0–5%	5–10%	10–15%	15%
Nutrition	29	4,022	Stable	Stable	Stable	Stable	0–5%				
Personal care	20	225	Stable	Stable	Stable	Stable	0–5%	0–5%	0–5%	0–5%	5–10%
Machinery	15	457	Reset	Reset	Stable		5–10%	5–10%	5–10%	5–10%	
Apparel and textiles	11	1,097	Reset	Rebound	Stable	Reset	0–5%	less than 0%	0–5%	5–10%	5–10%
Mining and metals	4	1,333	Reset	Reset	Stable	Rebound	10–15%	0–5%	0–5%	15%	5–10%

- Reset: Economic crisis in 2008–2009 resulted in a lower base line of activity in the end market compared to pre-crisis levels. End market has not reached pre-crisis levels (2005–2008).
- Rebound: If economic crisis in 2008–2009 had a larger effect, it was short lived and activity levels have bounced back in 2010 to pre-crisis levels.
- Stable: The economic crisis in 2008–2009 had little to no effect. Compared to 2008, the 2009 end market size has declined by less than or equal to one percent.

Color coding for outlook growth rate (CAGR) ranges for 2010–2014: less than 0% 0–5% 5–10% 10–15% greater than 15%

Not available data □: Data unavailable to make a comment on the status of the end-market.

Source: Datamonitor reports from 2010 and 2011 and DTTL Global Manufacturing Industry group analysis.

within the past few years.[7] As a consequence, apparel and textiles made in China in recent years will be made in countries such as Cambodia, where labor costs are still low.[8] The same trend is apparent among Korean apparel and textile companies.[9] In electronics, different dynamics are occurring. Here the production and design of semiconductors, televisions, and digital devices have moved steadily to key countries in Asia such as China, Korea, and Taiwan, where there are significant competitive advantages and advanced supply networks.

A summary of important points regarding four of the eight largest end markets (construction, electronics, automotive, and energy) follows. The selection was based on market size with construction as the largest market while electronics, automotive, and energy fall short behind. Significant changes are expected in these markets, which may lead to many opportunities for the global chemical industry.

Construction

Residential construction dominates the global construction market representing 72 percent of the total US$8 trillion market.[10] Infrastructure accounts for about 14 percent and commercial construction is an important segment with 12 percent of the total global market. The construction market is strongly dependent on macro-economic developments and government activities. Seasonality used to influence this industry, although it does so less and less as construction companies run their business over the course of the entire year. Success in the construction market depends on the targeting and capturing of growth, efficient production operations, the engineering experience of players, and beneficial relationships with suppliers and buyers.

It is estimated that every housing start in the United States is worth US$16,000 on average to the global chemicals industry.[11] On average, chemicals and plastics also account for about 17.5 percent of total construction costs for every unit of new residential construction.[12] Within the global chemical industry content in residential construction are thousands of commodity and specialty chemicals and materials.

In many cases, low-cost competition and commoditization have eroded global chemical industry pricing power and made innovation extremely selective. However, major chemical items such as adhesives, sealants, and protective coatings are high-value, lower-volume, differentiated products. To serve the need for these products, chemical makers need to know their customer base and the regulations surrounding their markets exceptionally well. Despite the tremendous effort and cost that goes into differentiation, these markets are also very competitive on a world scale. In addition, for products such as cement and synthetic latex for paint the cost of shipping is prohibitive and competition is local.

The global construction market is expected to grow at a CAGR of 18.3 percent from 2010–2014, led primarily by growth in developing markets, including the Asia-Pacific region (20.8 percent) and Latin America, which should also see double-digit growth.[13] Global growth of residential construction (20.5 percent) is anticipated to be much higher than that of infrastructure and non-residential (4.3 percent).[14] Infrastructure and non-residential construction show the highest growth rates in the Americas (5 percent), compared to 4.8 percent in the Asia-Pacific region and 2.8 percent in Europe.[15] Growth in the construction market overall is likely to exceed the global gross domestic product (GDP) from 2010–2020.[16]

Although the construction market in the United States is currently depressed because of poor residential demand (with a CAGR of 7.1 percent in the Americas for 2010–

7 TextilWirtschaft, "China chaos," 25 November 2010, www.textilWirtschaft.net.
8 Business-in-Asia.com, "Update on Cambodian garment and textile industry," accessed 17 October 2011, www.business-in-asia.com.
9 Ibid.
10 Datamonitor, "Global homebuilding," April 2010, "Global construction and engineering," April 2010, and other reports, www.datamonitor.com; DTTL Global Manufacturing Industry group analysis.
11 ICIS News, "US new home building drops 5% in August, down 5.8% year on year," statement by American Chemical Council, 20 September 2011, www.icis.com/news.
12 American Chemistry Council website, accessed 17 October 2011, www.americanchemistry.com; Bureau of Census and Moore Economics, "Economics analysis," 2010.
13 Datamonitor, "Global homebuilding," April 2010, "Global construction and engineering," April 2010, and other reports, www.datamonitor.com; DTTL Global Manufacturing Industry group analysis.
14 Ibid.
15 Ibid.
16 Ibid.

2014), the housing market is expected to grow later in the decade as population increases.[17]

Strong growth rates in the Asia-Pacific region are aided by increased government spending on new railways, roads, and power infrastructure projects. Furthermore, the urbanization megatrend — 200 million additional people will be living in Chinese cities by 2020 and the middle class is increasing rapidly across Asia, and especially in China — is expected to drive growth.[18] Also, low-cost residential construction such as slab buildings will likely enable more people to afford to own a house. During this period, India is likely to replace Japan as the third largest construction market, behind China and the United States. Another driving factor for innovation in the construction market is housing for elderly people, reflecting another demographic megatrend.

Green/sustainability is identified as a top megatrend in developed countries. This trend is not expected to drive growth in the Asia-Pacific region, however, as price will trump all other needs for the next few years. In 2010, the construction market for eco-efficient buildings was US$600 billion worldwide and US$150 billion in the United States.[19] The global demand for green building materials (cement, insulation, and wood products) is expected to reach US$571 billion in 2013, up by 25.5% from $455 billion in 2008.[20]

The following are some trends that drive eco-efficient building:[21]

- Heating/cooling systems used without electricity
- Noise- and heat-insulated windows that reduce heating costs and enhance the lifespan of a building
- Foaming insulation that reduces heating costs and the CO_2 footprint over a building's lifecycle
- Self-energy-generating homes
- Innovations that focus on sustainability, durability, and service life
- Materials free of halogen and solvents
- Replacement of plastics with biological or fiber-based materials
- Replacement of steel with lightweight materials such as aluminum or magnesium.

The primary drivers of innovation in the construction industry are regulation and the growing demand for green/sustainable living and solutions that can help to reduce costs. As a result, innovation often takes place only when it is affordable.

Among additional drivers of innovation in the construction market are:

- Water-resistant, higher load-bearing, and breathable foils and compounds
- "Ever clean" facades with special paints
- Cement additives with increased durability and faster handling[22]

Electronics

The dynamic changes underway in electronic equipment, semi-conductors, office and consumer electronics, cables, and the television segments present a wide range of opportunities for the global chemical industry. The US$2.5 trillion global electronics market is projected to grow at a CAGR of 6.2 percent from 2010–2014,[23] led by its largest segment, electronic equipment manufacturing (US$1.6 trillion[24]). Electronics is a fast-moving end market with shorter innovation cycles than most others. With a market share equal to that of Europe and the Americas combined, the Asia-Pacific region is likely to retain its leading share position over the next few years.

A major driver of growth for the electronics market is the convergence of technologies used in the different sub-segments, leading to all-in-one products such as flat-screen televisions that have Internet access and include a receiver

17 Oxford Economics, "China passes U.S. in global market share," 9 March 2011, www.oxfordeconomics.com.
18 Professor Jacques Gravereau, Chief Operating Officer of HEC Eurasia Institute, "Focus on Asia" presentation, 13 April 2011, www.hec.fr/HEC-Eurasia.
19 ICIS News, "US new home building drops 5% in August, down 5.8% year on year," statement by RPM International, 20 September 2011, www.icis.com/news.
20 ABI Research, "Green building products: Cement, insulation and wood products help engineer a greener world," April 2009, www.abiresearch.com.
21 Frost & Sullivan, "Global energy efficiency markets," May 2009, www.frost.com.
22 BASF, "BASF products help to construct the tallest building," 10 April 2010, www.basf.com.
23 Datamonitor reports, 2010 and 2011, www.datamonitor.com; DTTL Global Manufacturing Industry group analysis.
24 Datamonitor, "Global electronic equipment & instruments," April 2010, www.datamonitor.com.

and a media player. Furthermore, a trend to go green has emerged and is translating into demand for devices that are made with and consume less energy and that are more sustainable (e.g., solar-powered devices, recycled parts that can be substituted for rare earth materials, and bioplastic as a substitute for plastic and other materials).

Customer needs for the global chemical industry in the electronics equipment sector differ by geography. Robust economic growth in the developing world, led by the Asia-Pacific region, is combining with rapid urbanization and growth in government spending (especially in infrastructure such as roads and electricity generation).

Chemical companies that serve semi-conductor companies (both fabless and integrated device manufacturers) are witnessing collaborative working strategies to design and produce new products. This trend is being driven by greater chip complexity and the skyrocketing costs of semi-conductor fabrication facilities and mask sets. As a result, these companies are broadening their value chains beyond direct sub-system customers to include original equipment manufacturers (OEMs) and, eventually, end customers. Chemical companies acknowledge that new technologies (e.g., bottom-up fabrication using nanotechnology) may surpass semi-conductors in the future.

The global chemical industry supplies cable producers with plastics and rubbers for coating metal wires, electrical insulating materials, and additives. Although no direct substitutes currently exist for the high and extra-high voltage cables used in power transmission and distribution, variations in power generation exist at the individual household level (e.g., solar panels, localized power generation, and micro-generators), all of which provide growth opportunities for the chemical industry.

The economic crisis in 2008–2009 marked the beginning of a decade of restructuring for the television segment. The period began with an overall decline in the sector's resources before increasingly varied consumption patterns spurred a new period of growth. Liquid crystal display (LCD) televisions are replacing sets using cathode-ray tubes. Prices of flat-panel televisions (LCD, plasma, and digital light processing) are under pressure and large-screen high-definition televisions (HDTVs) are showing up in more and more homes.[25] As HDTV reaches maturity, manufacturers are turning their attention to three-dimensional television as their new engine for growth. All of these developments require additional chemical inputs in various forms, offering chemical companies opportunities to develop products that deliver the higher picture quality and outer design features demanded by consumers.

The integration of new features into consumer electronics is also allowing manufacturers to offer new devices and to encourage consumers to access the Internet through their televisions. Some companies prioritize an approach based on the "digital household," while others focus on integrating content. Again, the dynamics in this segment of the electronics industry are generating opportunities for the global chemical industry.

Opportunities for chemical companies include:

- Electronic chemicals catering to materials for portable electronic devices, solar cells, organic light-emitting diodes, and batteries for electric vehicles
- Recycling and substitution of rare earth materials
- Bioplastic as a substitute for plastic and other materials
- Materials for power generation, transmission, and distribution
- Materials for local power generation, such as solar panels, micro-generators, and wind-power generators for buildings
- Bottom-up new semi-conductor technology using nanotechnology
- Electronic displays, light-emitting diodes, portable communication, and information tools such as navigation devices, tablet personal computers (PCs), and photovoltaics[26]
- Chemicals used in etching and cleaning semi-conductors for mobile Internet devices such as smart phones and tablet PCs

Automotive

The large North American automotive market was reset by the 2008–2009 economic crisis. A new wave of restructuring and consolidation among auto companies

25 DisplaySearch, "Quarterly global TV shipment and forecast report," July 2010, www.displaysearch.com.
26 *China Daily*, "German chemicals firm has faith in fast-growing China," 9 April 2010, www.chinadaily.com.

and the disappearance of hundreds of suppliers have left the industry leaner and primed for growth from lower sales than pre-crisis levels. Overall, the industry is projected to grow at a CAGR of 6.4 percent from 2010–2014, driven by the Asia-Pacific region.[27] Developing markets, including China, India, and Brazil, are likely to increase their share of global automotive sales from 51 percent in 2010 to 53 percent in 2011 and will continue to increase their share in the following decade.[28] The developed economies of Western Europe, Japan, and the United States are expected to grow, but slowly.

Automotive companies are boosting investments in new technologies to produce hybrid and electric vehicles as an increasing number of consumers, particularly in developed markets such as the United States, are interested in alternative power-train vehicles. Greater emphasis on emission reductions and tighter regulatory norms for automobiles and trucks will require even more focus on improving fuel efficiency.[29] That said, the high-growth developing markets are expected to continue to rely on the internal combustion engine.[30]

Manufacturers are looking to develop a regionally optimized footprint to take advantage of free-trade agreements, labor-cost arbitrage, and exchange-rate volatility. At the same time, OEMs are moving toward high-volume global platforms, supported by networked design centers in emerging markets.[31]

Large investment requirements and market uncertainty are driving the need for more collaboration, and new ecosystems are forming that include nontraditional players such as battery manufacturers. To develop and bring to market new technologies, OEM partnerships that include players from other industries are expected to increase. This will help to minimize the investments required and manage risk.

27 Datamonitor reports, 2010 and 2011, www.datamonitor.com; DTTL Global Manufacturing Industry group analysis.
28 J.D. Power and Associates, "Global automotive outlook for 2011," 16 February 2011, www.jdpower.com.
29 DTTL Global Manufacturing Industry group, "Unplugged: Electric vehicle realities versus consumer expectations," 21 September 2011, www.deloitte.com.
30 Ibid.
31 DTTL Global Manufacturing Industry group, "A new era, Accelerating toward 2020 — An automotive industry transformed," 16 September 2009, www.deloitte.com/anewera.

Some key industry trends have already been identified:[32]

- There is a need for greater safety
- With an increased need for customers to remain in touch, automatic and hands-free connectivity features will become standard in developed markets, and increased penetration will be the norm in developing markets
- While awareness of "green" vehicles and environmental concerns will strengthen across the globe, the next 10 to 20 years will likely not see mass adoption of "green" vehicles without a clear and compelling financial benefit and value[33]
- Stronger and lighter weight materials will be a key response to the megatrend of green/sustainability issues
- New oil and fuel additives will be needed to extend engine life and improve fuel efficiency
- Appearance chemicals such as coatings, waxes, and polishes, as well as aftermarket service and maintenance chemicals, will be in greater demand as a result of the rising average lifespan of vehicles

Energy

New technology and innovation pervades the energy end market in many ways. Advanced technologies for exploration, development, and production of oil and gas from deeper and more remote locations, the confluence of academic disciplines to create new materials for alternative energy capture and production, and better techniques for energy storage are a few of the areas that will drive the need for new and more effective chemical products with enhanced properties.

The industry includes oil and gas (with almost 55 percent of global sales), energy/electrical utilities (42 percent), and renewable energy (3 percent).[34] The 2009 market size of energy is nearly the same in each geographical region (US$1.4 billion in the Americas, US$1.3 billion in Europe, and US$1.3 billion in the Asia-Pacific region). CAGR from 2010–2014 across all regions is expected to exceed 10 percent and to be highest in the Americas, at 15.1 percent.[35]

32 Ibid.
33 DTTL Global Manufacturing Industry group, "Unplugged: Electric vehicle realities versus consumer expectations," 21 September 2011, www.deloitte.com.
34 Datamonitor, "Global electricity," August 2010, "Global oil & gas," April 2010, and other reports, www.datamonitor.com.
35 DTTL Global Manufacturing Industry group analysis.

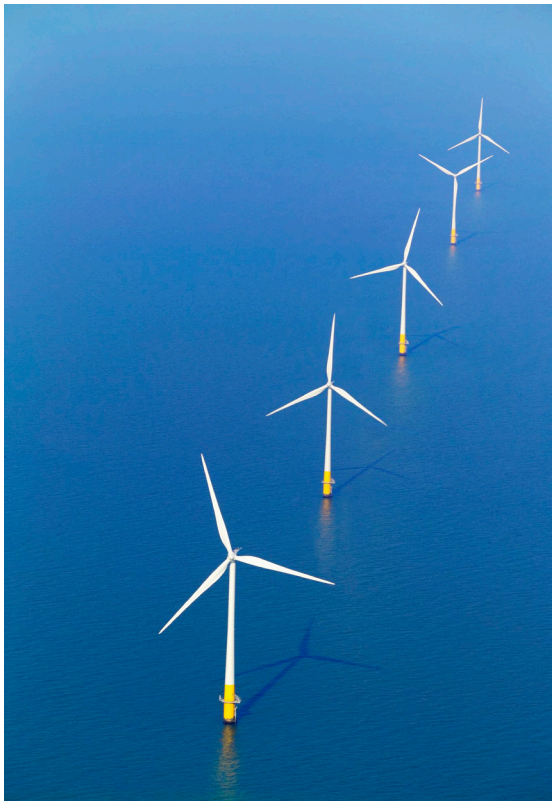
Oil and gas

Global sales of oil and gas reached US$2.1 trillion in 2009, of which the Americas (37.4 percent) and Europe (35.9 percent) had the largest shares, followed by the Asia-Pacific region with 26.6 percent.[36] Rising feedstock prices have challenged many North American and European petrochemical producers to maintain their profit margins vis-à-vis their global counterparts. However, the discovery of vast quantities of shale gas in North America and the subsequent drilling and extracting of this gas are a game changer for North American-based chemical companies that use natural gas as a feedstock and for energy. In the long term, the sustainability of this advantage is likely to depend on the amount of gas that can be recovered, the ability to get drilling permits, supply chain infrastructure development, and demand for natural gas for fuel in other markets. New chemical products will be used for hindered and deeper drilling and more difficult exploration.

Wind

Investments in the further expansion of wind energy, including the development of the large offshore wind potential, will help enable the industry to grow at a CAGR of six percent per year in installations, leading to a 17 percent increase in overall cumulative installed capacity between 2010–2015.[37]

36 Ibid.



Selected trends in the wind energy market can be described as follows:

- Stronger materials will be needed to make longer rotor blades. The future of wind energy may be located largely at sea, since the winds blowing across the ocean are stronger and more constant than those on land. Rotor blade lengths of 90 meters (twice the normal length) will yield four times more energy. Currently, plants are producing five to six megawatts (MW) of electricity per hour, but the target is 20 MW. Blades made from glued glass and carbon fiber will be replaced with blades that can withstand heavier winds[38]
- More durable coatings and materials will be needed for lighter weight blades
- Blades will be required to have a longer life. Operating in harsh environments is a challenge, and new materials will be needed that are less likely to fracture or to degrade when loaded, and that have stronger surfaces to withstand damage from corrosion and lighting strikes[39]

Solar

Like the other alternative energy sources, solar energy has moved into and out of favor depending on the price of oil and gas. The challenge for product developers in this area is to increase the conversion efficiency of the sun's rays and reduce the installed costs in order to provide an economical energy yield. Global CAGR for solar-related products from 2010–2014 is expected to reach 28 percent.[40] The Asia-Pacific region is the leading production center of solar-energy equipment.[41]

37 MarketsandMarkets, "Global & China wind turbine market," January 2011, www.marketsandmarkets.com.
38 European Wind Energy Association, "Upwind," March 2011, www.ewea.org.
39 Plastemart.com, "Composite use grows in wind energy market that doubles in size every 3 years," 28 February 2011, www.plastemart.com.
40 Global Information Inc., "U.S. Solar Energy Market World Data, 2nd Edition: PV, Solar Thermal, CSP," 14 September 2010, www.giiresearch.com.
41 ICIS News, "Shift in solar will challenge chemical suppliers," 29 July 2009, www.icis.com/news.

Selected trends and opportunities in the solar energy market can be identified:[42]

- Applications for photovoltaic cells are growing. The volatility in crude oil prices, combined with trends toward environmentally sustainable production of electricity, has resulted in growth in Europe
- There is a desire to create biofuels, based on improved algae photosynthesis, that will be cost competitive with fossil fuels
- New chemical products are needed that can either extend the use of or replace silicon to create better thin-film cells

Battery materials and technologies

It is expected that the global market for electric vehicles will increase at a CAGR of 18.5 percent through 2015, rising from US$26 billion in 2009 to US$78 billion in 2015.[43] Of that US$78 billion, US$7.6 billion will be associated with power sources, including batteries.[44]

Joint ventures and partnerships have formed among battery integrators, cell manufacturers, and vehicle manufacturers to collaborate in developing battery technologies.[45] Companies in the segment are working to find more affordable alternatives to lithium;[46] research is ongoing to develop sodium-ion batteries and other advanced materials for use in large-scale energy storage, such as storing energy from the electric grid. Electrodes made from nanomaterials are being developed for use in sodium-ion batteries.

42 Ibid.
43 BCC Research, "Fuel cell and battery technology," August 2010, www.bccresearch.com.
44 Ibid.
45 Freedonia, "World hybrid electric vehicle/plug-in hybrid electric vehicle battery market," September 2009, www.freedoniagroup.
46 Kevin Bullis, "Sodium-ion cells for cheap energy storage: DOE fund the development of low-cost sodium batteries," *Technology review,* 2 December 2009, www.technologyreview.com/energy/24043/page1.

Seizing end market opportunities

Attractiveness of end markets and opportunities to chemical companies

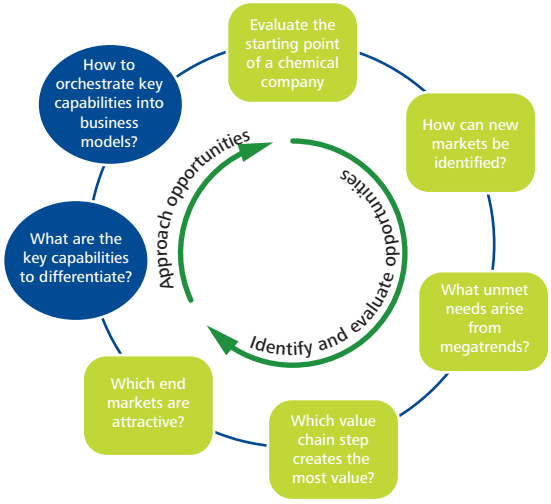
Deciding which new end markets to enter or in which existing end markets to continue investing can be challenging for a chemical company. These decisions should take into account not only an end market's attractiveness to an individual chemical company but the company's own unique starting point, financial resources, skill sets, customer relationships, and organizational capabilities. Companies will have to place their bets carefully. A company with many options but limited resources will have to make choices more watchfully than others. It may also need to make quicker decisions about issues such as how to avoid squandering time and precious resources pursuing opportunities that may remain out of reach.

Chemical companies focused on making commodity products or chemical intermediates will also be well served by understanding the opportunities emerging in the end markets their products are eventually sold into. Doing so will allow them to better assess geographical supply/demand balances and put them in a better position to make capital investment decisions.

The DTTL Global Manufacturing Industry group has developed an opportunity assessment framework (see Figure 5) that describes the steps that chemical companies can take to identify and evaluate opportunities, as well as to improve efforts to capture growth:

1. **Evaluate the starting point of a chemical company: How well is a company performing financially?** How much potential investment is available? To what extent is a company participating in desired end markets? How well do its business portfolio and organizational competencies match up against the end markets it currently serves or contemplates serving in the future?
2. **How can new markets be identified?** Are end markets reacting to changes and megatrends in a similar way? Are they acting in isolation or as part of a bigger network? How can value networks best be used to identify new markets? How have new markets been created in the past?
3. **What unmet needs arise from megatrends?** Which megatrends are having an impact on an individual end market and how are they affecting it? What unmet needs can be derived from the megatrends for each end market?
4. **Which value chain step creates the most value?** What are the most valuable and promising value chain links on which a chemical company can focus and allocate its investments?
5. **Which end markets are attractive?** Which end markets are the most attractive to a chemical company based on its individual starting point? What are the corresponding complexities and risks?
6. **What are the key capabilities to differentiate?** What are the required key capabilities that will enable the chemical company to differentiate and approach identified unmet needs in attractive end markets?
7. **How can key capabilities be orchestrated into business models?** How close does a chemical company need to be to the end market? Is collaboration necessary to address unmet needs? How can key capabilities be orchestrated to design the most promising business models?

Figure 5: Opportunity assessment framework for a chemical company



Source: DTTL Global Manufacturing Industry group.

Evaluate the starting point of a chemical company

The DTTL Global Manufacturing Industry group analyzed the starting points of some 230 chemical companies in depth. Understanding a chemical company's starting point is the first step to take within the opportunity assessment framework and is discussed in more detail later in this report.[47]

How can new markets be identified?

In a world of technology convergence, new markets develop when two or more end markets have related responses to unmet needs and forces for change exist. As an example, consumers did not want to have to carry multiple electronic devices such as a telephone, personal digital assistant, and camera but wanted an all-in-one electronic device instead. This desire drove different companies in different market segments to collaborate to develop products that merged the various technologies into one device — the smart phone.[48]

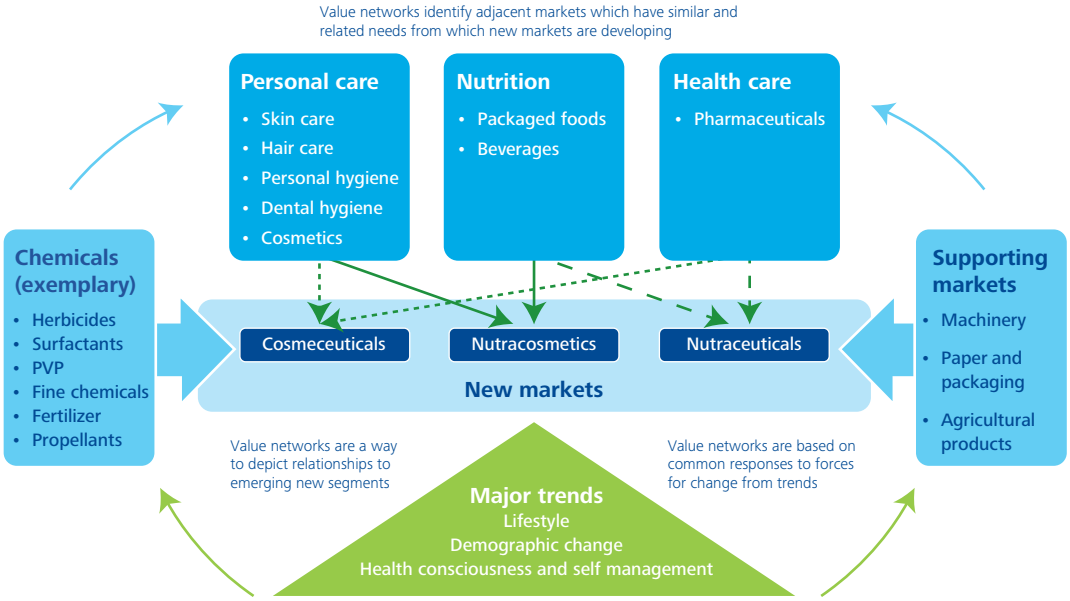
In order to identify these types of opportunities, companies may scan adjacent markets to see which technologies are converging and intersecting with megatrends. Once identified, the opportunities can be mapped in a value network that identifies the adjacent markets and groups of value chains with similar unmet needs.

Figure 6 depicts the example of a new segment that was derived from the life science value network (which consists of the nutrition, healthcare, and personal care end markets). Machinery, paper and packaging, and agricultural products are the supporting industries. A more health-conscious population, with greater awareness of the benefits of good nutrition, is looking for foods to help improve their health or provide vitamin supplements as a means of augmenting more traditional, pharmaceutical-

47 DTTL Global Manufacturing Industry group, "The chemical multiverse: Preparing for quantum changes in the global chemical industry," 16 November 2010, www.deloitte/thechemicalmultiverse.

48 Deutsche Bank DB Research, "Convergence markets: Smartphones and triple play continue to erode sector boundaries," 4 August 2011, www.dbresearch.com.

Figure 6: Life science value networks



Source: DTTL Global Manufacturing Industry group.

Figure 7: Five selective significant value networks developed from converging networks

Selective value networks	End markets/segments	Supporting industry
Life sciences	• Personal care • Nutrition • Pharmaceuticals	• Machinery • Paper and packaging • Agricultural products
Mobility	• Automotive • Transportation	• Machinery • Solar • Apparel, textile, and leather • Battery • Electronics • Mining and metal
Housing and infrastructure	• Construction and infrastructure • Household appliances • Home furnishings	• Machinery • Mining and metal • Solar • Electronics • Packaging
Digital life	• Electronics • Medical devices • Commercial printing	• Machinery • Solar • Battery • Machinery • Mining and metal
Energy	• Oil and gas • Solar/renewables • Wind/renewables • Energy/electric utilities	• Machinery • Solar • Wind • Battery • Electronics

Source: DTTL Global Manufacturing Industry group.

based health management. This trend has given rise to the nutraceutical segment, which includes products such as vitamin waters packaged foods with active pharmaceutical ingredients, like cholesterol-reducing butter, gluten-free foods, or digestion-improving drinks. A similar development in the cosmetics segment has produced another new market segment: cosmeceuticals. These beauty products, such as vitamin-enriched skin creams, include beneficial biologically active ingredients to produce various effects such as reducing signs of aging.[49] Pycnogenol, for example, is a multifunctional dietary supplement in many cosmeceuticals that is obtained from the bark of pine trees. It claims to protect the collagen of skin, hindering the effects of the sun's ultraviolet (UVB) rays and neutralizing their damaging effect to skin cells.[50]

Figure 7 displays four additional value networks that have been identified. Monitoring these value networks is one way for the global chemical industry to better spot emerging trends and markets for potential participation.

49 Phytopharm Consulting, "Cosmeceutical market opportunities today and tomorrow," 14 April 2005.

50 Nutra Legacy, "Cosmeceuticals are not just skin deep," 16 October 2008, www.nutralegacy.com.

What unmet needs arise from megatrends?

The impact of megatrends on end markets cannot be overstated. DTTL's Global Manufacturing group interviewed a number of industry executives who indicated that the impact of megatrends is likely to result in significant changes to product portfolios over time. Some trends will affect existing markets, while many have the potential to create entirely new market segments, such as the market for tablet PCs. The needs and desires of consumers are the driving forces behind some megatrends. Understanding these trends and the impact they may have on end markets helps a chemical company to identify new business opportunities. In order to understand end market needs and benefit from those that are key for the global chemical industry, companies will have to extend their perspective beyond the next value chain step through to the end markets.

The megatrends evaluated as most relevant to the global chemical industry (see Figure 8) are as follows:

- **Resource scarcity:** Availability and expense of energy, clean water, food, and energy alternatives; efficient use of resources
- **Green/sustainability:** Protection, preservation, and restoration of the environment and resources; earth-health consciousness; sustainability; the CO2 footprint
- **New patterns of consumption:** Major shifts in demand for goods and services, such as luxuries in China and India; a growing middle class in developing markets; a wealthier developing world
- **Demographic change:** Human population changes including size, age, gender, race, income, and location; the growth of the Asia-Pacific region, including India; a youthful Middle Eastern population; aging populations in developed countries
- **Technological convergence and new technology:** Technologies in addition to information technology (IT) performing similar tasks; technologies combining synergies for accelerated technological change
- **Urbanization:** More people living in cities and suburbs; strong growth of megacities and supporting infrastructure and housing
- **Globalization:** Commonality trends; integration of regional economies and cultures; global markets, including capital; the global impact of local events
- **Human health:** Self-management of health; consciousness about health issues; expanded and intensified health care, disease prevention, and health maintenance
- **New patterns of mobility:** Movement of people and freight in terms of mode, distance, frequency, and time in transit; increased movement of people and goods within and between urban regions, including work and pleasure travel

Figure 8: Megatrends driving changes in societies

Source: DTTL Global Manufacturing Industry group.

While many of the megatrends interact, the DTTL Global Manufacturing Industry group has determined the following conclusions:

- Demographic change has the greatest influence on the other megatrends
- Globalization and urbanization will together drive new mobility habits and new patterns of consumption
- Resource scarcity and the green/sustainability trend drive an increased consciousness about the earth's health and how to protect, preserve, and restore it

Figure 9: Megatrends affecting end markets

End market	Megatrends likely to have high impact								
	Resource scarcity	Green/sustainability	New pattern of consumption	Demographic change	Technological convergence and new technology	Urbanization	Globalization	Human health	New patterns of mobility
Construction	X	X		X	X	X			
Electronics	X		X		X	X			X
Household		X	X	X	X	X		X	
Agriculture	X	X	X	X				X	
Paper and packaging			X		X		X		
Automotive	X	X			X	X			X
Health care			X	X	X			X	
Energy	X	X			X				
Transportation	X	X				X	X		X
Nutrition	X		X	X	X			X	
Personal care		X	X	X				X	
Machinery					X		X		
Apparel and textiles			X	X	X				
Mining and metals	X	X				X			

Source: DTTL Global Manufacturing Industry group.

Each of the analyzed end markets is affected by more than one megatrend (see Figure 9), and chemical companies have significant opportunities to respond to these trends.

One theme underlying many of the unmet needs is how to create products/solutions to those needs are sustainable. As awareness grows in the general population about issues related to resource scarcity, recycling, alternative sources of energy, and the need for greater energy efficiency, consumers have been showing an increasing desire to have more products/solutions available that "do less harm" or work without hurting the environment. In some cases, consumers are willing to pay a premium for a product/solution with this label and/or functionality.

Megatrends have a wide variety of effects on markets and value networks; the same megatrend can translate into different unmet needs in the different value networks. The DTTL Global Manufacturing Industry group has analyzed the impact of the megatrends on five value networks and the unmet needs that result (see Figure 10). Sometimes emerging unmet needs are similar across value networks, such as the potential substitution of bio-based materials and processes for petroleum-based materials. Sometimes the same driver produces different needs in different value networks. For example, an aging population raises the need for senior-friendly residential buildings in the housing value network; for elderly-friendly mass- and urban-transport systems in the mobility value network; and for cosmeceuticals, nutraceuticals, and everyday biometric devices such as wrist monitors of blood pressure/sugar level/heart rate in the life sciences value network.

Figure 10 summarizes emerging unmet needs in each of the selected value networks. The global chemical industry can help solve many of these needs by creating a range of new or upgraded materials and/or solutions.

Figure 10 shows megatrends and their drivers cascading into a multitude of emerging unmet needs, some of which will be met sooner than others. This trend is based on:

- Government stimulus and regulation
- The market pull generated by consumers
- The complexity of the problem, as defined by the technological competence and convergence needed, the investment required to solve the problem, and how complex it will be to push the innovation in the market

One key question is whether it is possible for a single company to solve an unmet need or whether collaboration with other companies, authorities, or any other institutions is necessary.

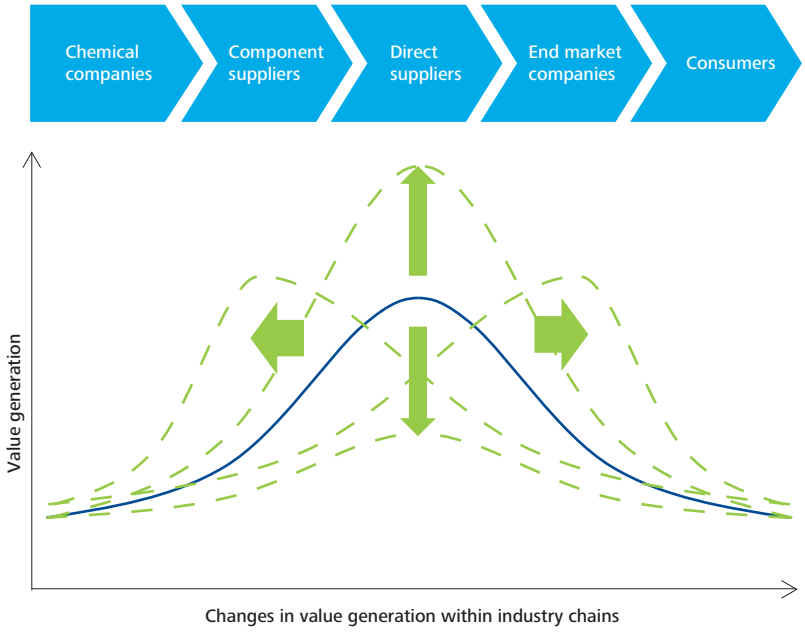
Figure 10: Megatrends creating unmet needs in value networks

Value networks	Megatrend drivers		Selected unmet needs where the g
Life sciences	• Demographics: – Aging population in developed countries • Green/sustainability: – Eco-friendly packaging • Human health: – Increasing health consciousness and self medication, self monitoring – Shortage of nursing staff and doctors – Food safety packaging	• Resource scarcity: – Scarcity of food (competition with e.g., biofuel) and new patterns of consumption – Convenience food for developing countries – Private labels – Demographics – Increase of middle class causes shift towards eating meat	• Human health: – Healthy cosmoceuticals or nutraceu – Agriculture: • Genetically modified food crops high yields for food and biofuel – Ingredients for geriatric medicine, chr – Medical devices: • Biometrics for every day use • Telemedicine and remote monit • Nurse robots • Self healing materials
Mobility	• New patterns of consumption/Demographics: – Senior-friendly transport – Demand for inexpensive cars – Demand for quality, functionality, and comfort in emerging middle class – Web-enabled cars that are connected with house, office, and personal devices • Efficient urban goods and people transport	• Green/Sustainability: – Demand for safe and green travel/transport – Reduced fuel and energy consumption – CO_2 reduction in production and product in use – Recycling of cars and materials • Information sensing, collecting, and presenting technological convergence: – E-mobility	• Power train: – Electric – Hybrid and fuel-cell cars • Pay-per-use business models drive sta • Proactive coatings • Mass and urban transport: – Systems and materials (lightweight, – Packages indicating content tempe
Housing	• New patterns of consumption: – Demand for quality, functionality, and comfort in emerging middle class – Housing for developing countries – Easy life systems (smart houses; cleaning; cooking, etc) • Urbanization: – Need for infrastructure development	• Green/Sustainability: – CO_2 reduction in production and product in use – Recycling/biodegradability of materials – Energy efficient housing (passive house) • Demographics: – Aging population in developed countries • Resource scarcity: – Water	• Residential and commercial buildings – Proactive and protective coatings – Plastics with form memory – Wind energy self-powered building – Intelligent sensor networks – Smart energy management – Senior-friendly residential buildings – Increasing use of wood instead of s
Digital life	• Convergence of technologies: – All-in-one products – Information sensing, collecting, and presenting – Mobile "offices" • Reduced energy consumption • Resource scarcity: – Rare earths and water	• Green/Sustainability: – CO_2 reduction – Recycling/biodegradability of materials • New patterns of consumption – Demand for quality, functionality, and comfort in developing middle class groups – Easy life systems (smart phones, smart houses, smart grid, etc.)	• Bio-based, biodegradable, and energ • Substitution of plastics by bioplastics • Energy-efficient products and produc • Web connectivity everywhere • Intelligent sensor networks
Energy	• Demographics: – Growth of world population • Increased per capita energy consumption • Regulation/stimulus • Green/Sustainability: – Desire for clean and safe energy – New renewables	• Resource scarcity: – Energy efficiency of renewables – Competition with food chain for land – Enough and clean water – Shale gas boom	• Alternative raw materials for chemica • Degradable drilling materials • No-waste processes • Energy use reduction materials such a transfer, weight, etc. • Photonics, light, and heat modifying • Biorefineries • Long-term, cheap storage of electrici

Source: DTTL Global Manufacturing Industry group.

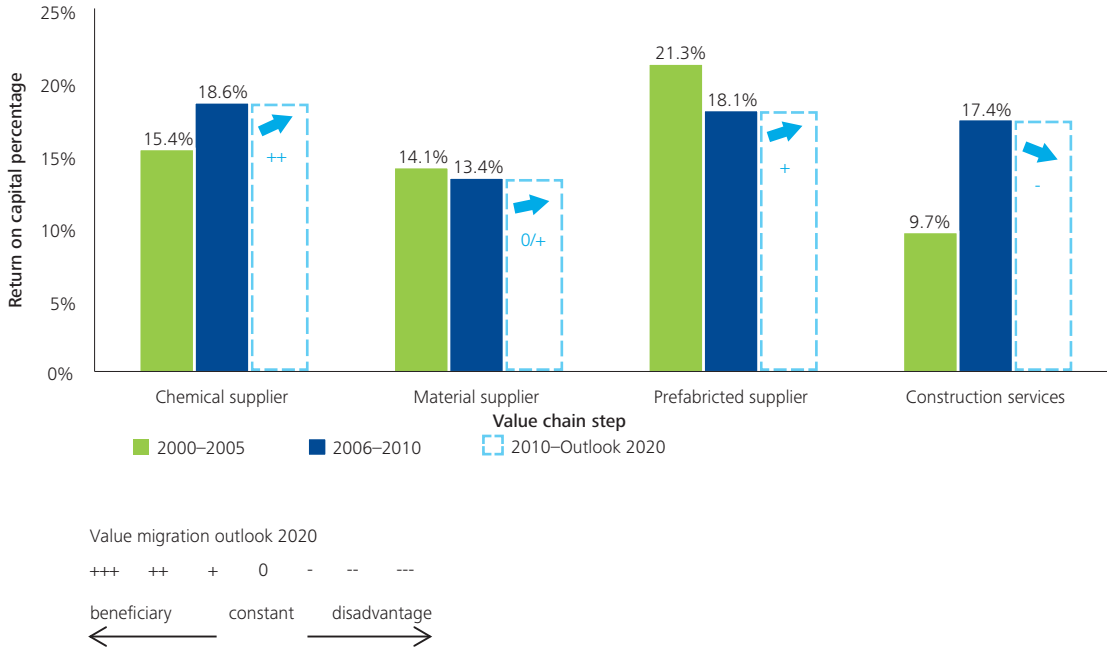
global chemical industry can contribute solutions		
uticals s with stress resistance and crops onic diseases, and oncology toring systems	• Human health (cont.): – Medical devices carrying pharmaceuticals – Catalytic production of enantiomers • Beauty and age: – Anti-aging cosmeceuticals or nutracosmetics – Sustainable no waste products such as diapers, shampoos, or female products – Cosmetics for diverse ethnic groups or male grooming – Bio products with natural ingredients • Food: – Bio-based food production processes – Functional foods on nanoscale as next frontier	• Food (cont.): – Nutraceuticals and nutracosmetics – Genetically engineered designer foods – Disease preventing ingredients (biomedical basis) – Nutraceutical ingredients require suspension aids to preserve the original structure – Dietary supplements – Healthier, more nutritious, and allergy-free food – No waste processes – Bio-security: Good sensing, storage, and shipping – Bottles/packaging lighter and stronger, with better thermal tolerance and less gas absorption
   andardization , nano-reinforced) rature history	• Cars: – Light-weight materials (plastic used as substitutes for metal under the hood and glazing) – Gluing instead of welding – Web connectivity – Energy generating vehicles/self-powered • Substitution of plastics by bioplastics	• Tires: – High-performance tires/less abrasion – Improve recyclability – Tire sensing • Batteries: – Compact batteries in the future – Fast rechargeable batteries and systems – Nano-materials with large surface-to-mass ratios to increase battery capacity
: gs /solutions steel and cement	• Glazing: – Significantly increased glazing – Substitute glass for bioplastics that are resistant and energy efficient • Infrastructure: – Nano-steel or nano-aluminium with higher durability – Systems to renovate canalization • Substitution of plastics by bioplastics	• Bio-based, biodegradable, and no volatiles materials • Energy-efficient construction material (solar shingles, insulation, non-electric heating/cooling systems, etc.) • Gluing for adhesion • CO_2 neutral – Autarkic cities • Household: – Bio-based and biodegradable cleaners – Cleaners with proactive functionality – Household appliances that reduced water and energy consumption
y-efficient use of material tion processes	• Home system management from a distance • Self-energized components • Rare earth mineral substitutes • Rare earth recycling • Proactive and protective coatings for electronics	• Battery long life and storage materials • Electrical polymers • Materials with enhanced optical, heat, etc. properties • Metals modifiers and metals material composites
l production as insulation, electric materials ty	• Solar: – Bio-solar materials – Solar electric storage – More efficient and low cost cells • Batteries: – Nanomaterials with large surface-to-mass ratios to increase battery capacity – Batteries on organic basis without minerals and acids	• Wind: – Offshoring systems with more resistant materials and coatings to prevent corrosion and icing – Lightweight materials for larger wind blades

Figure 11: Value migration in industry chains



Source: DTTL Global Manufacturing Industry group.

Figure 12: An example from the construction industry of how value migrates



Source: Capital IQ data and DTTL Global Manufacturing Industry group.

Which value chain step creates the most value?

Unmet needs can arise at any step along the value chain. It is not always obvious whether participants in the end market are best positioned to fill them or whether another participant along the value chain will drive the solution.

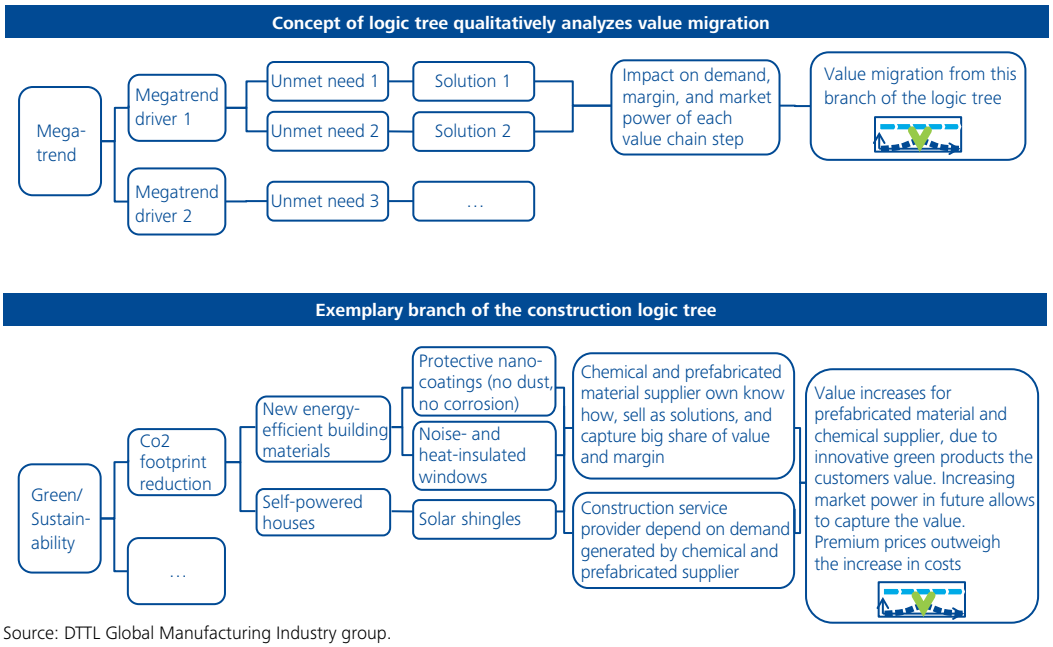
Competition, new products, technological advances, and the impact of megatrends are some of the major disruptive forces that drive the shift of value from one step to another within the chain. In e-mobility, for example, purchasing and sales power may shift from the OEMs to the battery suppliers. Changes in value generation along the chain can move in any direction (see Figure 11).

The most promising space for investment or collaboration for the global chemical industry — that is, the area in which a company can potentially create the most value— can be found by thoroughly analyzing each step in the value chain that serves an individual end market and assessing how value is likely to migrate within it over the next few years.

Example of a value logic tree for the construction end markets

One branch of the construction value logic tree is highlighted which focuses on the impact of green/sustainability (see Figure 13). Part of the green/sustainability mantra is the reduction of carbon emissions and energy consumption in the production process and use of energy-efficient construction materials. Therefore, industry players develop products like solar shingles, solar windows, improved insulation, and protective coatings. Construction companies are likely to charge a premium to the customer for environmentally-friendly products. Prefabricated-material suppliers and the global chemical industry will gain value because they own the technology and are able to deliver complete solutions through their downstream positioning. Meanwhile, the construction service provider will be positioned between its suppliers and the consumers, enabling them to capture value. This is one example where value is migrating away from the construction service providers and toward the prefabricated material supplier and the global chemical industry.

Figure 13: One element of the construction end market value logic tree



Source: DTTL Global Manufacturing Industry group.

This single example also reflects the overall result of the analysis of the construction end market in the developed world, which is shown with the blue arrows in Figure 12. As a result, the construction service providers have very limited capabilities to market-specific products to the end customers or the ability to create a market pull for specific (branded) chemical products/solutions. For solutions like the Eco Commercial Building of Bayer Materialscience[1] and 3l house of BASF,[2] these more likely to be considered marketed to the architects and rather developed in collaboration with the prefabricated material suppliers.

1 Bayer MaterialScience, "EcoCommercial building program," September 2010, www.bayermaterialscience.com.
2 BASF, "From the 3-liter house to the zero-heating cost house," accessed 18 October 2011, www.basf.com.

The analysis begins by mapping the complete value chain of an end market, identifying all relevant links, and listing a representative set of companies and their relevant financial data sets in each link. To extrapolate value migration, the current and past value of each of a company's steps in the chain are calculated and compared to the expected future value.

The DTTL Global Manufacturing Industry group uses logic trees within value chains to determine migration patterns and to gain a more granular view of what has happened and what is expected to happen. Figure 12 portrays an example of value migration over three different periods in the construction industry. It shows that chemical and prefabricated suppliers are likely to capture more value beyond 2010, whereas construction services are likely to decrease. The differences between the two markets are highlighted in the sidebar "Example of a value logic tree for the construction end markets."

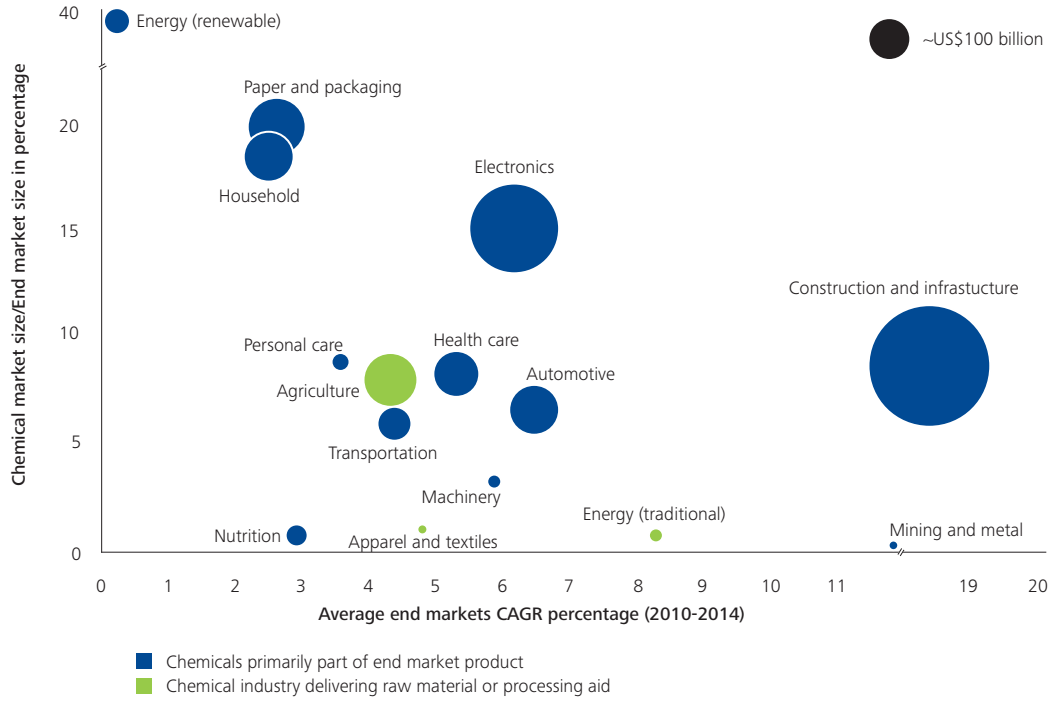
Which end markets are attractive?

Chemical companies considering investment opportunities presented by end markets should consider which are the most attractive. Does the attractiveness have to be mutual, or can the opportunity be attractive to the chemical company alone?

In general, end markets that are struggling financially are not as attractive as those with a healthy financial picture. Several indicators have been taken into consideration when analyzing end markets to find a proxy for attractiveness. They include the chemical company's starting point, end market size, growth rate, the penetration rate of chemicals into the end market, and potential areas to target within end market segments.

As illustrated in Figure 14, the penetration rate of chemicals as part of the end market product, measured by the chemical market share of end market, varies widely

Figure 14: A high-level view of respective end market groups



Note: Size of bubbles represents the size of the global chemical industry in US$ billion.

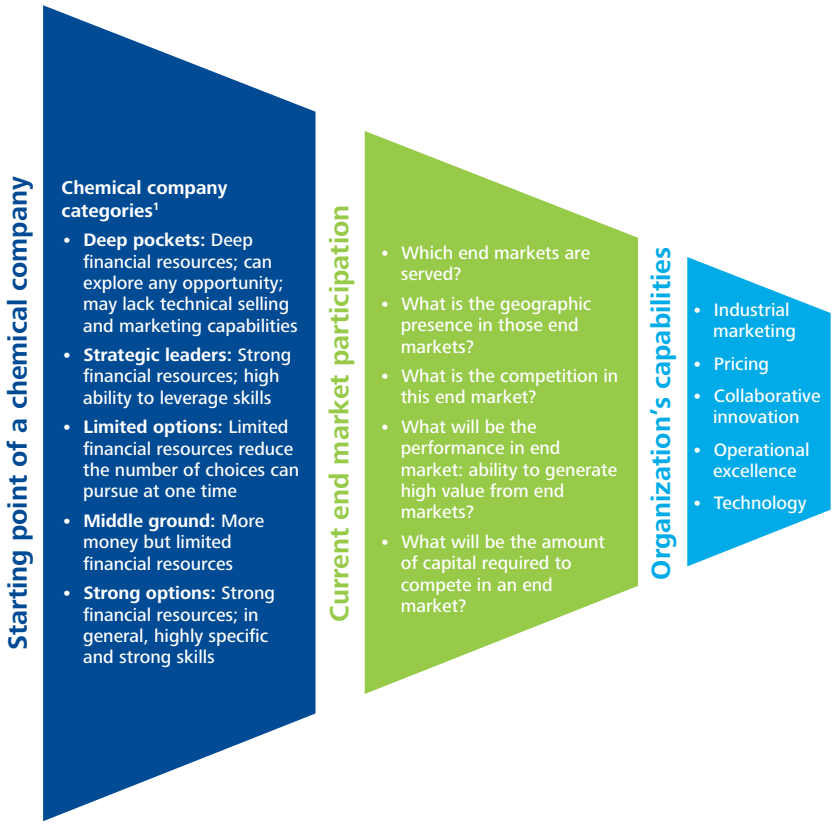
Source: Capital IQ, SRI, Datamonitor, and Freedonia data; DTTL Global Manufacturing Industry group analysis.

but is generally under 12 percent. The key exceptions are household and paper and packaging.[51]

Although chemicals are sold into virtually every end market, the chemicals themselves are used in widely varying amounts and for many different purposes, ranging from minor processing aids to major components in end-product formulations. In the latter case, the chemical itself might represent a large portion of the value of the finished product. Household cleaners are a good example; often, more than 90 percent of the cost-of-goods sold of the end product is chemicals.[52] The end market companies generate most of their value by marketing their branded products, not by producing them.

51 Capital IQ, SRI, and Freedonia data; DTTL Global Manufacturing Industry group.

Figure 15: A chemical company's individual starting point



1. DTTL Global Manufacturing Industry group, "The chemical multiverse: Preparing for quantum changes in the global chemical Industry," 16 December 2010.

Source: DTTL Global Manufacturing Industry group.

End markets that have high customer intimacy and high end consumer recognition tend to have higher profits. Is there room for the global chemical industry to penetrate there areas further and capture some of this value? This important question is necessary for the industry to ask as it assesses where it can create more value from the end markets it serves. There may be additional room to pursue new opportunities in many other end markets if the chemical penetration rate is low, the end market growth rate is high, and significant unmet needs are present.

It is valuable to add end market size to the equation of attractiveness. The larger an end market (see Figure 14), the more leverage it has when improving the penetration rate.

Finally, the end market's growth rate, as measured in CAGR, indicates the momentum in the industry. It can be used to determine expected growth rates for the global chemical industry, assuming that each chemical company is simply defending its market position.

Evaluate the starting point of a chemical company

To fully capture attractiveness, the starting point of a chemical company should be considered (see Figure 15). When it comes to creating value in end markets, the starting point is not limited to a company's current position in that market or to the potential to enhance its current position. As seen in Figure 15, a company must also consider its current end market participation, as well as organizational capabilities such as industrial marketing, R&D, and technology. These capabilities should align with the unmet needs of an end market or, at the very least, have the potential to match them.

Before entering a new market, a chemical company should consider and prepare for the associated risks. Several kinds of risk should be evaluated, and Figure 16 reflects the complexity involved in assessing "fit risk" in

52 Beth Geer, "Chemicals in household cleaners may pollute indoor air," 19 July 2006, www.articles.sfgate.com/2006-07-19/home-and-garden/17304606_1_cleaning-products-hazardous-chemical-endocrine-disrupting.

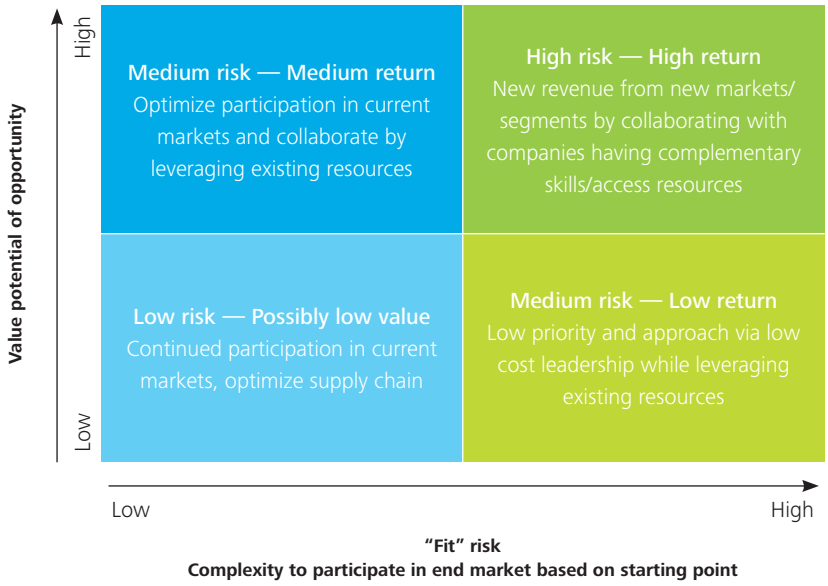
particular. Fit risk refers to how well the organization's skills, products, and capabilities align with those of the end market. It includes risks related to regulations, specific technical requirements, familiarity to the end market, and collaboration with others. For example, the automotive end market has a need for lightweight materials. A chemical company would have less associated fit risk if it already served that end market with other kinds of materials. Fit risk would also be lower if the lightweight material supported the green/sustainability regulation of CO_2 emissions and met the chemical companies' own technical requirements such as for intellectual property and respective production functionality. Alternatively, the risk would be higher for a chemical company if it had to establish or acquire the requisite capabilities to develop lightweight materials.

If the company does not have the desired capabilities, the opportunity has to present enough potential value to mitigate the uncertainties of having to invest internally to develop or acquire them. Fit risk tends to be highest when a company offers a new product, material, or service to an unfamiliar end market. In a new market such as nutracosmetics or cosmeceuticals, developed from the convergence of two markets or technologies, fit risk hinges on the question of whether the chemical company is familiar with at least one of the converging markets.

If the fit risk is high because of multiple unknowns, collaborating with others who have more knowledge or better positioning may be a good mitigation strategy. This will enable the company to partner with another in a new space to explore the terrain before making too large a financial commitment.

In short, the attractiveness of an end market opportunity for an individual chemical company is based not only on the potential value, but also on the fit risk associated with capturing the opportunity.

Figure 16: Fit risk return measured by potential value of the opportunity



Source: DTTL Global Manufacturing Industry group.

Evaluation of end market approaches

Through its analysis of the end markets, unmet needs, and companies in the global chemical industry, the DTTL Global Manufacturing Industry group found seven imperatives for chemical companies to consider:

1. **Extend the perspective and market approach beyond the next value chain step.** Understand key end markets and what drives them. Use a systematic approach to generate additional value. Think more like the customers and the end markets.
2. **Evaluate the impact of megatrends on end markets to identify unmet needs and opportunities.**
3. **Use an approach that incorporates a convergence of technologies and markets.** This strategy will become more significant when companies respond to more complex unmet needs by combining knowledge and market access.
4. **Search value networks to uncover new market segments.** Start early and use a value network approach to anticipate new markets and better identify potential partners.
5. **Look for the most beneficial and high-value players in the value chain steps.** They are not necessarily in the next value chain step or an end markets player. Understand the sources of demand.
6. **Collaborate along the value chain and across the industry while considering the complexity of doing so.** Does your company's culture encourage collaboration? Will it be recognized as a key driver in helping to identify unmet needs and opportunities?
7. **View R&D and SG&A not only costs, but also investments.** Expect new opportunities to surface when targeting these investments along the value chain.

Customer intimacy

The more that markets and technologies converge and the more complex it is to develop a solution for an unmet need, the more intimacy is needed between the end market and the chemical company. DTTL's Global Manufacturing Industry group found growing evidence of an increasingly converging world, collaboration across the value chain, and improvement in the steps that chemical companies are taking to gain a larger share of the value created within a value network. It was also uncovered during the report analyses that chemical producers should attempt to understand the growing intensity of customers and value chain influencers, as well as the role of the industries and markets where customers play to select the right collaboration partner and level of customer intimacy.

Figure 17: Degrees of customer intimacy

Product/service attributes	Low customer intimacy	Company X (exemplary)	High necessity to be close
Functional properties imparted to end product	Limited		Product impacts necessary functions
Percentage of cost of goods sold of final product (by volume)	Low		High
Potential to solve a particular problem of product offering	Just a small ingredient		Problem can be solved, as well as competing technologies
Legislation/regulations-driven changes	Limited changes		High likelihood of imminent changes
Percentage of product testing required by end market (e.g., engine testing or drug trials)	Limited to none required		High degree required (and usually costly to run)
Complexity of end market or resolution of customer issue	Little to no complexity		High level
The chemical company's existing relationship to and reputation in the end market	Limited or poor reputation or ability to service		Good reputation as a problem solver/ solution provider

Source: DTTL Global Manufacturing Industry group.

Chemical companies could benefit from such partnerships in several ways:

- Spread of the financial risk
- Increased visibility and oversight
- Syndication of investment costs
- Improved financial options
- Expanded capabilities and access to experience
- Increased depth of insight into new opportunities
- Increased relevance and timeliness of information
- Access to subject matter specialists

A successful customer relationship depends on selecting a complementary partner that is willing to collaborate and has enough stamina and shows growth potential. The assessment of degrees of customer intimacy shown in Figure 17 can guide a chemical company through key elements of a partnership and the associated risks.

Determining the key capabilities

What are the key capabilities needed for a chemical company to approach a selected opportunity successfully? In *The chemical multiverse*, the DTTL Global Manufacturing Industry group identified nine strategic drivers to help a company determine strategic capabilities that are useful in this changing and often uncertain environment.[53] They are portfolio, feedstock, talent, sustainability, end markets, innovation, capital flow, operational excellence, and business model. Successfully managing new opportunities requires business model experience. Thinking through a business model approach raises an array of additional and important capabilities to help drive an effective execution. These additional key capabilities include industrial marketing; value selling/pricing excellence; collaborative innovation; and operations excellence, supply chain integration, and sustainability.

Industrial marketing

The global chemical industry has spent decades executing a go-to-market model to sell and deliver liquids and solids efficiently. This model has morphed into a mindset — a lens through which opportunities, strategies, and transactions are viewed — with a notable deficiency in industrial marketing. That evolution is understandable because many chemical companies have managed contribution margin by necessity, functioning as stewards of complex asset networks, and have grown to offer multiple products and serve multiple customers throughout the world. As the environment moves toward finding new frontiers of collaborative innovation and a solutions mindset, industrial marketing disciplines can be expected to become more common in the industry.

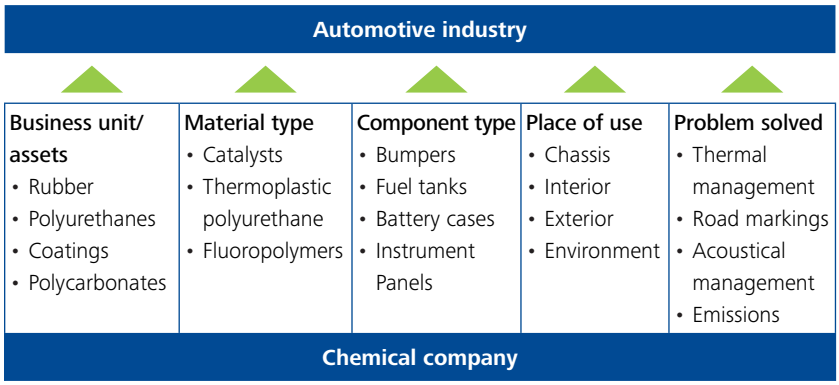
In order to take a sophisticated approach to industrial marketing, a chemical company should address the following questions:

- Is the value chain of a target new frontier end market well understood? Is this value chain in the throes of transformation? Can a company position itself in the value chain?
- Are the solutions/unmet needs in the respective new frontier markets clearly defined?
- How well do the entrepreneurial teams understand the landscape of new frontier customers and the markets they eventually serve?
- Do the business units within the company understand emerging generations of new solutions along the value chain in relation to their traditional product lines?
- Are the business units capable of competing on the basis of differentiated value instead of price alone?
- Are crossovers between business units desirable or required to address new frontier opportunities?

Figure 18 presents the example of various approaches to the automotive industry, ranging from a focus on a company's business units/assets, through material and component type offerings, to solving issues. This example shows the involvement of the global chemical industry in the automotive sector. In the past, chemical companies moved toward more sophisticated marketing and top-down initiatives to drive growth. Today's companies are starting to apply marketing concepts such as customer

53 DTTL Global Manufacturing Industry group, "The chemical multiverse: Preparing for quantum changes in the global chemical industry," 16 December 2011.

Figure 18: Exemplary market approaches to the automotive industry



Source: DTTL Global Manufacturing Industry group.

intimacy, adjacencies in the value chain, and changing patterns of consumption.

Why are marketing skills becoming an increasingly crucial factor in gaining a global competitive advantage? The global environment is changing in an unprecedented way. More than ever before, companies have access to information and resources. The challenges society faces an expanding population that requires scarce resources in a fragile global economy, which provide opportunities for the global chemical industry. It is time for companies to consider placing bigger bets on fewer squares, despite uncertainty. Industrial marketing offers a means to optimize the business models in practice today and to develop strategies that will align with the changing global dynamics.

In today's world, green/sustainability is already embedded in many consumer products, and, in some cases, serves as an important marketing feature. Consumers in several end markets may even be willing to pay a premium if the product is both green and sustainable (for example, low rolling resistance tires that improve fuel economy). While there may not always be a need for a green/sustainable product/solution, it is one of the industrial marketing group's roles to understand what the trends and needs are in the end markets their chemical company serves, and to figure out how to best meet them.

Another consideration that can move companies closer to end markets is the value chain itself. Evaluating the length and complexity of the value chain, as well as the size and sophistication of the players within it, has become a more practical and regular practice for leading chemical companies. A relevant and recent example shows how Bayer MaterialScience successfully puts together value chain, marketing, and business model thinking. Bayer MaterialScience is marketing the EcoCommercial Building program. This is an innovative concept that assembles architects, component manufacturers, materials producers, and other key influencers of non-residential building construction to offer solutions to the marketplace. These solutions are envisioned to be emissions free, zero-energy consumption, and free of volatile organic compounds. This integrated material and strategy solution keeps pace with the constant changes associated with urbanization and resource scarcity.[54]

In both of the examples, collaboration with new technology providers outside the value chain or along with various companies is a key success factor. Many skills and techniques are common to these various marketing programs at world-class levels: extensive market research capabilities, test-and-learn tools, and a value engineering mindset. Achieving world-class industry performance in solutions development joins together marketing, innovation, general management, operations, and other key skills. It requires talented people who often have multidisciplinary backgrounds and are comfortable working in teams and with resources in and outside their companies.

Value selling/pricing excellence

Most chemical companies analyzed for this report have a material component within their business portfolio that competes primarily on the basis of supply and demand. Competition can be global, regional, or local, but best cost plays a major role in success. By and large, the chemical companies analyzed also have a proportion (typically a much smaller proportion) of their portfolios in differentiated and solution-focused businesses. Given these dynamics, pricing and selling can be challenging for a chemical company, especially when business models

54 Bayer MaterialScience, "EcoCommercial building program," September 2010, www.bayermaterialscience.com.

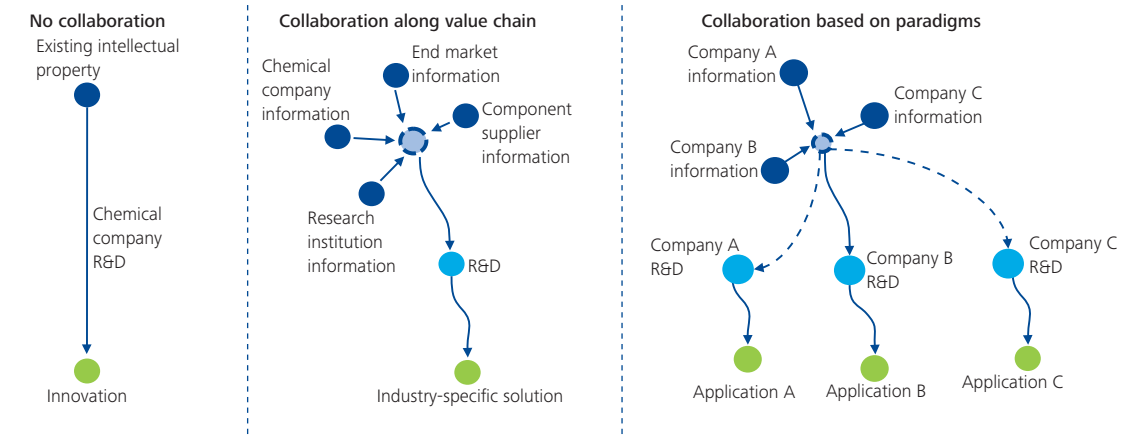
and customer value propositions are not clear and cost reductions dominate the management agenda.

As mentioned earlier, end markets with high consumer intimacy can earn healthier profits, in part because their approach to customers and the market is consciously linked to value (as perceived by those customers). The global chemical industry can learn from its end markets, particularly if the focus moves closer to the customer. Systematic, disciplined pricing and selling approaches, when linked to well-defined business models (i.e., those that must compete on cost, those that provide a valuable total solution, etc.), can form the foundation for market success. The report research revealed that a major function of success is consistent, superior execution, and that leading companies devote significant effort to people development, training, and innovation, especially to reinforce pricing discipline and to support sales, marketing, and innovation.

Collaborative innovation

How can companies participate in the convergence of technologies and markets? How can companies deal with the onset of additional complexity as they strive to become more intimate with the customer, more solutions driven, and more externally focused? How can a company assemble the capabilities needed to drive new solutions and manage the risk of unknowns? Collaborative processes are being discussed regularly in the global chemical industry as a means of filling capability gaps and managing risk. Because the industry attaches significant value to intellectual property that is capital intensive and extremely competitive globally, there has been reluctance in the past to collaborate on new technologies and potentially even more concern about collaborating on new solutions. Yet collaboration might be the only way for chemical players to help solve some of society's larger problems and to participate more broadly in the global market economy. The announcement from Evonik and Daimler of a joint

Figure 19: Collaboration models



No collaboration	Collaboration at level of innovation and market approach	Compete at level of development and marketing of application. Collaborate at level of molecular innovations
Innovation based on product/application		Innovation based on paradigms • Molecular attributes • Molecular information and communication • Molecular factories
Governance, risk, and reward is not shared	Risk, reward, and governance is shared	

Source: DTTL Global Manufacturing Industry group.

venture called Li-Tec to develop and produce advanced lithium ion batteries is just one example. It is quite common now for medical device makers to fabricate stents coated with therapeutic compounds in partnership with pharmaceutical makers and chemical companies.

Figure 19 depicts some of the collaboration options a chemical company may consider.

After a company decides whether to collaborate and to what the extent, the next decision is how to collaborate. In addition to classic product development within a company, two types of collaborative methods can be identified (see Figure 19):

- **Collaboration along the value chain:** Collaboration with companies on the same value chain. Universities or institutes can also be part of this type of collaborative process. Partnerships include entities that research and develop industry-specific solutions or applications. These partnerships do not necessarily compete in the market or approach the market jointly.
- **Collaboration based on paradigms:** Although this process may not develop the same solution or application, it enables companies from different industries to work together. These partnerships are based on the paradigms of molecules. Collaborative innovations take place at the levels of molecular attributes, molecular information and communication, and on the manufacturing of molecules. This collaborative process uses the concept of jointly developing molecules and independently developing a solution or application, based on the new molecules, that is then marketed individually.

Each of these types of processes allows risk, reward, and governance to be shared among partners, contributing to successful collaboration.

Operations excellence, supply chain integration, and sustainability

Smarter supply chains could become a key factor in meeting customer expectations. The notion of low-cost and solution-oriented business models that are not in conflict is also worth pursuing. Traditional supply chain techniques have sought to balance market responsiveness with high efficiency in standardized processes. These supply chains have been seen to deliver adequately differentiated services that are somewhat closely aligned with customer and market needs.

As advanced planning tools bring efficiency to specialized products and services (and solutions) and are combined in real time with asset intelligence to reduce process latency, the possibilities for increasing customer intimacy and developing customer solutions improve. Advanced tools and techniques are envisioned to move supply chains beyond their roles as efficient internal networks. These supply chains can function as connection points and information sources for new solutions and open architectures such as collaborative innovation and solution partnerships.

The green/sustainability movement provides an example. In some cases it is beneficial for chemical companies to construct and market green/sustainable supply chains because their customers' procurement departments are increasingly evaluating the CO2 footprints of suppliers. It is also becoming more common for consumers to factor the impact of the environment into their purchase decisions. The global chemical industry has made great progress, more so than most other industries, in the area of green/sustainability and customers perceive the global chemical industry as able to deliver sustainable products and solutions.

The challenge for many companies today is monetizing that achievement. With a smart supply chain and a solution focus, investments in sustainability and in solving societal problems can also be a source of value for chemical companies rather than simply a cost burden. It therefore makes good sense for companies to include appropriate green/sustainability elements in the design of business models, incorporating them at the beginning of the design phase of new products and solutions and then capitalizing on them through effective marketing and communications strategies. The degree to which a chemical company develops its key capabilities depends primarily on the requirements and trends present in the participating end markets.

Building better business models

Perhaps the most fundamental insight resulting from End market alchemy research is the importance of using customer and value network knowledge to build better business models. In the future, the business models chemical companies deploy will have to extend their perspective to better account for the challenges customers in end markets have trying to serve the ultimate end user.

Paying close attention to business models while thinking differently about providing solutions is a promising growth vector for the global chemical industry. To capitalize on that process, it would be expected to find better business models that a chemical company would consciously design and execute. Some design considerations are:

- Permanently expanding the company's perspective to end markets instead of focusing only on the next value chain step
- Combining business models effectively, especially if external partners are part of the solution
- Aligning with customer needs in the end markets and with costs
- Evaluating megatrends and their impact on value migration, value network dynamics, and emerging markets
- Raising new business model capabilities, information, and decision support to world-class levels in order to lock in competitive advantage
- Insuring sustainability is part of and drives a solution oriented mindset

Although business model development involves several considerations, Figure 20 depicts the relative degree of importance of five key capabilities. The x-axis plots the strategic intent of a business using low cost and differentiation as extremes. The y-axis plots the degree of customer and end market intimacy in relation to the degree of intimacy with companies in all links along the value chain.

Figure 20 helps to describe the following six representative business models.

Low-cost, reliable supplier

The low-cost, reliable supplier model requires underlying world-class operations that are streamlined to produce and deliver products at the lowest cost in the industry. Individual customer intimacy is not as crucial as in other business models because the products manufactured tend to be basic chemicals. In addition, this model bases purchasing decisions almost exclusively on specifications. Constant monitoring of the supply-demand balance in the various market and geographical segments is a required competency, as are pricing discipline and supply chain network optimization.

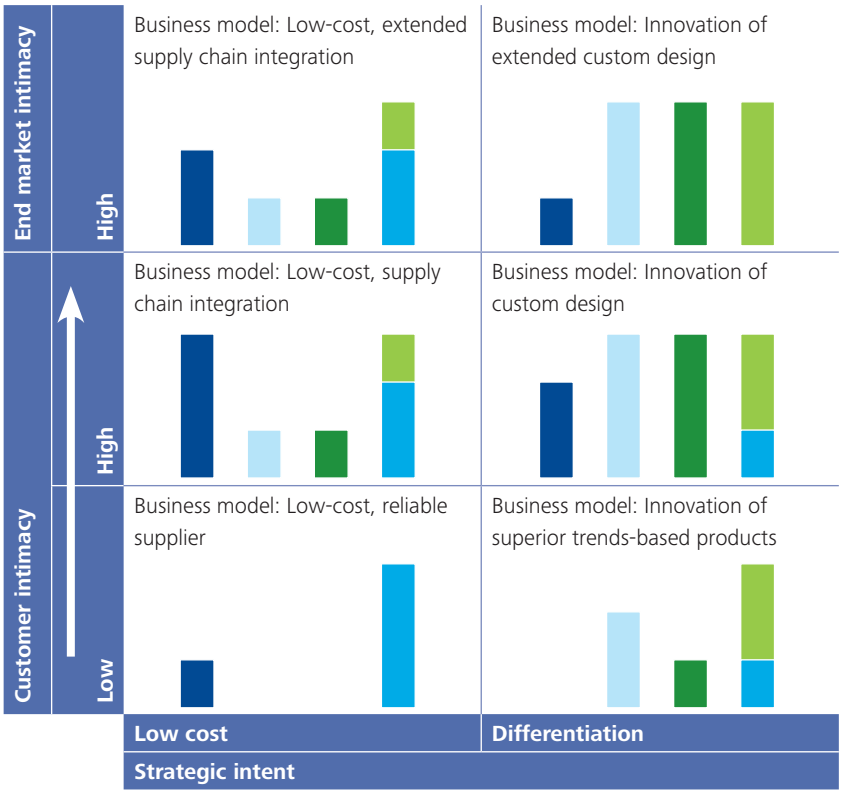
Low-cost, supply chain integration

This model has all the same characteristics as the low-cost, reliable supplier model, but in it a high degree of customer intimacy requires more advanced industrial marketing to identify opportunities such as additional cost reductions. This cost savings approach is accomplished by collaborating with selected supply chain partners to optimize and integrate operations more closely. Some value-selling skills are required when negotiating with customers and partners in the supply chain.

Low-cost, extended supply chain integration

This model builds on the characteristics of the low-cost, supply chain integration model and extends the entire supply chain to an end market. Value-selling skills are required to bring together various participants in the supply chain in a collaborative working relationship. Collaborative innovation is essential for success because this type of extended intimacy represents a structural change in the value chain that depends on joint planning, forecasting, and replenishment.

Figure 20: Extending a business model perspective to end markets



Key capabilities:

- Supply chain differentiation/ integration
- Industrial marketing
- Collaborative innovation
- Supply-demand pricing
- Value pricing

Source: DTTL Global Manufacturing Industry group.

Innovation of superior trends-based products

This model reflects a classic business focused on developing superior products based on market trends but acting independently from specific customers and other participants in the industry chain. Significant industrial marketing and market research, combined with R&D, are required to create innovative new products or processes. These products are pegged to value and sold to a wide range of potential customers. Market research may include input from focus groups that represent market segments and niches. Value-pricing skills are important as the new products developed are likely to be functional substitutes for versions already existing in the marketplace.

Innovation of custom design

Building on the same characteristics as the innovation of superior trends-based products, this business model incorporates a high degree of customer intimacy with selected customers and a focus on supply chain integration. Additional collaborative R&D and marketing programs are established to create products tailored to customers.

Innovation of extended custom design

This business model has most of the same characteristics as innovation of custom design but extends collaborative R&D and marketing to the end markets. The process flows not only to customers but also to companies along the value chain all the way to, and potentially including, end market companies. This business model emphasizes the value of product/process innovation with downstream companies.

Conclusion

The world may be on the verge of another economic downturn after a recovery that helped the global chemical industry to retrench. Growth in China has shown hints of volatility and possible moderation. The gross domestic product of the European Union and the United States will be flat to negative according to most forecasts.[55] As the global chemical industry prepares for another possible downturn, will traditional cost cutting deliver the necessary returns, or is there a different solution this time?

Regardless of the issues on the horizon in the short-term, this analysis of global chemical industry end markets has highlighted a path to increased understanding of customer and consumer needs. This understanding can enable chemical companies to act on opportunities presented by major societal challenges and megatrends. Even in a downturn, will real options exist to invest in solutions and address unmet needs? Whether a given end market remained stable, rebounded, or reset in the wake of the previous economic downturn could indicate future behavior. Almost certainly, a deeper understanding of end markets and the surrounding value networks will be helpful in navigating the times ahead.

With their important connections to consumers and society, end markets are replete with outstanding opportunities for value and growth. The challenge for the global chemical industry is how best to position itself to tap into these opportunities. Expanding the perspective to end markets and adjusting business models accordingly is a way to approach that challenge. Some of the world's greatest scientific breakthroughs came from the pursuit of alchemy. Perhaps the thorough study of end markets will enable the global chemical industry to take another large leap forward.

55 Deloitte Research, "Global Economic Outlook: Policy makers confront reality," Third quarter 2011, www.deloitte.com.

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Deloitte Touche Tohmatsu Limited Global Manufacturing Industry group

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