Transformations in the Fine and Speciality Chemicals Business

1.1 Fine and Speciality Chemicals Industry Structure

Rapidly changing demographics, global trade and labour patterns, increasing technological obsolescence combined with stringent environmental regulations and consumer pressures pose both short and long term challenges for the fine and speciality chemicals industry. Globally four macro trends influence the course of this industry – global population, climate changes, urbanization and food security. The demographic changes and the shift of power from West to East have also led to a different set of realities. The chemical industry and, in particular, the fine and speciality chemicals industry is passing through a challenging phase with margin squeeze, loss of consumer market and economic slowdown in Asia Pacific, Latin America and South Asia – some of the fastest emerging markets.

The end-use markets are today subjected to a wide range of global and regional regulations and product protocols. Across diverse segments of economy – oil and gas, life sciences, electronics, information technology (IT), construction, materials, energy, mining and agriculture – there is a high dependence on fine and speciality chemicals. The value proposition that these performance chemicals offer is equally matched by growing concerns about their manufacture, use and disposal in a safe manner.

Technology and market shifts within the end use segments are radically influencing the way fine and speciality chemicals are being designed, developed and taken to the market place in sustainable ways. Through the last decade rapid technology obsolescence and advances within the end use markets have been matched by innovative responses by from the fine and speciality chemical industry in product development, operational models and business structures. However, these have come at a high cost for the industry due to high costs of energy, feedstocks security, research and development (R&D) and, more importantly, the prohibitive costs related to meeting climate change and sustainability mandates. Notwithstanding its importance to all sectors of the economy and significant
progress made, the chemicals industry still faces a real concern over a shrinking resource base and increasingly negative climate change impacts.

These factors have been pushing the chemical industry and, in particular, the fine and speciality chemicals industry to seek new growth options. At an operational level the industry has resorted to rationalization of cost structures across diverse business functions through integration of new technologies, manufacturing models and novel feedstocks. Leveraging the potential of newly emerging chemical technologies while aligning with global sustainable development mandates has been a guiding force for the industry.

1.1.1 Global Chemical Industry Trends

The world chemical industry value chain from oil and gas in the ground to high value specialities in our personal lives has witnessed defining changes in business, financial, technology, manufacturing, marketing and supply chain models. Since the 1990s the industry structure has been continuously changing due to shutdowns, consolidation and mergers and acquisitions (M&A). To a great extent these shifts have been driven by slowly falling margins, volatility in oil and gas prices, increasing energy prices and shifts in market geographies. These have been complemented by shifting consumer preferences for environmentally benign products and stringent regulatory mechanisms.

There have been some defining changes in the global chemical industry with new feedstocks, both renewable and fossil based, forcing a rethink on the future of the chemical economy. The Middle East (ME) region with oil reserves dominated the 1970s to 1990s, while the last decade saw a shift of chemical hubs from the ME to the Americas and other parts of the world with shale gas finds. This shift is bound to alter the dynamics of global chemical and fine chemical industry in several ways. With a new-found edge in feedstocks coupled with tremendous technology capability across the entire spectrum of the chemical businesses the West is bound to emerge as a major force in the future and in the process alter the industry structure.

It has been a story of rapid growth for the chemical industry which was once valued at US$171 bn in 1970 to a staggering US$4.2 trillion in 2010 (Davis, 2009). Such growth has been mainly driven by the rapid expansion of the Chinese chemical industry from US$100.4 bn in 2000 to US$900.3 bn in 2010. During the 2000–2010 period while India grew at around 14% and China at around 24% respectively, growth had levelled out at 5–7% in Japan, the United States and Germany (American Chemical Council (ACC), 2011a). According to the Organization for Economic Co-operation and Development (OECD) projections, developing nations will account for 30% of global production and 33% of consumption by 2020 (OECD, 2001), which is in alignment with projections by the American Chemical Council for China at 10% y/y and India at 8%, in contrast to growth rates of under 4% in the United States, Canada and Europe (Swift et al., 2011). Between 2000 and 2010 BRICS (Brazil, Russia, India, China and South Africa) saw a doubling of chemical sales from 13 to 28% of global sales. This period also saw mega scale chemical facilities and infrastructure being set up in China, India and Brazil (OECD, 2011). Africa is poised to make its mark in the global chemical arena with increasing growth from the sub Saharan and North African regions. With a rise in living standards, governance and investment in oil and gas sectors the signs of emerging chemical markets are clear. Demand for pharmaceuticals, speciality
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Figure 1.1 Mega trends influencing the fine and speciality chemicals industry

consumer chemicals, electronics, clothing, etc., are likely to drive growth (Manda and Mohamed-Katererem, 2011).

1.1.1.1 Macro Trends Shaping the Fine and Speciality Chemicals Industry

Growth in the end-use industries, novel applications, focus on innovations and sustainability remain the key drivers for the fine and speciality chemicals market. The global fine and speciality chemical industry is governed and driven by macro level determinants, which are likely to shape the industry in the coming years (see Figure 1.1).

Meeting these needs will need companies to look for innovative and sustainable options in R&D, manufacturing, supply chain and business strategies. Newer opportunities from energy, materials and health care are likely to emerge. These will call for multitechnology and market platforms. Investments in new products, global service platforms and in innovative R&D programmes are poised to increase in the next few years.

With Asian growth slowing down Western firms that had invested for a long time in Asia have been facing a tight margin crunch. Operational models that were easy to adopt in developed nations needed a lot of modification to synergize with Asian regional realities, leading to customized region or country specific models (Verity et al., 2013).

1.1.1.2 Consolidation Continues

The fine and speciality chemicals industry is a complex and dynamic industry that is always in a state of perpetual transition. Uncertainties abound in this sector due to ever changing business structures and market fundamentals. Besides the impact of sharp decreases in sales and profits, producers have been grappling with challenges of demand shifts, margin squeeze and product protocols in regulated markets. These trends are compounded by the slowdown in life sciences, automotive, construction and other user segments that have a high level of fine and speciality chemicals component. Amidst this turmoil, managing
transitions and creating value have become central to the growth strategies of fine and speciality chemical players – in diverse markets such as pharmaceuticals, crop protection chemicals, home care and personal care, coatings, additives, colourants, food ingredients and water treatment.

With a revenue of over US$700 bn spread over 30 odd subsegments with diverse geographic spread the speciality sector today is differentiated by large players with multilocation, multiproduct, multimarket focus and multiproduct capability on the one side and niche players with focused products and markets on the other. Despite the reach and technology capability of bigger players the growth has come from niche players with focused portfolios.

The global fine and speciality segment slowly saw a recovery after the recessionary trends in 2009–2010 period. Despite the revival, however, production of chemicals (and most other manufactured goods) remained below prerecession levels. China and India emerged as major growth hubs followed by Brazil. Through this period speciality majors aggressively pursued diverse routes – cost cutting, acquisitions, portfolio restructuring, new product launch, market forays, and innovation models in response to slowdown and profit squeeze. China and India, in particular, anticipate double-digit or near-double-digit gross domestic product (GDP) growth. End-use markets for speciality chemicals continue to recover. Growth prospects for speciality polymers, biocatalysts, nutraceuticals, personal and home care, speciality coating additives and speciality surfactants continue to witness steady growth.

In recent years, medium sized companies like Ecolab, International Flavors & Fragrances and Sigma-Aldrich in the United States and Altana and Merck KGaA in Germany have proved to be highly profitable with unique models. The high entry barrier, strong brand image and track record of innovations have enabled these niche companies to remain leaders in their respective segments. This model also provides for better opportunities to develop sustainable products and solutions. BASF’s acquisition of catalysts firm Engelhard and Ciba Speciality Chemicals and Dow’s acquisition of US-based Rohm and Haas and recently Clariant’s acquisition of Sud Chemie were major strategic decisions.

Globally the speciality chemicals segment followed the fortunes of commodity businesses with rapid commoditization of specialities. The highly attractive speciality segments that attracted major investments witnessed a drastic climb down. Since the recent recessionary trends across the world global demand growth in specialities has been difficult to predict. The global speciality chemicals market is also a highly competitive market. Due to wide scope of applications and overlap of many chemicals across various segments, companies such as DuPont, BASF, Akzo Nobel, etc., have a strong presence across a host of application segments.

Through 2011 to 2012 the speciality chemicals industry witnessed a slowdown forcing companies to restructure operations, both internal and external transformations. BASF, DSM, DuPont and Evonik are among the speciality chemicals operators (or diversified companies with speciality businesses) that have responded to slowing demand with internal transformations. DuPont’s decision to divest its automotive paint business to Carlyle was yet another similar transformation and enabled it to focus on agriculture and nutrition. In several instances acquisitions were made as a strategy for forays into adjacent areas. For instance, BASF’s US$1.02 bn acquisition of Becker Underwood gave it access to a coating technology that can be extended to protect seeds.
1.1.2 Managing Transitions in the Fine and Speciality Chemicals Industry

The fine and speciality chemicals industry has been through several transitions in the last three decades. In the 1990s there was a major shift towards fine and speciality businesses. High operating margins and insulation from volatilities of commodity business were key drivers for such a shift in strategy. Through the 1990s, this move allowed the companies benefits of physical integration – a secure supply of feedstocks and markets for intermediates with minimal supply chain costs. However, in 2000 there was another major shift with commoditization of specialities due to maturing portfolios, high fragmentation due to the rise of Asian chemical hubs and regulatory pressures from the Registration, Evaluation and Authorization of Chemicals (REACH) initiative.

Through these periods, managing transitions and creating value through sustainable approaches became central to growth of the industry. It invested highly in innovation and R&D platforms for meeting climate change protocols, zero carbon footprint models and sustainable products. It also focused on cost rationalization and asset optimization across their businesses, with integrated sustainability protocols (Rajagopal, 2009c, 2009d). The fine and speciality chemicals industry has been facing transitional challenges related to changing industry structure, growth pressures, customer space changes, monetizing R&D platforms, sustainability demands and serving customers from a low cost base (see Figure 1.2).

These challenges were met with innovative approaches as most of them were significantly influenced by sustainability and climate changes factors. The fine and speciality chemicals industry adopted diverse approaches mentioned below to meet these challenges:

- Manage commoditization threats
- Restructure portfolios through M&A

![Figure 1.2 Transitional challenges](image-url)
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- Investing in innovative R&D innovations
- Leverage emerging technologies
- Tapping the promise of renewables
- Rationalize cost structures
- Explore sustainable value creation models

1.1.2.1 Manage Commodity Threats

In the 1990s transition from an integrated commodity business to a high value fine and speciality business was a major game changer for the industry. Fine and speciality chemicals were among the most attractive segments of the global chemical industry as they were immune to the vagaries of uncertain cycles typical of commodities markets. This period witnessed a marked forward integration by commodity companies to high value specialities, a move that enabled feedstocks security, minimal supply chain costs and optimization of resources and utilities. In addition it enabled a broader portfolio of products.

However, since 2000, increasing commoditization of specialities, shrinking profits and fragmentation due to new entrants led to a gradual slowdown of margins for first movers. A combination of market competition and customer consolidation led to pricing becoming a key criteria at the cost of customized service and performance. Speciality products which commanded a premium due to their performance became slowly commoditized, leading to shrinking margins.

The regulatory and sustainability mandates also forced these companies to invest highly in new R&D and technology platforms. Coupled with a slower pace of taking products to markets the industry responded through spin-offs and new alliances with Asian competitors. Speciality chemical companies having highly maturing portfolios found new growth options quite limited. New-found consumer consciousness for sustainable products and services imposed further challenges for the industry. Consolidation of the customer base, with concomitant sustainability demands in several speciality segments such as automotive, construction, personal care and food, significantly increased customers’ purchasing clout.

To offset the threats of commoditization of specialities companies resorted to diversification of portfolios and focused on M&A to seek a faster move to markets. Such trends were noted in DuPont’s acquisition of Danisco, which enabled it to access the synthetic enzyme technology of the latter for textile, feed and food applications. This move also enabled DuPont to access Danisco’s celluloseic ethanol platform. Recently, Solvay added Rhodia’s well established supply chain in Asia and Latin America (Cassidy et al., 2012).

Turning Commoditization and Sustainability Pressure to Competitive Advantage

Commoditization and sustainability mandates emerged as major drivers for the industry through 2000 to 2012. Slow product development, increasing regulatory pressures and falling margins brought on by commoditization reflect the difficulty of changing business models even as business conditions shift. Altering existing models to face new market environments involve significant disruptions in organizational structure and R&D focus. At present many companies straddle both the speciality and commodity space. These companies face three challenges: creating value for commodity products, evolving new operating models and integrating sustainability practices across the entire business functions. Speciality
chemical companies are compelled to develop real time tracking systems to assess pricing mechanisms, competitor strategies and customer preferences for sustainable products and services.

Speciality chemical companies have started to respond to these threats by cost rationalization across business functions, investments in innovative products and services and M&A. However, new models to meet the threats of commoditization by speciality companies have met with mixed success. Through the last decade poor returns on innovation investments, unsustainable service platforms and lack of models for integrating sustainable protocols into business goals posed serious challenges. No company today enjoys first mover advantage with increasing customer consolidation in high growth sectors such as construction, automotive, healthcare and personal care segments.

Product substitution is a key driver for shifting value chains. Previously high value products such as engineering thermoplastics are being replaced by new generation polypropylene. Automotive and construction sectors have witnessed significant product substitutions. More importantly, these are being driven by greener products with low carbon footprints. In several segments of specialities, such as personal care, home care and coatings, customers are increasingly demanding a complete dossier on the sustainability value of the ingredients they source.

It is imperative that speciality suppliers develop knowledge of their customer space, applications, technology and regulatory shifts to be able to provide products and solutions for an increasingly demanding customer base (Morawietz et al., 2011). In response to commoditization Dow Chemical adopted solutions-based businesses, making a transition from a product-focused approach to a ‘product-agnostic’ model. Under the market-facing model, Dow had shifted its focus from selling specific products to marketing formulation and application expertise. Investing in greater sophistication across business functions – R&D to markets – was yet another strategy adopted by several companies. Focusing on niche market segments was the key focus of Rohm and Haas (now a part of Dow) in their process chemicals and new platforms business, which included biocides, personal care ingredients and ion-exchange resins. Ciba Speciality Chemicals (now a part of BASF) had undertaken a reorganization of R&D in an effort to centralize research in each of its six main product areas: protection and stabilizing chemistries, colour components, polymerization and curing chemicals, interface and rheology additives, paper strength and coating chemicals, and solid/liquid separations.

Clariant, prior to its reorganization, had four divisions: textile, leather and paper chemicals; pigments and additives; functional chemicals; and colour additives masterbatches. Clariant once had 40% of its businesses based on a product-oriented model with an intense focus on efficiency and 60% of its businesses were service-oriented. FMC sought growth from shifting natural products and biopolymers into wound care and other applications. At Chemtura’s performance specialities division, which manufactures urethanes and petroleum additives and fluids, technical service and application research has driven growth to some extent.

Commoditization and sustainability challenges will need a radical approach in future R&D, operations and commercialization functions. Capability to develop a sustainable product and service portfolio will define the future survival for any fine and speciality chemicals company.
Sustainable Value Creation in the Fine and Speciality Chemicals Industry

1.1.2.2 Restructure Portfolios through Mergers and Acquisitions

Continuing shifts in global markets, trade and manufacturing have posed complex challenges for the fine and speciality chemicals players. In addition, increasingly strong regional competition, high energy and raw material costs, falling margins and in particular, commoditization of specialties have led to a slowdown in growth. The industry has been responding through asset restructuring and realignment of business models that are aligned with sustainable and best practices to be able to compete in a dynamic and often uncertain environment. In recent years rising customer demand for sustainable products and practices has also led to companies seeking alliances with potential partners having capabilities in offering such products and solutions.

To diversify portfolios and enhance the scale and breadth of existing businesses, companies are turning to acquisitions to swell their speciality offerings relatively quickly without the enormous upfront R&D costs (DTTL (Deloitte Touche Tohmatsu Ltd), 2009).

Revamping product and service portfolios led to a spate of M&A activities across the fine and speciality chemicals spectrum. The fine and speciality chemicals industry has seen a large number of deals involving M&A, exits and buyouts where strategic players had to compete with financial investors for potential targets. Rationalization of business portfolio and asset realization drives M&A and will continue through the next five years. The process of consolidation is likely to pan out over the next few years, opening up new M&A opportunities from fragmented segments. Overcapacity, restructuring and price pressure from Asia also provide new acquisition opportunities. Today, Asia has become the key hub for M&A. Cyclical and relocation are generally regarded as part of the challenge in the chemicals industry. A chemical business may be subject to a number of cycles and at present we notice that these cycles are shrinking. Some of the key M&A deals in recent years are given in Table 1.1.

Major fine and speciality chemical players in emerging economies of China, India and Brazil are also seeking alliances in raw material sourcing as well as market access and infrastructure. Niche product companies in areas that offer a value added portfolio will be most sought after. Buyers from the Middle East, Asia and other emerging economies are

<table>
<thead>
<tr>
<th>Acquirer</th>
<th>Target</th>
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<tr>
<td>BASF SE, Germany</td>
<td>Becker Underwood Inc., US</td>
</tr>
<tr>
<td>The Carlyle Group LP, US</td>
<td>DuPont Performance Coatings Unit, US</td>
</tr>
<tr>
<td>Clariant AG, Switzerland</td>
<td>Sud Chemie AG, Germany</td>
</tr>
<tr>
<td>Lonza Group Ltd, Switzerland</td>
<td>Arch Chemicals Inc., US</td>
</tr>
<tr>
<td>Solvay SA, Belgium</td>
<td>Rhodia SA, France</td>
</tr>
<tr>
<td>DuPont Denmark Holding ApS, Denmark</td>
<td>Danisco A/S, Denmark</td>
</tr>
<tr>
<td>Berkshire Hathaway Inc., US</td>
<td>Lubrizol Corp., US</td>
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</tbody>
</table>

Source: Industry sources and company websites.
expected to actively buy out assets in North America and Europe through the 2012–2014 period.

Private Equity Players Join the Foray  Though strategic investors were dominating the scene between 2006 and 2011, the period also saw intense activity by financial investors. Forays made by financial investors led to many disruptions due to changing business and revenue models. In an industry where returns on investments are spread over a longer period the new models often took time to fit in. Moreover, the internal changes within organizations also led to erosion of knowledge assets. The process of consolidation is likely to pan out over the next few years opening up new M&A opportunities from fragmented segments.

Private equity buyers with growth models based on value creation with limited exposure to market volatilities have made a comeback since 2011 as financing has become easier and affordable. These players continue to redefine the business models in the fine and specialty sector. The period also saw deals within financial communities like the US-based Royal Adhesives & Sealants sale by the US private equity firm Quad-C to the Global Arsenal Capital Partners, Rhone Capital’s sale of a 75% stake in the US-based pine chemicals producer Arizona Chemical to American Securities, CVC Capital Partners’ sale of a 42.5% stake in US chemical distributor Univar to Clayton, Dubilier & Rice and Apollo Management’s €1.1bn acquisition of a Belgium-based amines producer from the UK-based private equity firm CVC Capital Partners.

M&A Reflect Sustainability Trends  Three defining trends – globalization of operations and markets, commoditization of specialities and a shift towards sustainable practice – have transformed business practices within the industry. There is an increasing appreciation of the fact that sustainable value creation is possible by integrating environmental practices into business goals. The industry is now required to adhere to global standards in manufacturing and environmental practices in regions where it is relocating its manufacture. This often poses challenges when the regional standards are in variance with a company’s benchmarked standards. Asian companies are on a learning curve in adapting best practices in their businesses. This period also witnessed new business, R&D, market and SCM models incorporating sustainable protocols. The markets also saw a shift towards innovation in services and application. These trends are reflected in many M&A today where sustainability was a key driver for diversification of portfolios. However, the complexities involved in sustainability processes made it a challenging task for companies with diverse portfolios and related sustainability practices in the postmerger phase.

New regulations continue to drive changes. Today most chemical companies are looking for deals that will fast-track their core businesses rather than those that will lead them to new sectors. REACH will continue to make an impact on the future of M&A. REACH is seen mainly as a cost but also may develop into a business issue depending on the toxicity of the relevant products and the potential reaction of the market. The impact of REACH needs to be analysed and managed in M&A ventures. Asian companies are equally active pursuing an acquisition model for growth and focusing on those that have the capability to handle REACH compliance standards. In Europe, REACH compliance will drive future M&A. Many Asian companies are not compliant, so the only way they can service
10 Sustainable Value Creation in the Fine and Speciality Chemicals Industry

Europe-based customers is by having production within Europe. REACH compliance could have been an important factor for Japan’s Mitsui AgriScience International when it purchased the Ireland-based agricultural chemicals firm AgriGuard.

It remains to be seen whether the speciality firms realize their goals of revenue growth through portfolio revamps, growth in emerging markets, cost rationalization and operational excellence. In future these companies will need to explore new SCM models and, more importantly, they will need to develop elegant and feasible approaches to dealing with commoditization threats.

1.1.2.3 Investing in Innovative R&D Platforms

The speciality chemicals industry is under pressure as new mandates and regulations continue to raise cost while placing high expectations on innovation in products and processes. A combination of relatively high production costs, changing regional balance in manufacturing in customer sectors and the absence of advantaged feedstocks have all contributed to poor productivity. Investing in incremental innovation across business functions, and particularly in green R&D platforms, is a key focus for many companies to drive internal growth.

Investing in R&D innovation is perceived as a key driver of future growth and speciality majors have been investing heavily in innovative R&D since 2006. Such research was aimed at discovering new compounds as well as finding new applications for existing chemicals within and outside the boundaries of their segment. Green chemistry and engineering tools have been the mainstay for new product development in the fine and speciality chemicals segment (Anastas and Williamson, 1998).

Speciality chemical producers have set up a variety of structures and systems for achieving research breakthroughs. R&D programmes are being aimed at newer and sustainable compounds designed for end-use markets. Most large speciality chemicals companies have opted for a decentralized approach to R&D. However, there are sharp differences in the way these decentralized systems are run, especially in relation to customer partnerships. Bayer had, in the past, dismantled its central research unit and created a separate entity which included speciality chemicals for the paper, leather, textile and electronics industries, as well as for fine chemicals.

One of the historical examples of an internal research reorganization was within Ciba (now a part of BASF) through integration of expertise in dyes and pigments to make formulations for ‘soft pigments’, which find uses in both textile printing and bath dyeing. Clariant, another proponent of the decentralized approach, holds innovation forums every year, enabling scientists from around the corporation to discuss their findings and gain an insight into the research work throughout the company.

Increasing pressure on margins, high input costs and regulatory pressures have been pushing the industry to seek alternate innovative solutions. The industry has recognized that the way to competitiveness is only through enhanced boost to innovative R&D. This would then provide the platform for more sustainable chemicals production, products and services. Worldwide the industry is under great pressure, in particular on environmental and health aspects, even as new mandates and regulations raise indirect costs. Today research is not only focused on new compounds but also on new applications for existing products. Companies are looking at sectors beyond the traditional ones. Evolving new
Table 1.2  Some examples of sector innovations

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Domains</th>
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<tbody>
<tr>
<td>Adhesives</td>
<td>Light weighting through material substitutions, extreme</td>
</tr>
<tr>
<td></td>
<td>condition performance, for auto, aero space</td>
</tr>
<tr>
<td>Detergents</td>
<td>Biodegradable products – Henkel</td>
</tr>
<tr>
<td>Coatings</td>
<td>Reflector coatings, super solid ultra low emission products –</td>
</tr>
<tr>
<td></td>
<td>Dupont, Akzo Nobel</td>
</tr>
<tr>
<td>Fibres</td>
<td>Biopolymers, nonwoven from nanofibres, micro-encapsulations</td>
</tr>
<tr>
<td>Colourants</td>
<td>DyStar’s fluoro aromatic Levafix CA reactive dyes, with over 90%</td>
</tr>
<tr>
<td></td>
<td>fixation</td>
</tr>
<tr>
<td></td>
<td>Ciba: Cibacron S dyes ‘thrice-reactive’ chemistry</td>
</tr>
<tr>
<td></td>
<td>Clariant: Drimarene HF reactive dyes (no bound halogen)</td>
</tr>
<tr>
<td>Construction</td>
<td>New chemistries in concrete admixtures</td>
</tr>
<tr>
<td>chemicals</td>
<td>Polycarboxylates: Nippon Shokubai, Degussa, WR Grace, Sika</td>
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models and systems to promote innovations has been central to the business activities of this industry. New structures and models for research breakthroughs are being created to develop new products and transfer knowledge across the entire organization. Some of the notable examples of sustainable innovations are given in Table 1.2.

1.1.2.4 Leveraging Emerging Technologies

Fine and speciality chemical players have also been leveraging the emerging prospects from biotechnology, catalytic technology, computational tools and process intensifications – micro reactor technologies. This has helped them to develop eco-efficient products and sustainable processes that enable profit maximization and also meet sustainability mandates.

Process Intensification Through Micro Reactions  Micro reactor technology (MRT) has emerged as a key technological component featuring miniaturized reaction components and systems (Schwalbe et al., 2002). Global pharma and fine chemical majors such as Aventis, BASF, Clariant, Lonza, Schering, Sigma-Aldrich, Ticona, Roche, Merck KGaA and DuPont have all made significant forays in MRT for their existing and new product ranges. Global fine chemical majors such as Bayer, Clariant and Sigma Aldrich opted for MRT in their custom synthesis activities. Clariant invested in the Competence Centre in Microreaction Technology and has developed a production process for pigments. Degussa (now Evonik) developed an in-house process intensification model involving MRT systems. Others like FMC, Dow Chemical, Lonza, Glaxo Smith Kline, Johnson and Johnson are all focused on MRT applications. Novartis made forays into Michael additions, aldol condensations and peptide synthesis (Rajagopal, 2006).

Biotechnology Opens up New Vistas  Industrial biotechnology is poised for the next level of breakthroughs through advances in enzymes and whole cell systems to catalyse chemical conversions of renewable resources. Industrial biotechnology uses living cells like moulds, yeasts, bacteria or mammalian cells as well as enzymes to produce a large variety of products including bulk chemicals, enzymes, vitamins and active pharmaceutical ingredients (APIs).
This sector will drive significant innovations in the chemical and life science industry and lead to more customer-suited products at competitive costs (Bachmann et al., 2000).

New Catalytic Technologies New approaches in catalysis are expected to deliver safer, cleaner and more efficient chemical processes. Catalytic methods for transformation of complex molecules for fine chemicals production, the synthesis and immobilization of catalytic reactive centres in solid state surfaces, selective hydrogenation and oxidation, and biocatalysis have made significant contributions in developing several commercially important products (Arends et al., 2007).

Advanced Materials Technology Speciality polymer industries are projected to leverage ‘intelligent’ composite materials based on organic or inorganic materials as well as biocompatible materials to design longer lasting batteries, smaller and more stable sensors and improved fibres for prosthetics and implants. Nanotechnology covers many areas, including nanoparticles, nanocomposites and custom designed nanostructures that find applications from polymer additives to drug delivery and cosmetics. Advances in composite materials (e.g. mixtures of polymers and fibers and of metals and ceramics) have led to far-reaching developments (American Chemical Society (ACS), 2000).

1.1.2.5 Tapping the Promise of Renewables

The search for newer feedstocks and raw materials has never been so pronounced as now, with major R&D investments in carbohydrate and plant-based feedstocks. Drivers for this shift are a short supply of crude oil, process technology developments, biotechnology advancement and environmental stipulations concerning the use of petrochemical feedstocks. Development of a bio-based economy depends on how biorefineries are designed and scaled-up (IEA Bioenergy, 2011).

In its quest for identifying cost competitive ways of converting feedstocks to products of a higher margin, the chemical industry has been developing innovative processes and technologies for transforming low margin, raw bulk commodities to high value chemicals. Development of the bio-based chemicals and materials industry is at an early and high risk stage and emerging markets for bio-based products are expected to stimulate a new wave of innovation and in the process open up new avenues. Mandates and subsidies introduced by governments will ultimately create the markets to support biorefineries and encourage global competition. There are technical, strategic and commercial challenges to be overcome if we are to realize the potential of a bio-based economy. Bio-based science and new emerging technologies have a substantial role to play in maximizing the full potential of the bio-based economy and accelerating its development.

1.1.2.6 Rationalization of Cost Structures

The competitiveness of the industry lies in gaining a cost advantage in feedstocks, technology, research, procurement, utilities and in fact the entire chain. In every segment of the industry, companies are vying for cost leadership. ‘How to serve the customers from a low cost base?’ is the oft-asked question. The industry had adopted diverse approaches to managing costs across its business functions, both internal and external. The fine and speciality chemicals industry has positioned strategic cost management at the top of its priority list. As
new molecular discoveries, sophisticated instrumentation for micro analysis and software packages are all expected to drive costs further and new approaches to rationalizing costs are needed. The industry is increasingly focusing on the theme of maximizing productivity through low cost options (Rajagopal, 1999a).

1.1.3 Industry Shifts, Competitiveness and Markets

Fine and speciality chemicals companies have been focusing on delivering value to their customers through sustainable products and services. At present the global industry is highly fragmented with a focus on niche segments and customers. Most companies are looking to expand and broad-base their customer portfolio. It is an industry that has today geographically widened with major players locating their sites across the world. In the speciality chemicals space product differentiation and customer orientation have been complemented by an increased focus on innovative research practices and investments.

During the evolutionary phase the focus was on raw materials and new product development. The development phase saw a shift from lab to factory and the emphasis shifted from discovery to large scale organized production. Advances in chemical engineering and process development coupled with novel developments in chemistry became the prime movers of the industry. The expansion phase in the 1960s and 1970s saw a wide array of synthetic polymer products replacing natural products – paper, wood, cotton, etc. This phase also saw the entry of MNCs to the scene. The diversification phase in the late 1980s and 1990s emphasized a broad product portfolio and a shift from R&D to application development and a focus on markets. In the maturity phase between the late 1990s and now, innovation, manufacturing technologies, tools and metrics, sustainable practices, new feedstocks based on renewables, customer engagements and alliances have emerged as key drivers (see Figure 1.3).

1.1.3.1 Understanding Fine and Speciality Chemicals

Commodity chemicals, unlike speciality chemicals, are sold strictly on the basis of their chemical composition. Fine chemicals, like commodities, are sold on the basis of their composition and generally are interchangeable with other products of the same composition. Speciality chemicals are single-chemical entities or formulations/combinations of several chemicals whose composition sharply influences the performance and processing of the customer’s product. Fine chemicals are produced in limited quantities using a variety of key technologies such as chemical synthesis, biotechnology, extraction and hydrolysis of proteins. Speciality chemicals are of a smaller volume and are more specialized chemicals. These include chemical additives and auxiliaries; paints, inks, dyes and pigments; adhesives and sealants; and other chemicals (The European Chemical Industry Council (CEFIC), 2010). Speciality chemicals are formulated to custom specifications, often varying from one customer to another, even within the same industry. Formulations also vary with application, function and operating conditions.

The fine chemicals industry catering to both pharmaceuticals and crop protection chemicals is marked by an increasing emphasis on research and technology, high R&D costs, slow pace of NCEs and outsourcing practices (Pollak, 2007).
In the fine chemicals industry typically three tiers of players exist. At Tier 1 are companies with global operations and high R&D capability, operating in regulated markets. At Tier 2 are companies with high regulatory capabilities, operating in regulated markets, but with limited new chemical entity (NCE) development capability. At Tier 3 are companies with low technological or regulatory capabilities.

Rising pressures due to patent expirations, a slowdown in approvals and shrinking margins have been key drivers for outsourcing to emerging economies. Fine chemicals players have also been finding that the cost of managing environmental and waste management prohibitive. Fine chemicals manufacture is marked by a high waste generating potential and the industry has seen a major shift towards greener process technologies. Since 2000 fine chemicals players have been integrating sustainable protocols into their business goals. The fine chemicals industry has been focused on new molecules synthesized through energy efficient and low waste processes. New fine chemicals technologies such as catalytic, biocatalytic, process intensification, membrane separation reactions (MSR), etc., are redefining the industry as never before (Rajagopal, 2009a, 2009b).

Pharmaceutical intermediates are likely to account for over two-thirds of the fine chemicals market by 2012. There is an increasing shift towards advanced fine chemicals for biopharmaceuticals. High potency active pharmaceutical ingredients (HPAPIs) are the fastest growing segments within fine chemicals, with cancer therapies driving new developments. Besides the ability to deliver results at low dosages, they also help to improve life expectancy in cancer patients. In the next five years the segment will see a large number of players in high potency APIs. Agrochemical intermediates represent the second largest category among fine chemicals (after APIs), the majority of which are used in the manufacture of pesticides, herbicides, insecticides, fungicides and fumigates.

Fine chemicals manufacture has now predominantly shifted to emerging economies of Asia. Chinese and Indian companies dominate fine chemicals manufacture. The shift
Transformations in the Fine and Speciality Chemicals Business

of power from Western companies to regional companies has been profound in diverse segments, with increased trade, access to technology platforms and increasing living standards. Almost all global majors have their footprints across Asia and in particular China and India. Chinese and Indian manufacturers have become adept and innovative in tapping into traditional developed markets with a high export orientation for high value specialities.

1.1.3.2 Shift of Manufacturing and Markets to Emerging Economies

Since the 1990s there has been an increasing shift of manufacturing from developed nations to emerging or transition economies due to various factors. These related to shrinking margins due to high costs of manufacturing, energy and labour. In its quest for seeking a new growth model global companies from developed nations moved eastwards. Forces of globalization of markets led by a booming Asian economy, a growing consumer base increasing the pace of urbanization and lax regulatory and environmental standards provided a perfect scenario that enabled this migration of production bases. By the late 1990s Asia had become the largest global chemical hub for fine and speciality chemicals, led by China and India. This phase also saw the migration of polluting chemical manufacturing to the East (Rothman, 1998; Rajagopal, 1999b).

Between these two growing markets multinational corporations from the West found immense investment opportunities driven by lower labour costs, a reduction of tariffs and other trade barriers. These key drivers have facilitated the move of a very significant portion of chemical production activity from developed countries to emerging economies.

In due course growing demand for sustainability and safeguards led to a host of initiatives and standards being adopted in these emerging and transition economies. The migration of manufacturing to the East through tie-ups, M&A and joint ventures (JVs) also led to transfer and then absorption of global technology and chemical management practices in Asian economies (Kiriyama, 2010).

With evolving structural changes in the industry and increasingly high operating costs, MNCs are finding it difficult to maintain the competitiveness despite the Eastward shifts. At present fine and speciality chemicals manufacturing has moved Eastwards and closer to the markets. A case in point is the electronics sector (Box 1.1). This move has had profound ramifications, with a high degree of complex and hazardous manufacturing moving into regions with no previous track record of managing complex manufacturing facilities. Studies on the impact of such trends were carried out in order to understand the long term consequences of the flight of hazardous manufacturing from West to East (Rajagopal, 1999b).

In Asia several countries are in different stages of development and industrial infrastructure still lags behind. The continuing shifts in global output, trade and usage pattern for specialties will lead to increasing pressure on these countries, which are in a transition phase with less than adequate capabilities to manage the complex challenges from resource use, emission and waste management. The future of fine and speciality chemicals growth will be decided by Asian economies with its large markets and manufacturing facilities. However, in the long term innovations in product design and technology will be decided by Western companies until Asian economies evolve globally accepted best practices.
Sustainable Value Creation in the Fine and Speciality Chemicals Industry

Box 1.1 Case study of the electronics sector

Global demand for electronic chemicals and materials, particularly in developed countries, was projected to increase between 5% and 12.6% annually from 2010 to 2015. By 2015, global demand for electronic chemicals and materials is anticipated to reach $51.6 billion (BCC Research, 2011). Currently, 77% of the chemicals used for the production of integrated circuits and printed circuit boards are being used in Asia. Japan and China account for 21% and 14% of the global total respectively and other Asian countries account for 42% of the global total (Hackett et al., 2011). The electronics industry, with a large dependence on chemical specialities, has shifted Eastwards due to a host of regulatory and safety protocols in developed nations. Electronics production has grown globally, and is expected to grow, with an increasing percentage in developing/transition countries.

The electronics industry uses a diverse range of speciality chemicals such as heavy metals, rare earth metals, solvents, polymers and flame retardants (OECD, 2010). Electronic devices such as personal computers, laptops, cell phones, televisions and other household appliances and entertainment devices are composed of a number of materials and components made from chemicals such as lead, cadmium, chromium, etc., and other polybrominated derivatives (Robinson, 2009).

Since the 1990s a wide spectrum of electronic devices and applications manufacture shifted to China, Taiwan, Korea and other parts of Asia. Large scale and nonoptimal ways of using such chemicals in many developing economies with no comprehensive chemical management policies for such chemicals have led to serious health hazards (Bender et al., 2007).

Increasing consumer demand for electrical/electronic goods and materials, along with rapid technology change and high obsolescence rate of these electronic items, contribute to a global e-waste generation of around 40 million tons a year. With a strong emphasis on the information and communication technology (ICT) sector in emerging economies, the prospects of the e-waste burden is very high and countries like India and China are likely to see a hundredfold increase in e-wastes (Schluep et al., 2009).

1.1.3.3 Market Focus on Sustainable Products

The fine and speciality chemicals market was valued at US$768 bn in 2011–2012 and is projected to grow to US$980 bn by 2016–2017 (Market Line, 2012). Fine chemicals account for nearly 29% of this market. Comparatively, the European and Asia-Pacific markets are expected to grow with compound annual growth rates (CAGRs) of 5% and 5.8% respectively, over the same period, to reach respective values of US$295.4 bn and US$394.9 bn by 2016. Following the recessionary slowdown in 2010–2011, the fine and speciality chemicals sector witnessed renewed growth from automotive, construction and consumer electronics. Asian nations, and in particular China and India, with growing local markets are projected to grow at around 8% through to 2016. In the next five years personal and home care, adhesives and sealants, speciality surfactants, construction chemicals and automotive chemicals are expected to grow fast. Growth in the end-use industries, escalating demand from China, India and the rest of Asia, new products and applications that integrate the
Transformations in the Fine and Speciality Chemicals Business

Sustainability protocols will drive the markets. However, the rising cost of raw materials, regulatory issues and environmental concerns remain key challenges.

Speciality chemicals end markets are closely linked to each other and often impact on adjacent markets. For example, automotive, electronics, healthcare and construction markets have a direct impact on energy, metals, fine and speciality chemicals, polymers, etc. The customer preferences in these end markets have seen marked shifts, with increasing demand and emphasis on sustainable products, processes and practices. With rapidly urbanizing BRICS economies the need to factor in sustainable protocols across business functions will drive fine and speciality chemicals growth.

**Construction Industry Moves towards Greener Products**

The US$8 trillion global construction market is expected to grow at a CAGR of 18.3% from 2010 to 2014, led primarily by growth in developing markets, including the Asia-Pacific region (20.8%) and Latin America, which is likely to see double-digit growth (Datamonitor, 2010a). High value specialties such as adhesives, sealants, coatings, antimicrobials, elastomers, etc., account for about 17.5% of total construction costs for every unit of new residential construction (ACC, 2011b). Sustainability practices and greener building materials have emerged as defining trends. With increasingly stringent environmental standards the demand for bioplastics, speciality elastomers, high performance coatings, advanced composites and polymers for lightweighting and other sustainable products is projected to go up. To meet these needs speciality suppliers will have to seek and develop high performance and sustainable products. The global demand for green building materials (cement, insulation and wood products) is expected to reach US$571 bn in 2013, up by 25.5% from US$455 bn in 2008 (ABI Research, 2009).

**Electronics Industry Sets the Pace for Greener Speciality Products**

The electronics industry has witnessed rapid shifts in the way new electronic equipment, semiconductors, office and consumer electronics, cables, etc., were designed and developed in tune with environmental mandates. Technology convergence is changing the way components are designed and developed. Health issues and energy optimization criteria are defining new developments in TVs, mobile phones and a host of other devices (Datamonitor, 2010b).

At present the world electronics sector is being driven by demands for products that are made by sustainable processes. New opportunities for bioplastics, advanced composites, polymeric materials for solar panels, micro generators and photovoltaics are projected to open up new avenues for speciality players. In addition, traditional cable markets have opened up immense opportunities for polymers used in coating metal wires, insulating materials and additives, as well as local power generation devices (DisplaySearch, 2010).

**Sustainability Drives the Automotive Sector**

Expected to grow at around 6.4% through 2010 to 2020 and largely driven by growth in Asia-Pacific, China, India and Brazil, the auto sector has been on overdrive in developing new technologies (J.D. Power and Associates, 2011). Green trends in automotive markets such as biobased tyres, bioplastics components, novel elastomers, biofuel additives and special effect water-based coatings have led to new market segments opening up in the automotive value chain. Advances in hybrid and electric vehicles with an emphasis on emission reduction fuel efficiency, lightweighting and new generation batteries are likely to define new growth paths for chemical companies catering to such applications (DTTL, 2011).
1.2 Regulations and Fine and Speciality Chemicals Industry

The fine and speciality chemicals business today faces tremendous challenges in providing services to consumers, while trying to innovate new ways of doing so, with markedly lower reliance on materials, energy, labour and waste treatment. Increasingly complex and tight regulations have been a double-edged sword for the industry. While it drove innovation in businesses it also led to a tight margin squeeze in the short term. With increasing economic development in developing nations led by the chemical industry, a variety of adverse challenges related to safety, toxicity, air and water emissions and waste management have cropped up. The chemical industry today faces challenges in key areas where the scope for innovation is enormous. New regulations will be key drivers for such innovations. Fine and speciality chemical sectors ranging from dyes, textiles, leather, coatings and electronics deploy a range of speciality chemicals, that find their way into consumer markets, and have yet to be evaluated for their harmful impact on humans and the environment.

Climate change remains the main environmental topic on the global agenda of business and of governments. The driving force behind this development is a growing awareness and public discussion of climate change, its consequences to humans and the demand for transparency on the carbon footprint of operations, product life cycles, etc. Today, to be sustainable a company must meet performance standards in economic, environmental and social factors. The chemical industry has made strides in meeting these requirements through its commitment to Responsible Care, which encompasses environmental protection, product stewardship and occupational health and safety. A responsible care programme was initiated in the late 1980s (Simmons and Wynne, 1993). It was based on self-regulation by the industry without sanctions (King and Lenox, 2000; Solomon and Mihelcic, 2001).

1.2.1 New Directions in Regulatory Regimes

In the late 1970s stringent rules and regulations were framed following the Stockholm Convention (1972) for persistent organic pollutants. This was followed by the Marpol Convention (1973), the Helsinki Convention (1974) and the Vienna Convention (1985). In the 1990s far-reaching declarations like the Rio Declaration (1992), the Kyoto Protocol (1997) and the Rotterdam Convention (1998) came into being. In early 2002 the major summit, the World Summit on Sustainable Development (2002) took place, followed by REACH (2007). REACH was a milestone in that it transferred the onus of responsibility from the government to the manufacturer. These conventions led to a series of similar regulations in other regions. Despite the direct impact on industry competitiveness, many of these led to significant sustainable innovations and enabled eco-efficient products and solutions in the fine and speciality chemicals industry.

Historically the evolution of regulations began in the 1970s and continues to evolve (Geiser and Edwards, 2012). The evolution of national instruments and programmes for safe management of chemicals are given in Table 1.3.

In response to complex environmental impacts involving chemicals, governments and multilateral organizations around the world have undertaken active initiatives to protect the environment. Initiatives like the Emission Trading Scheme (ETS), REACH (Registration, Evaluation, Authorization and Restriction of Chemicals), voluntary programmes, carbon or energy taxes and standards on energy efficiency are just a few examples. To address
### Table 1.3 National instruments and programmes for the sound management of chemicals

<table>
<thead>
<tr>
<th>Goal of Instrument</th>
<th>Timeframe</th>
<th>Legal</th>
<th>Technical</th>
<th>Voluntary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Controlling Chemical Pollution</strong></td>
<td>1970s+</td>
<td></td>
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<tr>
<td>- Air quality and emission control</td>
<td>X</td>
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<td>- Ambient water protection and waste water control</td>
<td>X</td>
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<tr>
<td>- Drinking water protection</td>
<td>X</td>
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<tr>
<td><strong>Remediating Contaminated Sites and Managing Waste Chemicals</strong></td>
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<tr>
<td>- Emergency response and spill management programs</td>
<td>X</td>
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<tr>
<td>- Hazardous waste site remediation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Hazardous and municipal waste management</td>
<td>1970s+</td>
<td>X</td>
<td></td>
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<tr>
<td>- Legacy chemicals and stockpile management</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td><strong>Controlling Dangerous Chemicals</strong></td>
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<td></td>
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<tr>
<td>- Food and drug safety</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Pesticide regulation and management</td>
<td>1970s+</td>
<td>X</td>
<td></td>
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<tr>
<td>- Workplace health and safety</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td><strong>Preventing Chemical Pollution</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>- Pollution prevention and waste reduction</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>- Cleaner production programs</td>
<td>1980s+</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>- Chemical accident prevention programs</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>- Sustainable agriculture and Integrated Pest/Vector Management</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td><strong>Managing Chemical Information</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>- Chemical testing programs</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
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<tr>
<td>- Hazard communication and Right-to-Know</td>
<td>1980s+</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>- Product ingredient disclosure/Product declaration</td>
<td>X</td>
<td>X</td>
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<tr>
<td>- Pollutant Release and Transfer Inventories (PRTRs)</td>
<td>X</td>
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<tr>
<td><strong>Generating Safer Chemicals and encouraging resource efficiency</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>- Green and sustainable chemistry programs</td>
<td>2000s+</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>- Green engineering programs</td>
<td>X</td>
<td>X</td>
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<td></td>
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<tr>
<td>- Chemicals Leasing</td>
<td>X</td>
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</table>

sustainable development fully the industry needs to develop indicators to measure the progress in these new areas. Newer molecules for a variety of end-use markets involve complex chemicals and reactants. The long-term impact of these new molecules has inherent risks that need a detailed evaluation. There is a perception that increased regulations means increased risks, liabilities, restrictions, costs, uncertainties, and delays (Cusumano, 1991).

A recent United Nations Industrial Development Organization (UNIDO) initiative in chemical leasing and ICCA’s Global Product Strategy (GPS) are innovative steps aimed at minimizing the carbon footprint of the industry. The Carbon Disclosure Project (CDP), a landmark effort due to efforts of civil society movements, maintains the largest database of primary corporate climate change information in the world. It consequently follows up the goal to disclose CO\textsubscript{2} emissions (Carbon Disclosure Project, 2010).

The United Nations has been pushing for the global adoption of its strategic approach to international chemicals management (SAICM) since 2002. The SAICM concept and framework endorsed by the World Summit on Sustainable Development in 2002, and by subsequent global conferences, aims to fulfill the Johannesburg Plan of Implementation. The Globally Harmonized System (GHS) of Classification and Labelling of Chemicals was a major effort to identify hazardous chemicals and communicate these to society through standard symbols, phrases on packaging labels and through safety data sheets. This encouraged countries to implement GHS on a harmonized basis for providing consistent physical, environmental, and safety information on hazardous chemical substances and mixtures.

1.2.1.1 GHG and Water Footprint Mapping

In recent times two major initiatives, energy emission reduction mapping and water footprint mapping, were initiated. The Greenhouse Gas (GHG) Protocol Initiative, founded in 1998, developed internationally accepted GHG accounting and reporting standards and promotes its use worldwide. It is a benchmark standard for all six GHGs identified by the Kyoto Protocol. There is a lot of ground to be covered here with the scope of data collection going beyond direct and indirect emissions to cover all outsourced services and suppliers, as well as channel partners (The Greenhouse Gas Protocol Initiative, 2010). The classification, labelling and packaging (CLP) of substances and mixtures was another major regulation in alignment with the existing UN GHG regime. The World Business Council for Sustainable Development (WBCSD) launched a global water tool that was updated in 2009 (WBCSD, 2010).

Governments were not alone in developing new instruments and approaches for the sound management of chemicals. Many enterprises, business associations and institutes synergized to develop new tools for sound management of chemicals, known as the Chemical Hazard Assessment and Identification of Preferred Chemicals and Products (Geiser and Edwards, 2012).

1.2.1.2 Impact of REACH on Fine and Specialty Chemicals Industry

REACH was a key milestone in the regulatory process governing the chemical industry as it shifted the onus of responsibility of chemicals on to the manufacturers who have to prove the safety aspects of chemicals in their use. On 1 June 2007 REACH came into force. It also streamlined and improved the previous legislative framework on chemicals for the European Union (EU). The thrust of REACH was to encourage the replacement of hazardous
chemicals with safer ones and to act as a stimulus to businesses in the chemicals sector to develop safer products. It is not yet clear how many chemicals will be covered, but under the preregistration requirement of the European Union chemicals regulation, REACH, 143 835 chemical substances have been preregistered. As of 6 May 2011, 3523 of these chemicals were registered (European Chemical Agency (ECHA), 2011). REACH had set a deadline of 1 June 2013 for preregistered substances manufactured or imported in the EU in tonnage between 100 and 1000 tons per year and 1 June 2018 as the registration deadline for preregistered substances manufactured or imported in the EU of between 1 and 100 tons per year.

Fine and speciality chemicals firms have been seeking a dilution of REACH standards due to perceptions that REACH will prevent essential products such as drugs, clothing, food products, etc., from reaching society. Key concerns of the industry relate to the fact that high costs coupled with product withdrawal by smaller players with low volumes serving niche segments will lead to dominance of bigger players with financial clout. Niche players will also have to bear additional administrative costs due to their inability to form a consortia and give unfair advantages for EU15 companies and may eventually drive local companies out of business.

1.3 Fine and Speciality Chemicals Industry and Sustainable Practices

Fine and speciality chemicals business needs considerable flexibility and innovative approaches to serve the customer from a low cost base. Facing increasing pressure from commoditization, competition and regulations, speciality chemicals players will find it very challenging to create value in the future. Opportunities for portfolio restructuring, consolidation (especially in Asia) and rationalizing costs across various functions still offer value creation opportunities for many companies. In the near future these companies will focus on options to leverage their assets in a targeted manner to create values that are sustainable. Value creation in the chemical industry is often a complex issue. Normally a product portfolio and returns on invested capital were key drivers for value creation in the industry, with varying products, diverse geographies, variety of regulations and applications (Budde et al., 2006). The evolution of the fine and speciality chemicals industry over the last five decades has been led by diverse advances in the industry.

In 2000 these value drivers were extended to include cost rationalization, new market access, innovation and novel SCM models. More importantly, the focus on seeking newer insights into the customer base behaviour became vital as the demand for performance and price was coupled with strident calls for sustainable products and practices. This in itself was a complex task as the fine and speciality chemicals industry is very diverse with vastly different applications, product protocols and regulations.

1.3.1 Sustainable Value Creation in the Fine and Speciality Chemicals Industry

In its efforts to capture value the industry is faced with the onerous task of identifying the definitive areas where value can be created. It also needs to change its business models continuously to remain in tune with the interdependencies in the value chain it is catering for. This often becomes very complex when sustainability parameters are factored into value creation models. This calls for new tools and methodologies to assess sustainable value
creation that incorporates the cost of the natural resources used. A detailed comprehensive approach has been used to estimate the sustainable value created by chemical companies (Liesen et al., 2009).

Perhaps the most significant challenge for the industry is to assess on a continuous basis the mega trends related to resource management and depletion, sustainability, urbanization and unmet product needs in diverse segments. With technology convergence, sustainability pressures and the need for multidisciplinary models businesses will have to chart new roadmaps to deliver products and value to customers. The fine and speciality chemicals industry has been responding through innovative approaches in R&D, scale-up, manufacturing, packaging and distribution that help in the development of eco-efficient products, enhancing energy efficiency, improving process safety and, more importantly, lowering GHG emissions. Innovation has indeed taken centre stage across business functions.

From a commercial angle questions remain about the willingness of the market to absorb the additional cost of meeting sustainability criteria and the feasibility of several new technologies to deliver competitive solutions. Identifying new markets for greener products requires that end market complexity should be better analysed – be it in coatings, personal care, pharmaceuticals, colorants, textiles, etc. The fine and speciality chemicals industry, which caters to each of these vital segments, holds the key to finding resolutions in sustainable ways. The industry needs to create opportunities that are so essential for business to grow while addressing the crucial customer end demands for safer products and sustainable solutions. Ranging from hydrocarbons to petrochemicals to commodities and to high end specialities such as coatings, materials, healthcare and textile segments, sustainability practices have increasingly gained wider acceptance.

Since the last decade there have been major initiatives by various industry coalitions and governments to fast-track sustainable practices within each industry segment. The World Business Council for Sustainable Development (WBCSD) has been at the forefront of several key initiatives and has provided leadership in sustainable industrial development. Recently it provided an ‘Agenda for Business’, a document that sets out the sustainability roadmap for the industry. It addresses societal needs through the development of eco-efficient solutions, lifestyles and behaviour while halving carbon emissions (WBCSD, 2012).

1.3.1.1 New Growth Models Driven by Sustainability Forces

To meet the emerging challenges new operational models are being developed. A key driver for these changing models is the realization within the industry that there is economic merit in conforming to sustainable practices that enable high resource optimization, cost rationalization and opens up new opportunities for growth. It was also realized that value creation needs to be integrated into sustainable practices to survive in the newly emerging tough consumer environments. Last decade witnessed a steady rise in the number of companies across various industrial sectors and in particular the chemical industry investing resources – financial, technology and human power – to develop sustainable practices. Creating value goes far beyond shareholder dividends and profits and extends to the vast natural resources base that the industry uses but fails to account for. Sustainable value creation involves delivering value while integrating the cost of resources and the cost of addressing climate change and other impacts delivered by the industry.
In the last five years several new and innovative initiatives were undertaken by the industry, which led to profound shifts in the business and manufacturing practices within the industry. Investing in sustainable practices across the entire business function led to significant improvements in the balance and social score cards of many companies. In addition to substantial gains made in reducing the carbon footprint this also led to increased brand recognition.

In due course innovation-driven sustainable products and services will open up opportunities for the fine and specialty chemicals industry. The challenge will be to translate the concepts of industrial sustainability into actionable strategies. The fine and specialty chemicals industry has never before been tested as it is now to develop new pathways and models in tune with sustainability protocols. What the industry can possibly do in future will be determined by how well it has assessed and tested the present platforms for R&D, manufacturing and services. Speciality companies have realized that creating value is not just about sustainable revenue growth but also factoring in the cost of natural resources and its regeneration.

Fine and specialty chemicals companies have focused on revamping product portfolios, customer servicing models and increased emphasis on sustainability as a core business goal. This has led to radical changes in the way operational and revenue models were developed (Accenture, 2011). Perhaps the most significant move has been to aim at a leadership position in their operating markets with sustainability as a key driver. Governments and global agencies have also enabled faster adoption of sustainable practices through a host of measures and charters. Several fine and specialty chemicals players have adopted varied business models for growth. These were customer centric, M&A and new operational models. A customer-centric model was based on aligning with customer locations, product differentiation and sustainable products.

Following customers to their markets is quite evident, as seen by several MNCs relocating their bases in China, Korea and India. In a move to offer differentiated products and services fine and specialty chemicals players opted for a variety of collaborative models with partners with complementary skills, as was evident in personal care and healthcare markets. There was a systematic focus by chemicals players to align their business strategies with that of end markets, as seen in the construction, automotive and electronics industries.

This necessitated a deeper understanding of regulatory and legislative determinants of each end-use sector they served. It also called for better insights into customer expectations from them. With customer preferences for supply chain reliability, eco-efficient products, sustainable practices and value addition, suppliers face immense challenges. Shifts in customer preferences have led to manufacturers investing in new products, applications and features aligned with global sustainability practices. Several speciality companies have engaged seriously in developing sustainable protocols and standards and assist their customers in sustainability practices (Lewe et al., 2011).

1.3.1.2 Customer Drives Industrial Sustainability

The industry has been proactive in moving from normal approaches to radically innovative approaches. The present transformations are likely to open up new and diverse opportunities for the fine and speciality chemicals businesses as demand for speciality materials and polymers, eco-friendly paints, smart textiles and speciality adhesives are expected to rise.
rapidly. The high level of sophistication in the end-use segments, coupled with increasing demand for sustainable products and solutions, will spur the need for customized solutions aligned with global sustainability mandates. Newer customer end preferences will pose the biggest challenge for the fine and specialty chemicals industry.

Since 2000, the fine and speciality chemicals industry has been actively pursuing a sustainability agenda, as reflected in the sustainability reports of several companies. Challenges of climate change, design of low carbon footprint technologies and products, and crude oil volatilities are being viewed more as opportunities than as impediments. New growth models are being based on sustainability principles as companies face increasingly higher demands for safer, eco-efficient and competitive products. Several companies look at the present challenges as an impetus for new R&D, business and market models. On the consumer front challenges exist as consumers demand that the products are not only sustainable but also deliver value to their businesses. With an increasingly aware consumer pushing for better industry practices in consumer product segments, like foods, personal and home care, textiles, etc., there have been marked changes in the industry’s response. It has become more adept in managing business and technology challenges emanating from resource use and has also adopted newer models of evaluating profitability, pricing and productivity.

In future, as resource scarcity compounds and regulations become tougher, the fine and speciality chemicals players will need to innovate continuously and competitively to find cost effective and sustainable solutions for their customers. This will call for experimenting with new models in diverse geographies, stakeholders, partners and governments. Today, the industry is fast aligning its commercial goals with that of new societal perceptions and has been working with governments, social leaders and civil societies. It has also actively engaged with the social media in its sustainability efforts.

In a rapidly changing market environment driven by regulations, consumer preferences and market flights the fine and speciality chemicals industry faces the toughest challenge from an evolved and aware customer. Meeting customer needs for performance products competitively and with social and environmental safeguards call for very innovative approaches. In the next ten years the fine and speciality chemicals players will go through radical changes, with competition in their markets, commoditization and scope for innovation becoming challenging. New business and revenue models will have to be developed across the spectrum of fine and specialities to tailor products and services to customer needs. Those companies that focus on product and service differentiation will have to track market behaviour, develop new tools and methodologies to understand and analyse customer landscape shifts accurately and predict their behaviour well in advance. New strategies for asset management, product differentiation and market entry are also needed. All these initiatives will have to be aligned with global environmental and regulatory mandates to develop sustainable value creation.

References


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