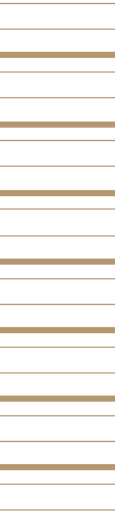




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Stern Stewart Research on European Chemical Industry // October 2002

Value Creation in the Chemical Industry

Challenging the Business Cycle

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Management Summary

Recently, companies in the chemical industry have faced a challenging business environment. Increased resource prices in combination with falling demand prices, overcapacity and lower operating rates have led to a sharp decline in economic performance.

The industry now is confronted with a slowdown in the economic cycle. In fact, today's cumulative operative value created by all European companies in the chemical industry is even lower than ten years ago when the industry was on the floor of the last business cycle. From an investors' point of view, the cumulative Market Value Added (MVA)¹ has been squeezed by almost 80% since its height in 1999. In other words, the industry has created minimal value.

On average the industry does not meet investors' expectations. The return from operations both in the period of expansion from 1993 to 1997 and in the contraction phase from 1998 until now has fallen short of the cost of capital. Naturally this is a generalised observation which may not be reflected in the performance of individual companies. For a more specific indication of how value may be created given the nature of the chemical industry, we analysed individual European companies² on their ability to create value.

The results reveal a fundamental, but often overlooked insight on what creates value in the industry. Companies that invested at the right time, i.e. at the bottom of the business cycle, were rewarded by more value created during the subsequent expansion phase. In fact these companies were rewarded on average by three times excess return during the following expansion phase compared to their competitors. In addition, companies that consistently moved towards a core activity, no matter if they are either key players or act as niche

¹ Market Value Added (MVA) is an indicator of external value creation. It is measured as the difference between the market value of a company and the capital invested over the years.

² Base: n=39 companies in the European chemicals sector. See for details '4. Companies Covered', p. 20.

players, achieved the highest operational margin in their segment. In some cases this strategy allowed for margins of up to five times the average competitor margins.

Evidently there have been constraints on applying this understanding in practice. We believe that the answer is first to apply a clear value-based business strategy. Value potential should be the clear focus of the decision-making process. As a result, strategic decisions will automatically align with the creation of value. Given the nature of the business cycle, making the right investments at the right time is crucial for value creation. This requires a forecast of shifts and the development of key indicators.

To be better prepared, we further suggest an active financial strategy to take advantage of opportunities for profitable growth, especially in downturns. A strategy of more efficient capital use may take advantage of lower acquisition prices, coupled with an increase in capital discipline, which husbands money more conscientiously. Investments in downturns can usefully energise management behaviour, focusing managers intently on maximizing performance. When the business cycle finally rebounds, the assets are in full bloom and ready to earn an excess return.

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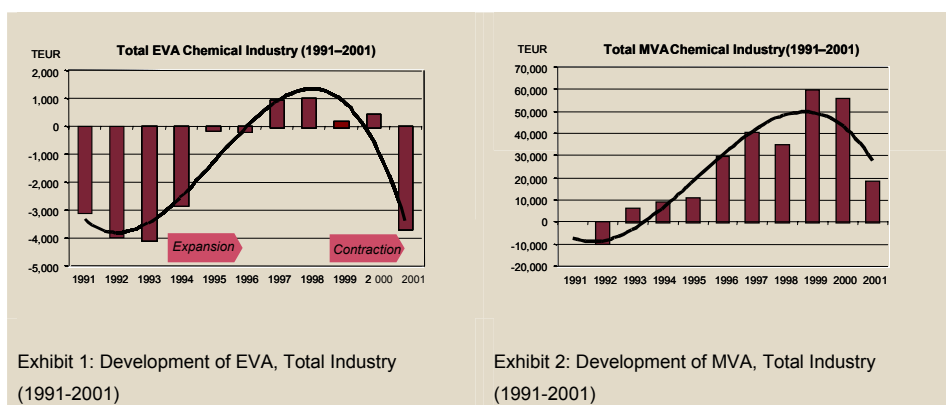
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1. One Industry Cycle, Varied Value Creation Among Segments

The chemical industry is highly cyclical, showing huge ups and downs both in operational results and market valuation. The cyclical nature can easily be traced by looking at the aggregate EVA^{®3} and the aggregate MVA.

The period following the last recession in 1992 can be divided into an expansion period (from 1993 to 1997) and a contraction period (from 1998 until today). Over the last ten years, value creation at the operations level, represented by aggregate EVA, moved in line with the value created for shareholders, represented by MVA. Only during the stock market boom at the end of the millennium, mainly in 1999 and 2000, did the development of chemicals stocks seem to move away from its intrinsic value – a fact mainly driven by high valuations of hybrid chemical companies with a strong foothold in the pharmaceutical business. Later this was corrected by a sharp decline in share prices in 2001.

Until 1999 operative value creation moved well in line with the value created for shareholders



Apart from long-term trends, large swings on the demand side as well as on the supply side impact all the industry participants. However the value created shifted within the industry. Some sub-segments and players better managed

³ EVA[®], Economic Value Added: measures the periodic operational value created by deducting the cost of capital from the net operating profit after taxes (NOPAT).

risks and opportunities compared to others and were more successful in convincing investors of the underlying potential of their businesses.

The chemical industry is highly fragmented and heterogeneous. The world's ten biggest chemical companies accounted for only 13% of the world's chemicals production in 2000. Chemical companies in Western Europe account for approximately 32% of the worldwide chemical market volume. The industry's heterogeneous environment is mainly due to the fact that it supplies virtually all sectors of the economy. Products may serve as intermediates for further industrial processes, or may be used in the environment, health care or nutrition segments. Despite fragmentation at a company level, going down to product level reveals a much higher degree of concentration.

To correctly take the industry's economics into account, we investigated developments in five segments:⁴

Analysing developments in five segments

>> Conglomerates: chemical companies of hybrid nature, engaged in various chemical fields - from basic chemicals to pharmaceuticals (companies with sales in the pharmaceutical business exceeding 50% were excluded from the study).

>> PPP: companies engaged mainly as producers of plastic and polymer related products.

>> Industrial Gases: companies whose main business is to manufacture and sell gases for large industries, electronics, or the healthcare business.

>> Speciality Chemicals: industry participants focusing on high value added services and selling chemical products for their specific functionality or performance (usually in small quantities).

>> Petrochemicals: companies focusing on base chemicals and oil derivatives – mainly divisions of international oil & gas companies.

⁴ The assignment to segments of all companies covered is listed in chapter 5.

Each of these sectors shows, in addition to general characteristics of the industry, distinct segment features such as variations in sales volume, profitability, or growth dynamics. Operative value creation, in combination with investors' expectations of future performance, influences the total value created for shareholders.

Shift of value creation within the industry – some sub-segments were better able to manage risks and opportunities

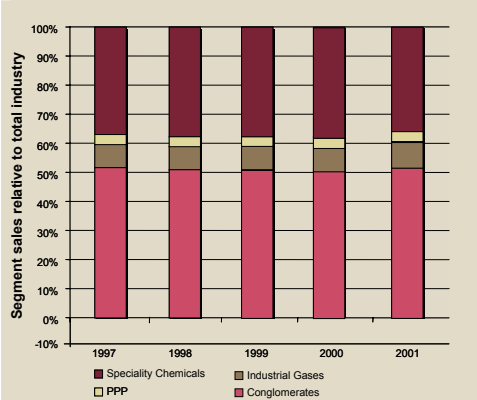


Exhibit 3: Share of segment sales as a percentage of total industry sales volume (1997-2001)⁵

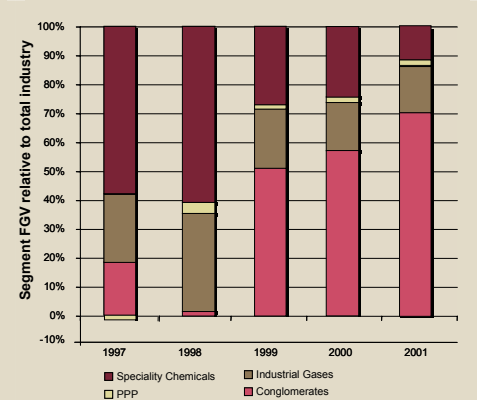


Exhibit 4: Share of segment FGV as a percentage of total industry FGV (1997-2001)

A comparison between relative segments' sales and relative expectation premiums reflected in chemicals segments' share prices (measured by Future Growth ValueTM - FGVTM)⁶ clearly shows a shift of investors' confidence away from speciality chemicals. Companies in this segment accounted for nearly 60% of the industry's total Future Growth Value⁷ in 1997. However, this premium shrank to about 12% at the end of 2001. At the same time, the segment sales relative to total industry sales were quite stable. Industrial gas companies managed to keep a high expectation level, given their relatively low sales. Companies producing mainly plastics and polymer related products raised their FGV. However, their valuations still remain low.

⁵ Industry defined as sum of companies covered.

⁶ Future Growth ValueTM (FGVTM) measures the value of expected improvements in EVA from this point forward. It represents the portion of market value not determined by a company's current operational performance.

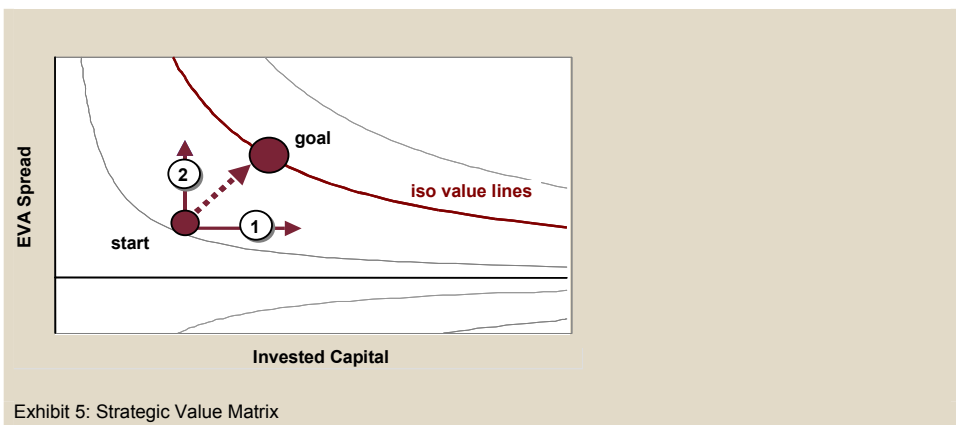
⁷ Excluding petrochemical companies, as they are mainly part of Oil & Gas Companies, and not separately listed.

2. Go Against the Flow – Strategic Paths to Value Creation

Strategic decisions have to ensure that business continuously creates an appropriate amount of value. In our view, any strategic decision-making process should therefore be the result of a deep understanding of the underlying value potentials of the industry, followed by a clear recognition of and response to opportunities and challenges as they arise.

Every business decision should be driven by two main levers of value creation: on the one hand the efficiency of existing operations and on the other hand profitable growth. There are infinite combinations of operating efficiency – measured by EVA spread⁸ – and growth – measured by invested capital. Each combination leads to a specific level of periodic value creation or EVA⁹. Any incremental investment that results in a positive EVA spread is profitable growth. Notwithstanding, to better identify the industry's actual ability to create value we independently analysed the core forces driving the two levers.

Analysing the two main levers of value creation: operating efficiency and profitable growth



⁸ Operating efficiency or EVA Spread is defined as Return on Invested Capital (ROIC) above the Cost of Capital (WACC), in technical terms [ROIC – WACC].

⁹ EVA in technical terms is defined as [ROIC – WACC] x Invested Capital

2.1 Investment Against the Tide

Industry cycles, including those within the chemical industry, are driven by two main forces. In terms of demand, since the buyers' businesses tend to be cyclical, products are affected by big changes in prices. On the supply side, when economies of scale are large and demand is falling, overcapacity puts prices even more under pressure, resulting finally in collapse.

Companies facing cyclical business models often show that they commit to heavy investments when market prices are solid

Knowing this, it is surprising that consensus earnings forecasts for cyclical companies ignore the cyclicity. Regardless of whether the cycle is at the top or at the bottom, forecasts show upward trends. Also, managers often misinterpret investing opportunities, causing even more cyclicity. Taking a deeper view inside companies based on cyclical business models often shows that they commit heavily to investments when market prices are solid. In addition, the companies are flush with cash at the top of the cycle, so external funding requirements are slim. Capital expenditures when prices are high often send wrong signals to the market. This tells the market that the future looks bright. That leads analysts to higher forecasts, which confirms managers in their decision to invest.

However, at the same time competitors are also approving their own capital programs. What results when the investments are operational is that capacity soars ahead of demand and prices collapse. Awareness of this focuses attention on the timing of major capital spending projects.

Definition of capital expenditure

For the analysis, the definition of capital expenditure includes investments in property, plant and equipment (PP&E) as well as expenditures in acquiring other companies. Being a major part of economic assets R&D expenses were considered, too: For this purpose, R&D expenses were added back to the profit figure and were capitalized and depreciated over their useful life. To relate total capital expenditure to the size of the sample companies, every number had to be standardized by the total capital invested of the company – first for the expansion phase in 1992, second in 1997, which was the recent high of the last cycle before contraction.

The adjusted numbers have been classified into three groups: High, medium and low investment behaviour (each in comparison to average total capital). For each group, value creation was calculated by measuring cumulative average EVA spreads for the years 1993 to 1997 and 1998 to 2001. To compare value creation with capital expenditure, the results have been classified as well: high value creation with an average cumulative excess return of more than 6.7%, medium value creation as 2.4% to 6.7%, and low value creation with excess returns of less than 2.4%.

The results of the analysis are a heavy slap in the face to many companies that have focused in investment cutting programs in times of an economic slowdown. Companies that invested more capital at the bottom of the last cycle performed much better than other companies. In fact, our value proposition is that cumulative excess returns of companies that made high investments at the bottom of the cycle are significantly higher than those of companies that concentrated on conserving capital during tough periods (exhibit 6). Why is that?

The more companies invested at the bottom of the cycle the more they performed better during the following upswing

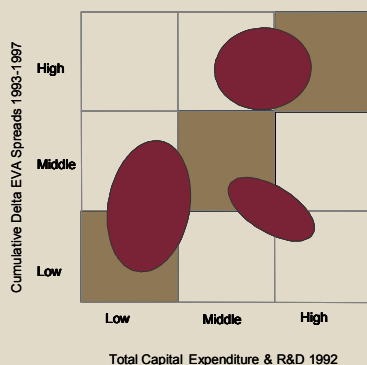


Exhibit 6: Value Creation depending on investment timing (bundles of companies in expansion phase)

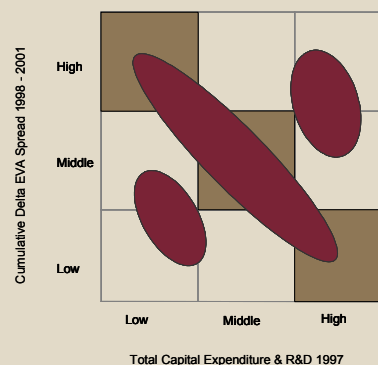


Exhibit 7: Value Creation depending on investment timing (bundles of companies in contraction phase)

The opposite of the first value proposition (contraction phase, exhibit 7) implies that companies with active investment behaviour at the top of cycle create less value. Although this still holds true for more than half of the sample companies, the picture is not as homogenous as it is in the economic upswing. On the one hand there is a group of companies that invests less at the top of the cycle but does have poor value creation. On the other hand there are still companies with a distinctive value strategy that invest at the peak of a cycle and still create value. This group of companies manages to invest only capital that is allocated with a positive EVA spread. Value drivers that are addressed by looking at capital expenditure therefore have to be complemented by the second component of value creation, profitability. These players therefore achieve a high level of “operational excellence”, which will be described later.

Investments are not expected to create value when they are not timed right.

Why did companies that invested more capital at the bottom of the last cycle perform much better than other companies? First of all, companies that are relatively capital intensive are more affected by cyclicality than companies that are relatively less capital intensive. Therefore a company should have already invested at the beginning of an upswing. Second, capital expenditures in the chemical industry require a considerable time period to reach full productivity. Investments that are made at the bottom of the cycle become fully operational in the middle of the following upswing. A company that timed investments at the cycle bottom creates an ‘asset base’ to create value while all the other companies still suffer from the last downturn. These companies missed the chance to gain high economic profits because they have shortened their expenditures. Third, suppliers of plant constructions are also having difficulties when the cycle turns down and are probably more willing to accept lower negotiated prices at the bottom of the cycle. This argument is also valid in the case of growth by acquisition. Prices for acquired companies are much lower at the bottom of the cycle than they are at the peak. Finally, the cash constraints often faced at the bottom of the cycle serve as a natural deterrent to unnecessary overspending. When cash is plentiful, human nature leads one to supplement what is needed. Only the best and most expensive seems good enough to fulfill all needs. At the bottom of the cycle, spending has to face very restrictive cash constraints.

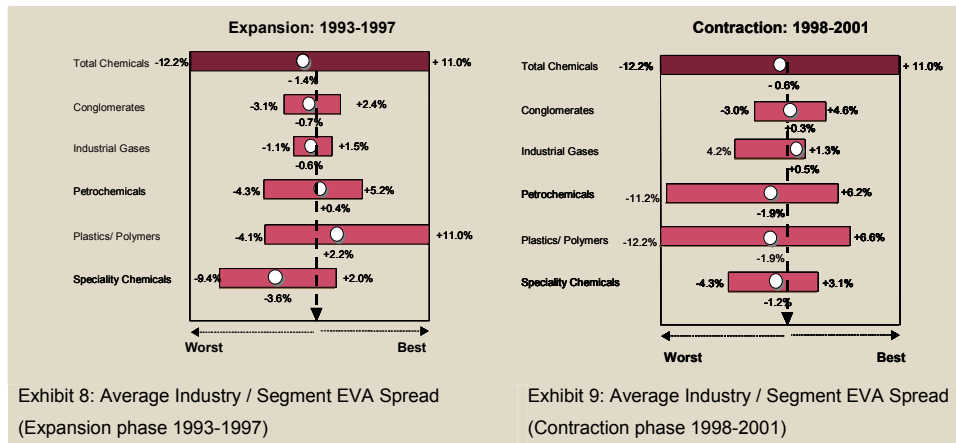
2.2 Achieving Operational Excellence

On average, the European chemical industry does not earn its cost of capital

Operational excellence is achieved by reaching either a margin above the market average, or by using the invested capital in the business more efficiently than other market participants. Over the course of the business cycle companies have to earn at least a threshold rate of return that investors require to compensate them for the risk of the underlying business. In other words, the EVA Spread must be positive, showing that the cost of capital has been covered.

The European chemical industry in total did not achieve to reach this goal. The industry earned a positive EVA Spread only in three years (1995, 1997, 1998) out of ten years reviewed (1992-2001). When separating the total business cycle into the expansion period (from 1993 to 1997) and the contraction period (from 1998 to 2001), the industry on average earned a negative EVA Spread over both periods: on average -1.4% for the expansion period and -0.6% for the contraction period.

Contrary to the popular business view, in terms of value creation conglomerates outperformed most other segments



Looking at the industry's segments the picture is quite mixed: both conglomerates and industrial gases outperformed the overall industry in the expansion as well as in the contraction periods (conglomerates achieved an average EVA spread of -0.7% and +0.3%, and industrial gases -0.6% and +0.5%, respectively). Due to a less cyclical nature, conglomerates with stakes in the pharmaceutical business did even better in the contraction period (+0.4%). This stands in sharp contrast to the development of companies engaged mainly in the speciality chemicals segment, which underperformed the total industry during both parts of the cycle (-3.6%, -1.2% respectively). In general we could not prove a less than average cyclicity of the speciality chemicals business. Petrochemicals and companies in the polymer and plastic business profited above average during the expansion phase, even reaching a positive spread over this period, but dipped deep down into negative realms during the second part of the cycle.

Focus on core competencies: *modus vivendi* even for conglomerates

Highly capital-intensive manufacturers like basic chemicals earn much lower margins than more knowledge-driven segments such as pharmaceuticals or speciality chemicals. Thus, the more companies are facing a commodity business, the more attention has to be directed to capital efficiency. In general: strategies that consistently lead towards a core activity, where companies either act as key players or where they are niche players, lead to a higher spread and therefore higher operational value creation in a segment.

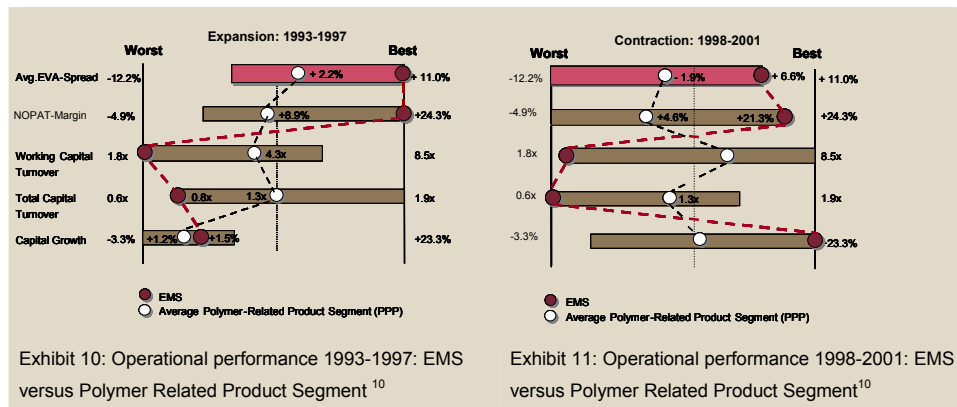
Companies that moved away from being a pure chemical player achieved the highest margin, on average exceeding those of the overall industry by more than 1.5% during the contraction period. *Lonzagroup*, for instance, has a mixed portfolio of chemical and pharmaceutical activities and acts as a supplier to the life science industry. Such knowledge-driven companies earn after-tax margins of more than 20% even though, or probably because, personnel costs top the industry average by nearly 10%. Players in this field have to win the so-called *war for talent* to stay competitive, and must offer attractive opportunities to people looking for challenges.

Although the pharmaceutical business in general shows higher margins than the basic chemicals segment, operating in this growing segment is not the only way to success. The German conglomerate *BASF* divested its pharmaceutical

business in 2000, after realizing that it lacked the necessary size to succeed in this research-intensive segment. However, over both the expansion and contraction phases it reached a positive EVA Spread and demonstrated above average operational performance. This was achieved by expanding less cyclical segments like agrochemicals or gases, or by reaching a cost or technological leadership position in more cyclical segments, such as polymer-related products or fibres. Due to its 'Verbund' production, *BASF* is not forced to buy all of its raw materials and intermediates on the world markets. Staying more independent from world market prices has enabled *BASF* to reach an average (pre-tax) margin in the cyclical plastics business as much as 2.1% higher than the average margins of competitors in this field during the contraction period. *EVC*, Europe's largest producer of PVC-related products, shows how difficult it is to earn an adequate return in the highly cyclical plastics business. The company did not earn a return exceeding its cost of capital from 1992 until 2001. Its pre-tax return in its polymer-segment was positive only in 1995.

A success story of
value creation in the
highly competitive
PPP segment

In contrast to *EVC* and despite the difficulties of the polymer-related segment, Swiss player *EMS Chemie* achieved the highest average EVA Spread (+11.0% in expansion, +6.6% in contraction), as well as the highest average margin of all European chemical companies studied. Continuously reshaping its product portfolio and putting a focus on high-grade and sophisticated products with a strong market position created the foundation for *EMS'* leadership position. Furthermore its qualification as system provider for the automobile industry allows *EMS* to propose ways to increase revenue or reduce total costs to its customers and enjoy for itself some of the additional value created. This strategy allowed for average (after-tax) margins of +21.3% during the contraction period, which is quite remarkable given average after-tax margins in the PPP segment of about +4.6% for this period. This leadership in profitability gives access to another value opportunity – anti-cyclical growth. Fuelled by strong operational performance the company continued to grow even stronger during the contraction phase of the business cycle, and strengthened its position as system provider to the automobile industry with several acquisitions.



Due to *EMS*' engagement in segments such as fine chemicals and engineering, both showing considerably lower capital efficiency, *EMS* lags the PPP segment's average capital efficiency (measured by working capital turnover and total capital turnover). Still, the company's cutting edge margins easily compensate for the less efficient use of its capital employed. However, improvement of capital efficiency clearly may be a driver of *EMS*' future value creation.

Shareholders reward efficient resource management. Capital-intensive segments have to strive for a high efficiency of capital invested

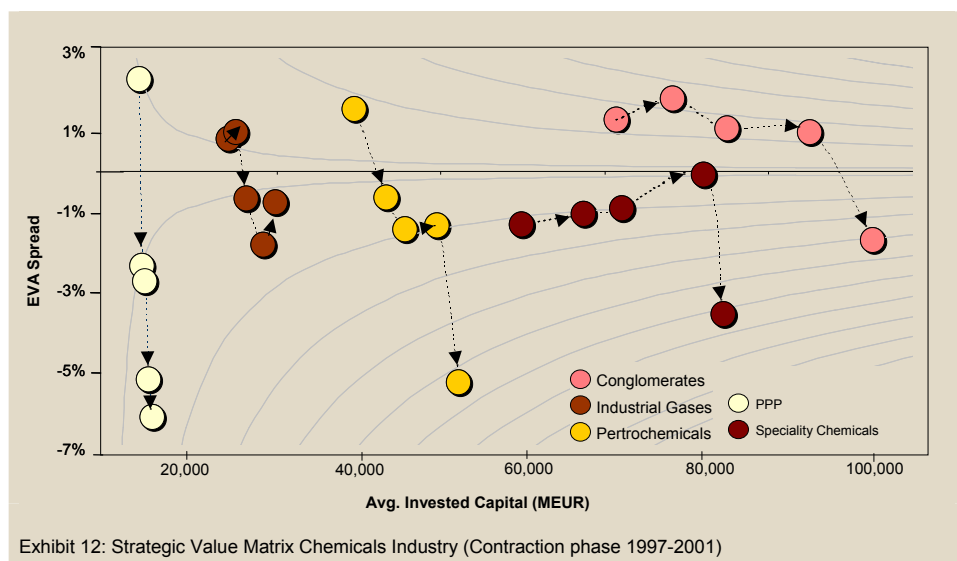
Especially in areas prone for overcapacity, such as the petrochemicals segment or basic chemicals, capital efficiency is an important lever for operating excellence. This holds especially true for the industry's most capital-intensive sub-segment, the industrial gas sector. *Air Liquide* leads the sub-segment in the efficient use of invested capital. After the massive capacity additions of the past years, increased capital efficiency and active portfolio management will be of increasing importance in this segment in the future. This can also be enhanced by further concentration on less capital-intensive client portfolios in the industrial gas segment, such as the health care or service segments. *Air Liquide* demonstrates that operational excellence consistently shows up in a higher valuation. The company was, on average over the contraction period, worth about 1.9 times the invested capital, compared to an average valuation of peer companies of 1.5 over this period.

¹⁰ NOPAT, Net Operating Profit After Taxes – before costs of financing activities

3. Conclusion and Outlook

Given the results of the analysis – how did the segments perform in each value creation component in the past? And how will the industry develop in the future?

At the moment all segments in the chemical business are facing a situation in which a turning point in terms of value creation is desperately needed



The picture is quite alarming: with a few exceptions the EVA spread of almost all segments deteriorated – accompanied, to some extent, by a heavy increase in capital. The contraction phase altogether is characterized by unprofitable growth, although some segments occasionally managed to improve their level of value creation. Only industrial gases grew profitable from 1997 to 1998 as well as from 2000 to 2001. Speciality chemicals created additional value from 1999 to 2000, and conglomerates from 1997 to 1998. The period from 2000 to 2001 further worsened the situation to the point that none of the segments earned its cost of capital. Now all segments are facing a situation in which a turning point – in terms of value creation – is desperately needed.

However, the unpleasant predicament is that nobody really knows for sure at any given moment whether we are observing a trend or a cycle. In hindsight, we know when an industrial sector collapsed. When we hit the bottom of the cycle we just do not 'know' if it will ever rebound. An indication of the actual position within a cycle could be the comparison of average EVA spreads. As shown in section 2.2 the current average EVA spread (contraction phase) still is 0.8% above its counterpart of the expansion period. This could be interpreted as a warning that the turning point of the cycle may not yet have been reached – threatening a further downturn of the chemical industry as a whole in the near future.

There is no secret blueprint for value creation in this industry. But there are a few very important tasks that management must perform in order to maximise a company's potential for creating value in this industry:

Five useful applications for management to foster the creation of value in the chemical industry

>> **React appropriately by identifying nature of cycle:** Any company facing a downturn first of all needs to differentiate between a cyclical slide and a permanent trend. If it is cyclical, then some well-positioned investments now could put the company in a future position of wealth creation. If it is a downward trend, the first priority is to manage the key operative value drivers in order to rapidly improve operating performance.

>> **Employ an active financial strategy:** How to invest when the operating cash flows are low or even negative? This may be a constraint during a down cycle, particularly if debt covenants are being violated. But as this analysis has shown, the companies that have invested at the bottom of the business cycle did so because of their strategic proposition. They had more cash and had built a higher debt capacity. This strategy allows continuous investment during downswings. The aim therefore must be to strive for an optimal capital structure, which preserves the flexibility to invest. While this may not be part of a short-term focus, it will pay back in a long-term perspective by creating value.

>> Implement an early warning system to take advantage of opportunities and manage risks: To recognize shifts in the business environment a systematic forecasting of key indicators is required. Any appropriate management reaction further calls for value-based reporting in all business units as well as consistent performance monitoring of value drivers and investments.

>> Choose the right value metrics: Measure the profit of all decisions the way investors do. It sounds simple but until a business returns a profit that is greater than its total cost – including cost of capital – it destroys value. EVA (Economic Value Added) is the right measure. EVA is the only financial management system that provides a common language for employees across all operating and staff functions and allows all management decisions to be modelled, monitored, communicated and compensated in a single and consistent way - always in terms of the value added to investor's investment.

>> Apply a clear value-based business strategy: A value-based strategic decision-making process is one of decentralized discovery of all value opportunities. Thus, management's main challenge is to determine value opportunities, or, economically speaking, the present value of all future EVA, of each strategic direction. This is best done by assessing the possible impact on the two main levers: operating excellence and invested capital.

4. Companies Covered

Company	Segment
Air Liquide	Industrial Gases
Akzo Nobel	Conglomerates
BASF	Conglomerates
Bayer	Conglomerates
BOC Group	Industrial Gases
Borealis	PPP
BP Chemicals	Petrochemicals
British Vita	PPP
Celanese	Conglomerates
Ciba Specialty Chemicals	Speciality Chemicals
Clariant	Speciality Chemicals
Cognis	Speciality Chemicals
Croda International	Speciality Chemicals
Degussa	Speciality Chemicals
DSM	Conglomerates
Elementis	Speciality Chemicals
EMS-Chemie	PPP
Eni Chemicals	Petrochemicals
EVC Int.	PPP
Fuchs Petrolub	Petrochemicals
Henkel	Speciality Chemicals
ICI	Speciality Chemicals
Kemira	Speciality Chemicals
Lonzagroup	Conglomerates
Messer Griesheim	Industrial Gases
Perstorp	Speciality Chemicals
Recticel	Speciality Chemicals
Repsol	Petrochemicals
Rhodia	Speciality Chemicals
Rütgers	Speciality Chemicals
Shell Chemicals	Petrochemicals
SKW Trostberg	Speciality Chemicals
Sol	Industrial Gases
Solvay	Conglomerates
Süd-Chemie	Speciality Chemicals
Tessenderlo Chemie	Conglomerates
Totalfina Elf	Petrochemicals
Wacker Chemie	Speciality Chemicals
Yule Catto	Conglomerates



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