



Sector Futures

The chemicals sector

What future?

Visions of the future

Challenges, policy issues and the future

References



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What future?

The chemicals industry is one of the largest and internationally most successful European industries. The first of three articles in the Sector Futures series on this sector – excluding pharmaceuticals – delineates the chemicals industry sector, looking at its market size, structure and nature of employment. The chemicals sector is capital-intensive and has traditionally enjoyed a comparative advantage in mature industrialised countries. This advantage, however, is now being challenged by globalisation. This factor is explored here, along with other trends and drivers likely to shape the sector's future.

Main features of the chemicals sector

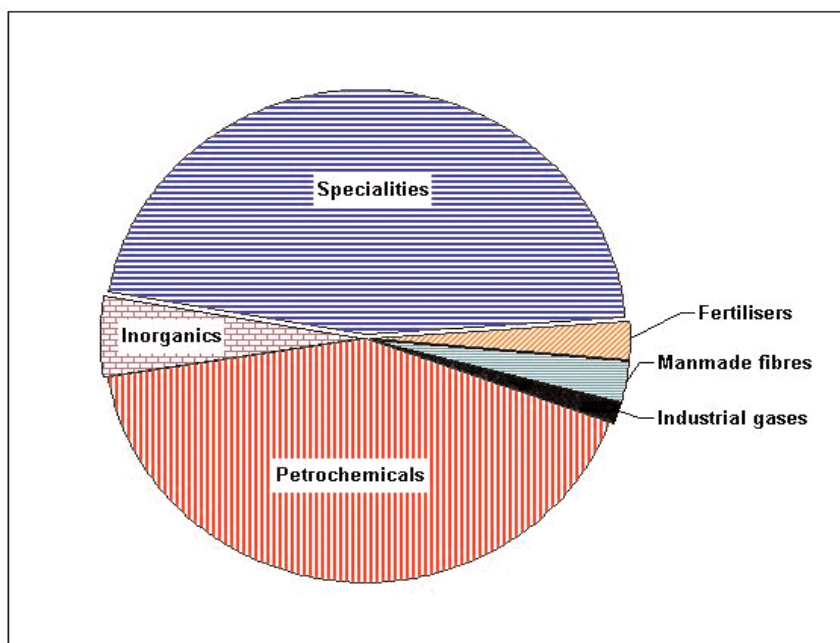
This article deals with chemicals but not with pharmaceuticals because the two industries are driven by different factors. Because of this difference, the major companies have in recent years been separating their chemicals and pharmaceuticals businesses and now concentrate on one or the other, but not on both.

Chemicals are typically intermediate products and therefore innovation is highly important, as it is for all downstream industries. Many chemicals products thus require a high research and development (R&D) input. Chemicals is also a capital-intensive industry and that has made it appropriate for its production to be located in mature industrialised countries. In the era of globalisation and capital mobility, however, this is no longer valid for the manufacture of commodities and consequently there is very substantial foreign investment in chemicals production in the booming markets of Asia. Since commodities have a substantial share in the product portfolio of the chemicals industry, the European industry has to accelerate its pace of innovation to stay in the lead. As a result, economic policymakers face the challenge of providing conditions that promote a more knowledge-driven industry with a sound basis for production in Europe. If this challenge is not met, the decline in chemicals employment will become even more pronounced.

Within the chemicals sector, petrochemicals is the second largest product group as shown in Figure 1, accounting for about 40% of chemicals output. Petrochemicals is located near the beginning of the value-added chain and provides intermediate goods for other types of chemicals products. Its products are manufactured and sold globally. Petrochemicals is characterised by high capital intensity, by considerable opportunities for the exploitation of economies of scale and by high feedstock costs. The output is standardised and price is an important determinant of sales. As a result, margins are low and research and development (R&D) expenditure – measured as a share of turnover (R&D-intensity) – is small. The success of a petrochemicals production plant depends crucially on its physical relationship to other parts of the value-added chain. The most important considerations governing location are upstream linkages, especially the availability of raw material, and/or downstream linkages, i.e. the location of facilities for further processing. For all these reasons, several new plants were built in the Middle East and Asia during the 1990s.

Like petrochemicals, inorganics also stands close to the beginning of the value-added chain, but it accounts for only around 5% of total chemicals output.

Figure 1: *Output of the EU25 chemicals industry by subsectors, 2002*



Source: Based on EUROSTAT data; calculations by the Institute for Economic Research (Ifo), Munich, 2005.

The manufacture of speciality chemicals involves the processing of petrochemicals and inorganic products. The output of speciality chemicals is supplied to other subsectors of the chemicals industry (and to other industries not discussed in this article, such as pharmaceuticals). Speciality chemicals is the largest single group within chemicals, accounting for about 45% of the output of the sector. Speciality chemicals covers a very wide product range and is thus divided into two subgroups. These differ according to the importance of specialist knowledge and expertise in their manufacture, and according to their market environment.

The first subgroup is fine chemicals. Processing expertise is of great importance, but does not represent a high market-access barrier because it is not tied closely to the special requirements of the clients. Different manufacturers can supply products of the same quality to downstream clients without any effect on the quality of the final product. In this respect, the market environment is very similar to that of commodity chemicals of the upstream industries. Consequently, product quality and cost efficiency are as important as processing expertise.

The second subgroup of speciality chemicals is performance chemicals. These have to meet the clearly defined requirements of clients to guarantee the proper functioning of final products. One example is the development of ink for specific inkjet printers. The manufacture of performance chemicals therefore requires an exchange of technical information and expertise between their manufacturer and the client. This creates high market-access barriers. For the clients, there is a trade-off between the risk that competitors will gain access to their expertise and the advantages of lower prices from standardised producers.

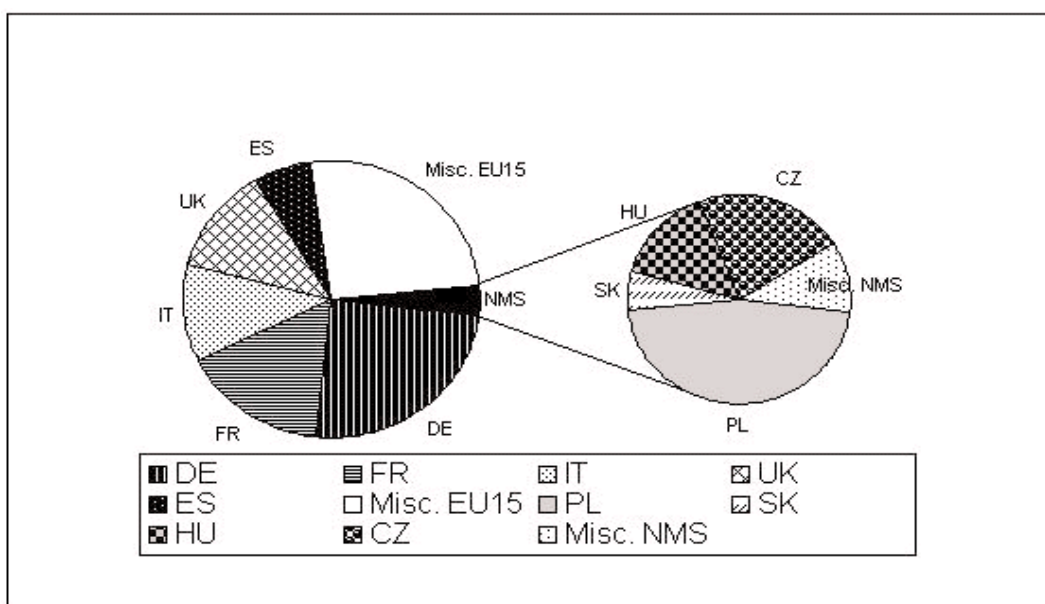
The remainder of chemicals output, around 10%, is accounted for by the processing of intermediate products for specific industries and by industrial gases. The specific industries are agrochemicals, in particular fertilisers, and man-made fibres, which comprise synthetics and celluloses. In contrast, industrial gases are used in a wide range of different industries, including welding in metal-working, chemical processes, the health sector and agriculture.

Market size, structure and employment

Market size

The chemicals industry (excluding pharmaceuticals) is one of the largest and internationally most important European industries. In 2004, the value of EU25 chemicals production amounted to €417 billion and the industry employed a workforce of around 1.45 million people. Between 1995 and 2000, output of this industry grew strongly at an average rate of 3.2% per year at constant prices. After 2000, growth slowed to an average of 1.4% per year. Output share is closely related to the size of the Member States' economies. This is true for the 15 'old' Member States (EU15) and the 10 'new' Member States (NMS), as seen in Figure 2.

Figure 2: *Regional distribution of the EU25 chemicals production, 2002*



Source: Based on EUROSTAT data; calculations by the Institute for Economic Research (Ifo), Munich, 2005.

The European chemicals industry has been highly successful in international markets, largely because of the marketing activities in Asia of the big European players. The chemicals trade balance is in a healthy surplus. After growing by an average of 12% per year over 1995–2000, the surplus grew by 6.5% per year after 2000. This is quite an unusual development because most European manufacturing industries have seen their trade surplus shrink. Nevertheless, exports amount to less than one-thousandth of the total production of the European chemicals industry according to the [European Chemical Industry Council](#)¹ (CEFIC, 2004).

Market structure

Until the mid-1990s, the European chemicals industry had too many manufacturers in upstream segments, such as petrochemicals and polymers. This was partly a legacy from the former focus on having a chemicals industry in each country covering the complete value chain. Moreover, many large diversified groups, for which commodity

¹ <http://www.cefic.org/Templates/shwStory.asp?NID=472&HID=427>

petrochemicals represented a significant component of their portfolios, played a key role in the European chemicals industry. As a result, companies were not able to exploit economies of scale and thus were at a cost disadvantage in international competition with US firms and emerging suppliers from the Middle East and other oil-producing countries.

From the mid-1990s, European chemicals companies have been responding to growing competitive pressure by restructuring and focusing on their core businesses according to a report on **Industrial restructuring in the chemical industry**² (ChemSystems, 1998). Only a few conglomerates still have broad and diversified portfolios. The most noteworthy feature of this restructuring is the separation between chemicals and life-sciences products. Among other recent examples, DuPont sold its pharmaceuticals division to Bristol-Myers Squibb in 2001, and in 2005 Altana announced that it would split its chemicals and pharmaceuticals activities. In the speciality chemicals subsector, Lonza, DSM and Clariant improved their position between the manufacturers of commodities and research-intensive downstream clients, following cost-cutting programmes during the 1990s. Companies specialising in fine chemicals are now reaping the benefits of their restructuring and cost-saving programmes as their profits are growing despite high feedstock prices (Ernst & Young, 2001; *Handelsblatt*, 2005; *Frankfurter Allgemeine Zeitung*, 2005a and 2005b).

The restructuring of the industry has been accompanied by changes in ownership. Institutional investors, who played only a minor role in the past, have become engaged in the consolidation of the sector. The acquisition of Cognis from Henkel in 2001 for €3 billion by a consortium of investment funds was one of the largest private-equity deals in the European chemicals industry. Another indicator of increasing globalisation of this industry is the growing activity of industrial investors from oil-producing countries in acquiring stakes in downstream production companies.

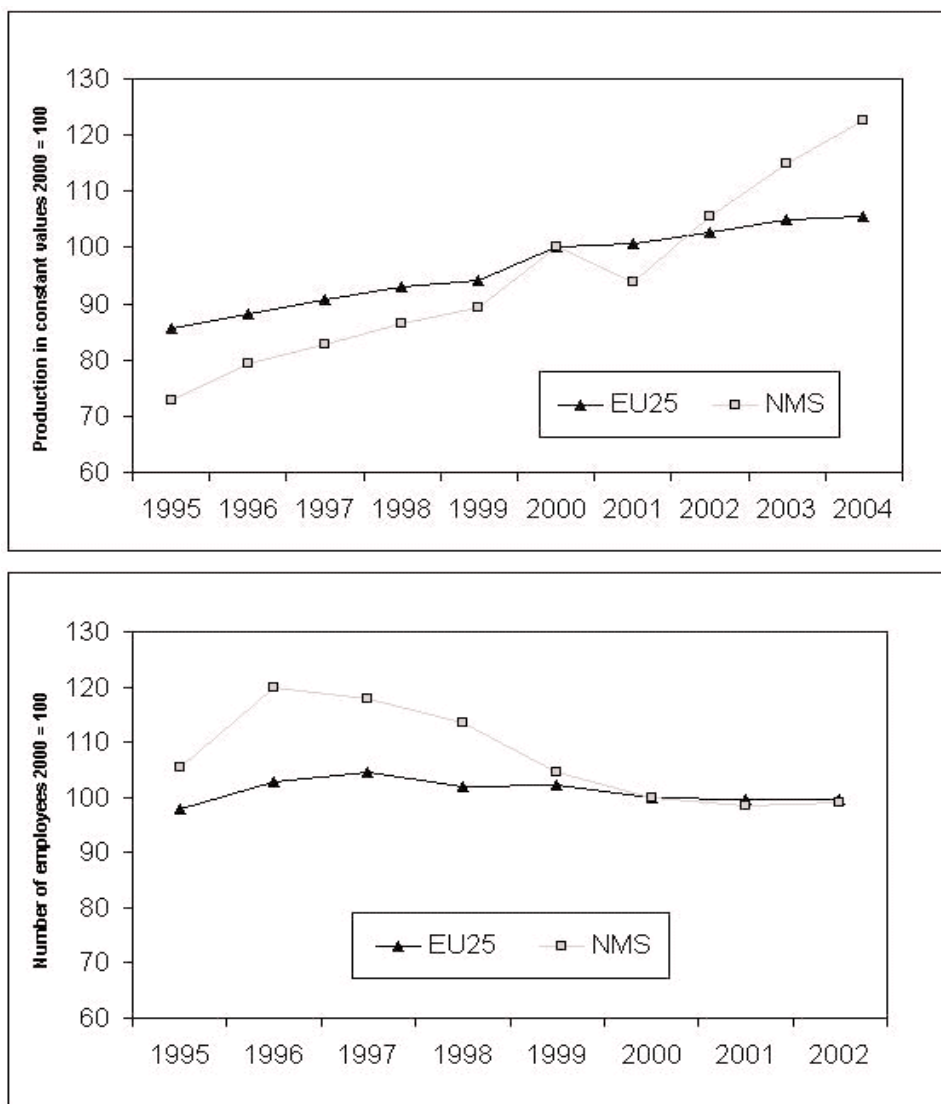
Employment

The slowdown in chemicals output growth has affected employment. Employment increased, albeit at a low rate of 0.4% per year, when output was growing strongly at 3.2% per year between 1995 and 2000. But it started to decline by about 0.5% per year after 2000, when output growth slowed to 1.2% per year. Labour productivity, however, increased at the impressively high rate of 2.3% per year on average over the whole period 1995–2004.

In the new Member States (NMS), which joined the EU in May 2004, the pattern of employment decline is different. Chemicals output grew at an average rate of 6% per year between 1995 and 2004, but employment declined by 0.7% per year (see Figure 3). This implies that productivity improved by nearly 7% per year. This improvement is not only related to organisational and technological progress, but also, in the case of the eight former communist countries, to the reduction of over-high levels in the workforces inherited from the previous regime. This is not specific to the chemicals industry in the NMS; many other manufacturing industries in these countries have also shed surplus labour.

² <http://www.europa.eu.int/comm/enterprise/chemicals/competiv/report.pdf>

Figure 3: Production and employment development of the EU25 chemicals industry



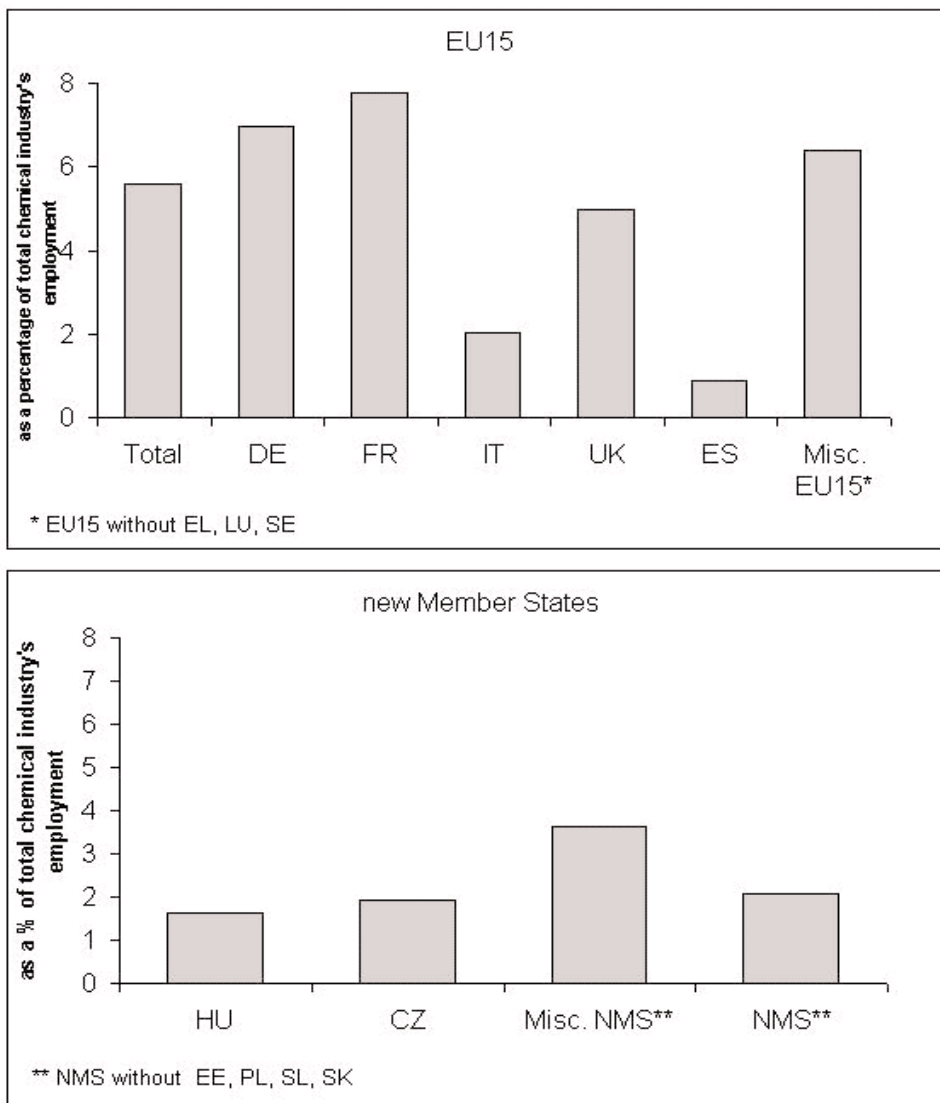
Source: Based on EUROSTAT data; calculations by the Institute for Economic Research (Ifo), Munich, 2005.

Trends and drivers

Sociological drivers

Part-time employment, sabbaticals, etc. have become important tools for companies to attract highly qualified applicants, in particular to tap into the full potential of the female labour force. The adoption of new patterns of working time has, however, been far from uniform across EU Member States. Within the EU15, the southern Member States lag behind the others (see Figure 4). They are roughly on the same level as the new Member States, where the share of part-time employees ranges between 2% and 4% of all employees.

Figure 4: Part-time employment in the EU25 chemicals industry, 2002



Source: Based on EUROSTAT data; calculations by Ifo, Munich, 2005.

Technological drivers

Research and development (R&D) is of outstanding importance in the chemicals industry, particularly for the downstream industries. Chemical products are intermediate goods that are incorporated in client industries' products, from semi-finished metal products, consumer electronics and machinery and equipment, to domestic appliances and furniture. The stimulus for innovation comes from the development of products, as well as from joint R&D projects with client companies in other industry sectors (ZEW/NIW, 2003).

For many years, European chemicals companies were world leaders in technology and innovation, but they lost their lead during the 1990s. Since the mid-1990s, the US chemicals industry has regularly spent 2.5% of its total sales revenue on R&D and the Japanese industry has spent 3%, whereas the proportion of sales revenue spent by European companies has fallen from 2.4% in 1995 to 1.9% in 2004. One explanation for this slackening of research activity might lie in the considerable effort and share of resources given to restructure the chemicals industry in order to create companies capable of meeting the competitive challenges of global markets. If this proves to be the correct explanation, then companies can be expected to shift more resources to R&D activities after restructuring has been successfully completed.

But one cannot be fully confident that this will happen because European companies face higher costs and generate lower profits than their foreign competitors, and thus face a major challenge in allocating sufficient resources. The gross-operating surplus of the European chemicals industry is only half that of its US counterpart (CEFIC, 2004).

The European chemicals industry faces two main obstacles to future innovation. The first arises from the relocation of production sites to locations outside the EU. This makes it more difficult to work closely with clients so as to develop innovations relevant to their requirements. This does not apply only to the supply of chemical products for the textiles industry, which has shifted the bulk of its production to Asia. Even the development of intermediate products for the electronics industry has become more complicated, despite the fact that European chemicals companies are on the leading edge of technology as suppliers of high-tech intermediates. Production has to be carried out in Asia, the region with by far the largest demand and the greatest number of clients. Most of the basic research activity is still carried out in Europe, but the fine tuning of chemical products to customer needs is carried out in Asia. Examples cited by ZEW/NIW (2003) include liquid crystals for television screens (Merck KGaA) and substrate for computer memories (Bayer AG).

The second obstacle arises from Europe's delayed take-off in biotechnologies as outlined by a **2005 comparative study on biotechnology in Europe**³ (EuropaBio, 2005). While biotechnologies include some processes that have been well known for a long time, such as the fermentation of foodstuffs and beverages, they are also used in a broad range of processes and products. Innovations in these will change the chemicals industry's structure and output.

The main activities of biotechnology are:

- *red biotechnology*, which belongs under life sciences and is thus not under discussion in this article;
- *white biotechnology*: industrial and environmental products and processes, such as biocleaning, bioremediation, environmental and industrial diagnostics, water and effluent treatment, as well as recycling;
- *green biotechnology*: veterinary healthcare, biopesticides, plant agriculture, food technology and processing;
- *services*, such as contract research, contract manufacturing, bioinformatics and functional genomics.

The biotechnology sector had a turnover of €19 billion in 2003 and employed 94,000 people. Around one-half of this sector's activities are related to the chemicals industry; the other half being concerned with pharmaceuticals. The biotechnology sector is of outstanding importance for the future of the chemicals industry because of its research intensity. About one-third of biotechnology revenues are spent on the development of innovative processes and products. However, the biotechnology industry is small: its total workforce amounts to no more than 3% of the numbers employed in chemicals.

³ <http://www.europabio.org/events/BioVision/CriticalII%20studyBiotech-Europ.pdf>

Environmental drivers

The chemicals industry is the largest of the energy-intensive industrial sectors. The following discussion of changes in energy intensity also applies to the pharmaceuticals industry. Analyses that solely focus on the energy consumption of the chemicals industry as defined in this article were not available. Between 1990 and 2000, the chemicals industry was substantially reoriented towards products of low-energy intensity. The output growth attributable to products of high-energy intensity, such as fertilisers, was far below the average growth rate of the industry (2.1% per year over 1990-2000). Despite strong output growth, the energy consumption of the chemicals industry declined by around 3% per year between 1990 and 2000. Most of these savings were achieved during the first half of the 1990s when the industry's energy consumption declined by 5.5% per year. Between 1995 and 2000, energy consumption fell by only 0.5% per year.

The future energy intensity of the chemicals industry will depend on further structural change, investment in new process technologies and public policies aimed at the reduction of emissions. Among the new process technologies, combined heat and power generation (of electricity and steam) will play an important role. The dependence of the chemicals industry on fuel imports will decline somewhat faster than it did in the late 1990s because of the growing use of biomass and waste as energy inputs (see the Commission's **EU-15 energy and transport outlook to 2030**⁴, 2003).

The protection of the environment, consumers and workers from hazardous chemicals are institutional aspects of outstanding importance for the industry. Formerly, different national regulations hampered the free circulation of chemicals in the Single Market. The European Commission has to take into consideration the internal market aspects of free movement while preserving high levels of environmental protection. Member States are allowed to introduce even stricter rules, but they must not impede the free movement of goods. According to the principle of mutual recognition, established by the 'Cassis de Dijon' judgment of the European Court of Justice in 1979, products legally marketed in one Member State must in principle be admitted in any other Member State.

The development of a harmonised system for classification, packaging and labelling of **dangerous substances**⁵ and **dangerous preparations**⁶ began with the adoption of Directive 67/548/EEC. The system was enhanced by Directive 88/379/EEC, which also introduced the classification of dangerous substances. Principles for further action were adopted by the Commission on 16 January 1996 in the internal 'Guidelines for regulatory policy'. One important principle is the risk assessment of chemicals. If there is an unacceptable risk, strategies for risk reduction have to be identified and the most cost-effective has to be taken. If no international agreement can be reached on the prevention of unacceptable risk, the EU introduces an adequate European regulation, but its effect on the European chemicals industry has to be taken into account (as outlined in the Commission's communication on **An industrial competitiveness policy for the European chemical industry**⁷ in 1996). This institutional framework has made the free movement of chemicals easier within the internal market.

⁴ http://www.europa.eu.int/comm/dgs/energy_transport/figures/trends_2030/index_en.htm

⁵ http://www.europa.eu.int/comm/environment/dansub/home_en.htm

⁶ http://www.europa.eu.int/comm/enterprise/chemicals/legislation/dangerous/directive_en.htm

⁷ http://europa.eu.int/comm/enterprise/reach/whitepaper/communication_en.htm

In early 2001 the White Paper on *Strategy for a future chemicals policy* was adopted (European Commission, 2001). It addressed shortcomings of the system that allows substances to be used without testing, places the burden of proof on public authorities, has no efficient instrument to ensure safe use of the most problematic substances and provides no incentives for the development of less hazardous substitutes. These considerations led to a proposal for a new EU regulatory framework, the **Registration, Evaluation and Authorisation of Chemicals Proposal (REACH)**⁸. The Commission adopted this proposal on 29 October 2003. REACH lays down the following requirements concerning the registration, evaluation and authorisation of chemical products:

- **Registration:** Manufacturers and importers of substances or preparations are obliged to register them at a **European Chemicals Bureau (ECB)**⁹. Nearly all chemicals are covered by this rule, with the exception of substances that are regulated under other legislation or manufactured or imported below certain quantitative thresholds. The rule applies not only to substances and preparations during their use and processing in the chemicals industry, but also to their subsequent processing in downstream industries. This affects the broad range of industries for which the chemicals industry is a manufacturer of intermediate products. A technical dossier is required and for quantities of 10 tonnes or more a chemical safety report (CSR) has to be created. Exposure scenarios have to be created to cover the manufacture and use of substances and preparations. Manufacturers have to describe how they control or recommend control of the exposure of humans and the environment. The exposure scenarios need to be developed to cover all identified uses, including further processing and distribution.
- **Evaluation:** An evaluation of the information has to be carried out by the authorities in Member States and this may lead to the conclusion that action needs to be taken.
- **Authorisation and restrictions:** For substances of very high concern, an authorisation is required for use and placing in the market. Downstream users may use substances for an authorised use if they acquire them from an authorised supplier. Any substance, whether on its own, in preparations or in an article, may be subject to Community-wide restriction. Interested parties will have an opportunity to comment on the ECB's proposed restriction, which will give grounds for any proposed decision. The restrictions are understood as a safety net and the Bureau's position has been described as a body with sovereign decision-making power.

Economic drivers

The chemicals industry accounts for around 12% of the EU's total energy demand according to the **CEFIC review 2004-2005**¹⁰ (CEFIC, 2005). Energy is not only a major cost in the processing of chemicals, but gas and oil are also feedstock for the manufacture of many chemical products. This means that companies should benefit from the EU's single market and the abolition of market-access barriers. But the liberalisation of gas and electricity markets within the EU is proceeding very slowly and unevenly due to incomplete and delayed implementation of a number of measures by Member States. Energy prices in the EU are roughly one-tenth higher than in the US (CEFIC, 1998). This turns out to be a disadvantage for production locations in the EU because chemical products are sold into the global market and higher energy prices cannot be passed on to clients.

⁸ http://europa.eu.int/comm/enterprise/reach/overview_en.htm

⁹ <http://ecb.jrc.it/>

¹⁰ http://www.cefic.be/Files/Publications/Cefic_Review_2004.pdf

EU and national environmental policies are directed towards the reduction of emissions. Emissions trading has become the preferred instrument for the economic allocation of scarce resources. In combination with absolute emissions reduction targets of 20% by 2020, emissions trading could curb the growth of the chemicals industry because it would raise already high energy prices yet further and weaken the price competitiveness of the European industry in global markets.

Since the early 1990s, the European chemicals industry has focused its activities away from products that require high-energy inputs. Under tough objectives for the reduction of emissions, these energy-intensive processes may well become even less competitive. As a consequence, EU production of upstream products might be substituted by imports of commodities. From a global point of view, such a development does not contribute to emissions reduction.

Traditionally, the bulk of chemicals production has been carried out in mature industrialised countries. The Triad accounts for two-thirds of global supply, with the EU15 and the US producing 28% and 26% respectively, while Japan accounted for only 10% in 2002. These figures represent, however, a reduction in the share of the industrialised countries. In 1990, the EU contributed 32% of global output of chemicals, with Japan contributing 12% and the US 29%. Asian output soared and its global share escalated from 13% to around 24% between 1990 and 2002 (see CEFIC review 2004–2005). Nevertheless, in spite of considerable investment in new capacity in Asia, domestic supply could not keep pace with demand and the shortfall was made up by exports from industrialised countries. That is why the European trade balance for chemicals improved. For example, exports to China grew at double-digit annual rates between 1995 and 2002 (see **European competitiveness report 2004**¹¹, p.270). New plants are now being built in Asia, but it will take some time before sufficient capacity is available to meet soaring demand.

It is worth noting that the recently planned and built chemicals plants in Asia not only incorporate the latest production technology, but are also, in most cases, much bigger than European plants. This gives Asian companies opportunities to exploit economies of scale which are not possible in Europe. As soon as these plants come on stream, European commodity exports to Asia will slow down and it must be expected that, when Asian capacity exceeds demand, there will be exports to Europe based on marginal cost calculations.

The chemicals industry is characterised by strong upstream and downstream linkages. By far the most important raw material is crude oil and petrochemical intermediaries are used in most other subsectors of the chemicals industry. There is a tendency of oil-producing countries not only to invest in oil refineries, but also to take over primary processes of the chemicals industry. As a result, oil-producing countries are becoming ever-more important suppliers of intermediate chemical products.

New processing capacities are erected by Western companies close to oil and gas resources to exploit regional advantages. In many cases, joint ventures and cooperation with local companies facilitate access to the regions. A recent example of this is **Acetex's joint venture**¹² with Saudi Arabia's Jubail: in 2004, Acetex signed a contract with Jubail to build a \$1 billion petrochemicals plant, which will start production in 2007. Jubail is a branch of **Sabic**¹³, a group founded in 1976 to invest in the petrochemicals industry. The activities of Sabic reveal that not only do Western

¹¹ http://europa.eu.int/comm/enterprise/enterprise_policy/competitiveness/doc/compreg_2004_en.pdf

¹² [http://www.fdimagazine.com/news/printpage.php/aid/982/MIDDLE_EAST:_Acetex%92s_\\$1bn_joint_venture_to_build_a_petrochemicals_plant_in_Saudi_Arabia%92s_Jubail.html](http://www.fdimagazine.com/news/printpage.php/aid/982/MIDDLE_EAST:_Acetex%92s_$1bn_joint_venture_to_build_a_petrochemicals_plant_in_Saudi_Arabia%92s_Jubail.html)

¹³ http://www.sabic.com/sabic-www/index_Overview.htm

companies invest in upstream industries close to natural resources, but that investment also flows in the other direction, into downstream activities. Sabic invests in the Middle East as well as in downstream industries in the industrialised countries. It has acquired chemicals companies in the Netherlands and Germany, such as the Dutch DSM in 2002. This development reveals that, besides growing cross-border linkages along the value-added chain, there are also equity affiliations between companies within the chemicals industry.

The downstream linkages to client industries are no less important than upstream for the globalisation of production networks. The clearest example is provided by man-made fibres. The relocation of fabrics, textiles and clothes manufacturing away from the EU has persuaded manufacturers of man-made fibres to follow their clients. Turkey, North Africa, the Far East and, in particular, China have become sales regions and locations for new facilities for man-made fibres. The latest surge in imports of textiles from China as a consequence of the phasing out of the Multi-Fibre Agreement (MFA) and the accession of China to the World Trade Organisation (WTO) has accelerated this long-term development (see Table 1).

Table 1: *New ethylene capacities in China*

Company	Location	Capacity	Initial operation (year)
BASF/Sinopec	Naming	600	2005
Maoming/Petrochem	Guangdong	420	2005
Sinopec/BP	Shanghai	900	2005
Oilu Petrochem	Shangdong	270	2005
Daqing General	Daqing	600	2006
Petrochem	Daqing	320	2006
Lanzhou Petrochem	Gansu	360	2006
Shell/CNOOC	Guan gdong	800	2006
Formosa Petrochem	Mailiao/Taiwan	1,200	2006
Jilin Chemical	Jilin	220	2006

Source: *Oppenheim Research, as mentioned in Handelsblatt on 29 June 2005.*

Political drivers

DG Research and the European chemicals industry have launched a common initiative for a sustainable chemical industry¹⁴ (SusChem). It is organised as one of those European technology platforms that aims to bring together researchers from industry and academia. It is directed towards the stimulation of innovation in the private sector and in that way can contribute to the Lisbon objectives. Its focus is on dynamic high-tech areas, such as biotechnology and materials technology, but it is also concerned with institutional impediments to innovation.

Important activities are arranged by EuropaBio, a European association representing companies from all areas of white, green and red biotechnology. It has become a well accepted contact institution for DG Enterprise and Industry, as well as for DG Research to stimulate communication among decision-makers of all political and societal groups and to formulate European research under the 7th EU Framework Programme. EuropaBio is also a major player in the creation of European framework conditions for biotechnology, which is a highly sensitive topic. It faces the challenge of taking into account the objections of various groups in society and yet creating an environment that will help the industry catch up with the United States.

¹⁴ <http://www.suschem.org/content.php?pageId=2479&lang=en&PHPSESSID=0ae28842bb455fffd68114764181cb6c>

The social partners in the European chemicals industry – namely, the European Chemicals Employers Group (ECEG), the European Mine, Chemicals and Energy Workers Federation (EMCEF) and the European Chemicals Industry Council (CEFIC) – have created a sectoral social dialogue with the aim of representing the shared views of the intra-industrial stakeholders in the processes of political decision-making, together with the views of stakeholders outside the chemicals industry. The underlying basis for this initiative was the perception that their interests had not been sufficiently considered (ECEG/EMCEF/CEFIC, 2005).

Uncertainties and issues

The major challenges and changes for the European chemicals industry derive from globalisation. European companies have to exploit the advantages of production locations anywhere in the world to maintain their strong position in the face of growing competitive pressures. Regional linkages to upstream and downstream industries not only provide cost advantages, but also growth opportunities. European companies that make use of opportunities in overseas markets will benefit from soaring demand in Asia and enjoy economies of scale. While this will certainly lead to some loss of employment in Europe, it will at the same time give opportunities to the companies to strengthen their position in areas of comparative advantages in the European Union. This means that global production and marketing networks will help to allocate resources for a more knowledge-driven industry in the EU.

In recent years, the European chemicals industry has undergone a major restructuring. Former national companies have become European players, but they have remained exposed to procurement markets that have not yet been fully liberalised. This means that input prices are high – higher than for important competing nations, such as the US. In particular, the European players face disadvantages in energy supply and transport services, which are of importance for the chemicals industry. This environment accelerates the relocation of production capacities and thus intensifies the challenges of globalisation.

In R&D, innovation efforts have slowed down since the mid-1990s. In biotechnology, Europe is lagging behind the US. This indicates that the European players, who traditionally have been on the leading edge of innovation, have lost some of their strengths. An optimistic explanation would be that companies have had to devote resources to restructuring in order to face the global market, but that they are now in a position to increase their research efforts. Only a monitoring of innovation in the next few years will show whether European companies will lose further ground or are beginning to catch up.

The future development of the European chemicals industry will depend also on the institutional frameworks, i.e. not only the liberalisation of upstream markets, but also the institutions of relevance for entrepreneurship in the chemicals industry. With regard to the administrative burden borne by the industry, the final agreement on the REACH initiative will be of importance. If a compromise is found that not only meets the requirements of the extra-industrial stakeholders but also of the intra-industrial stakeholders, the confidence of the industry in European locations will be boosted.

The European chemicals industry has to catch up on the US lead in biotechnology if it is to catch up in innovation more widely and replace jobs lost through the relocation of commodities production by new jobs in knowledge-driven activities.

Visions of the future

This article builds on the discussion in the first article on the trends and drivers likely to shape the future of the sector and the challenges it faces in the era of globalisation. In particular, it looks at issues related to employment, innovation, EU regulation – notably the REACH proposal – and the factors influencing relocation of client industries away from the EU. The article also explores four alternative scenarios for the chemicals industry in the light of the main pressures on it, and concludes that the most optimistic one is unlikely to be realised.

As one of the largest and internationally most successful of European industries, the chemicals sector is capital-intensive and that has made it appropriate for its production to be located in mature industrialised countries. In the era of globalisation and capital mobility, however, this is no longer true for the manufacture of commodities and consequently there is very substantial foreign investment in chemicals production in the booming markets of Asia. Because commodities have a substantial share in the product portfolio of the chemicals industry, the European industry has to accelerate its pace of innovation to stay in the lead. Economic policymakers currently face the challenge of providing conditions that promote a more knowledge-driven industry with a sound basis for production in Europe.

Trends and drivers of change

The second article of three in this series discusses the main factors influencing the present and future of the chemicals industry, looking particularly at:

- employment, with a particular reference to the brain-drain of young talent;
- the importance of innovation;
- the two main obstacles the sector now faces (relocation of client industries away from the EU and the deferred take-off of biotechnology in Europe);
- the effects of high energy prices and environmental targets on the industry's prices and competitiveness;
- the challenge from Middle Eastern producers in basic chemicals and from Asian producers in commodity chemicals and, increasingly in the future, in speciality chemicals;
- the effects of EU regulation, notably the REACH Proposal.

In conclusion, this feature examines four alternative scenarios for the chemicals industry in the light of the main pressures on the industry, and reckons that the most optimistic scenario is unlikely to be realised.

STEEP analysis

Table 1 summarises the sociological, technological, economic, environmental and political (STEEP) factors affecting, or expected to affect, the European chemicals industry sector.

Table 1: *STEEP analysis and possible future of the chemicals industry*

Trends and drivers	Possible future of chemicals industry
Sociological	
Working time models	Flexible working time arrangements are becoming increasingly important for attracting qualified labour.
Chemicals as a career choice	Chemicals faces a long-term brain-drain as the young choose other careers.
Technological	
Decreasing research and development (R&D) expenditure	R&D expenditure as a proportion of total sales in the EU has been decreasing since the late 1990s.
Relocation of chemicals manufacture	Relocation of production sites to non-EU locations leaves fewer downstream clients to stimulate technological advances in the chemicals industry.
Challenges from biotechnology	The deferred take-off in biotechnology means that the European chemicals industry lacks an important driver of innovation.
Economic	
Energy intensity	Increasing energy prices could damage the EU chemicals industry competitiveness further.
Emissions trading	In combination with absolute emissions reduction targets, the already high energy prices are likely to increase further.
Globalisation	Increasing competition from new economic powers, such as China.
Environmental	
Energy intensity	Public policy is towards reducing energy intensity, which will bring challenges to the chemicals industry.
Emissions targets	Absolute emissions reduction targets of 20% by the year 2020 will bring challenges to the chemicals industry.
Environmental awareness	A shift towards environmentally friendly products is forcing the industry to verify the safety of existing and future products (REACH).
Political	
Legislation	Legislation could force unrecoverable costs on the chemicals industry (REACH).
Decline of the chemicals industry	The EU chemicals industry has launched a common initiative for a sustainable chemicals industry.
Unfavourable political environment	Can be countered by a better representation of the common views of the industrial stakeholders in political decision-making.

Assessment of major trends and drivers

Sociological drivers

Part-time employment, sabbaticals, etc. have become important tools for companies to attract highly qualified applicants, in particular to tap into the full potential of the female labour force. The adoption of new patterns of working time has, however, been far from uniform across EU Member States. Within the EU15, the southern Member States lag behind the others. They are roughly on the same level as the new Member States, where the share of part-time employees ranges between 2% and 4% of all employees.

The chemicals industry has also been suffering from a long-term brain-drain as experienced workers have left and the young choose other careers. The attractiveness of the chemicals industry as a career choice has been declining since the 1990s. Many chemicals companies are working to improve matters. BASF, for example, is among the most active of the leading global chemicals companies when it comes to fostering an understanding for chemicals. The company runs 'Kids Labs' at schools, which allow children to learn more about the chemicals that surround them at home. Similarly, Air

Products, a global supplier of chemicals, industrial gases and equipment, sends 'science ambassadors' to schools and organises workshops at universities where undergraduates can get hands-on experience.

Technological drivers

Research and development (R&D) is particularly important for the chemicals industry. Technological advances not only benefit the industry itself, but also feed into many downstream industries because its products are often intermediate goods in the production chain. This role makes the chemicals industry important for a country's competitiveness in terms of innovation.

Traditionally, the EU has been a technology leader, but some of this has been lost during the 1990s to the United States (US). The share of research and development (R&D) expenditure as a proportion of total sales has remained constant in the US and Japan since the mid-1990s, but in the EU the share has shrunk.

One explanation for this trend could be the enormous effort that the European chemicals industry has put into restructuring in order to remain competitive. After completing their restructuring programmes, companies might shift more resources back to R&D. However, this is likely to be an optimistic view. EU companies face higher costs and generate lower profits than their foreign counterparts. The gross-operating surplus of EU chemicals companies is only half that of those in the US.

There are at present two main challenges to innovation in the European chemicals industry. The first is the structural change in other manufacturing industries. Relocation of production to non-EU locations has removed many industries that used to take advantage of technological advances in chemicals. For example, the textiles industry has to a large extent shifted its production to Asia, and the development and manufacture of feedstock for textiles is expected to follow. Although the EU remains a leading supplier of high-tech intermediates, these too are likely to move in time as the chemicals industry in Asia becomes more sophisticated and the market for end-products grows. In most cases, basic research has remained in the EU, but the adjustment of intermediates to customer needs is carried out elsewhere. Examples of this are liquid crystals for television screens (Merck KGaA) and substrate for computer memories (Bayer AG), both of which are manufactured in Asia.

The second challenge to innovation in the European chemicals industry comes from the deferred take-off in biotechnology. European biotechnology has relied too much on processes that have been around for a long time, such as the fermentation of foodstuffs and beverages, and it is also a small industry in Europe. Its total workforce amounts to no more than 3% of the numbers employed in chemicals.

Economic drivers

The chemicals industry accounts for around 12% of the EU's total energy demand according to the **European Chemical Industry Council's review 2004-2005**¹⁵ (CEFIC, 2005). Energy is not only a major cost in the processing of chemicals, but gas and oil are also used for the manufacture of many chemical products. In 1998, **a comparison of energy prices and efficiency in the EU and US chemicals industry**¹⁶ highlights that energy prices in the EU are roughly one-tenth higher than in the US. This turns out to be a disadvantage for production locations in the EU because chemical products are sold into the global market and higher energy prices cannot be passed on to clients.

¹⁵ http://www.cefic.be/Files/Publications/Cefic_Review_2004.pdf

¹⁶ <http://www.cefic.be/Files/Publications/energy11.1998.pdf>

Furthermore, EU and national environmental policies aim at reducing emissions by 20% by 2020 and thus rely heavily on emissions trading as the means of allocating scarce resources. This is likely to lead to further increases in Europe's already high energy prices. Energy is therefore likely to become a constraint on the EU chemical industry's growth and its price competitiveness will continue to deteriorate. Since the early 1990s, the energy intensity of the EU chemicals industry has reduced because of structural change in the industry, which has led to the relocation of the more energy-intensive processes away from the EU. Tough emissions regulations have also encouraged this relocation. European production has thus been based on imports from countries with less strict emissions regulations.

Traditionally, most of the world's chemicals production has been carried out in the advanced industrial countries. Thus, the EU15, US and Japan accounted for two-thirds of global chemicals production in 2002. However, they are losing out to Asian countries, where output has soared from 13% of global production in 1990 to around 24% in 2002 (see CEFIC review 2004–2005). Meanwhile, the EU share has fallen from 32% to 28%, the US share from 27% to 26%, and the Japanese share from 12% to 10%.

Despite the high level of investment in new capacity in Asia, domestic supply of chemicals has not kept pace with demand. European exports of chemicals to China grew at double-digit rates between 1995 and 2002 (see European competitiveness report 2004, p.270), which mostly contributed to the improvement in the EU trade balance for chemicals. However, Asian demand for imported chemicals is likely to last only until the capacity under construction there comes on stream. Furthermore, the new chemicals plants in Asia incorporate the latest production technology and are much bigger than plants in the EU, and so they will enjoy far greater economies of scale. When these plants are operational, the flow of chemicals commodities is expected to be from Asia to Europe.

Another threat to the EU chemicals industry comes from oil-producing countries. Such countries are increasingly investing in the primary processes of the chemicals industry. Joint ventures between Western and local companies are bringing together Western technology with the regional advantages of being near sources of oil. For example, Jubail, a branch of **Sabic**¹⁷, which was founded in 1976 to invest in the petrochemicals industry, has a joint venture with Canada's Acetex to build a \$1 billion petrochemicals plant in Saudi Arabia. Sabic has also invested in downstream companies; for example, in July 2002 it acquired the Dutch chemicals group, DSM, along with its production sites in the Netherlands and Germany. In these ways, the chemicals industry is developing cross-border linkages along the value chain, as well as affiliations between companies.

The downstream linkages to client industries are as important to the globalisation of the chemicals industry as upstream linkages. The most obvious example of this is man-made fibres. The move of the textiles industry away from the EU drew the man-made fibres industry with it. There are now manufacturing plants producing and selling man-made fibres in Turkey, North Africa, the Far East and, in particular, China. The phasing out of the Multi-Fibre Agreement (MFA) and the accession of China to the World Trade Organisation (WTO) have reinforced this long-term development.

Environmental drivers

Although recent restructuring has shifted the focus of the chemicals industry towards low energy-intensity products, chemicals remains the most energy-intensive industry. New process technologies, combined heat and power generation (of electricity and steam), will play an important role in further reducing the energy intensity of the chemicals industry,

¹⁷ http://www.sabic.com/sabic-www/index_Overview.htm

as well as public policies aimed at reducing emissions. During the 1990s, the chemicals industry shifted its focus towards low-energy processes and became less dependent on fuel imports. This trend is expected to become more pronounced, as the use of biomass and waste as energy inputs is expected to grow by 10% per year to 2030, according to the Commission's **EU-15 energy and transport outlook to 2030**¹⁸ (2003).

The protection of the environment, consumers and workers from hazardous chemicals are institutional aspects of outstanding importance for the industry. Formerly, different national regulations hampered the free circulation of chemicals in the single market. With the principle of mutual recognition, however, products legally marketed in one Member State must in principle be admitted in any other Member State. This institutional framework has made the free movement of chemicals easier within the internal market with the obligation to preserve high levels of environmental protection.

The greatest challenge currently faced by the European chemicals industry lies in the **proposed REACH legislation**¹⁹ (REACH is an acronym for the Registration, Evaluation and Authorisation of Chemicals). The draft chemicals regulations, proposed by the Commission in 2003, require companies to register some 30,000 substances with a new organisation called the European Chemicals Agency. Companies would have to demonstrate that the chemicals they use cause no harm to humans or the environment.

Two recent reports suggest that the REACH Proposal will hurt chemicals businesses, but probably less than previously feared. A **2005 impact assessment based on a case study approach**²⁰, written by KPMG and funded by the industry, argues that REACH is likely to impose 'significant' one-off costs on companies (KPMG, 2005). In one case examined, costs amounted to 20% of annual turnover. However, the report also says the new framework is unlikely to force companies to abandon the production of critically important substances. It also points out that businesses could reduce costs by joining forces with other companies or by rationalising their product portfolios. The second report, by the Institute for Prospective Technological Studies (IPTS) and funded by the European Commission, assesses the impact of the new rules on the chemicals sector in the 10 new Member States (see **Implementation of REACH in the new Member States**²¹, 2005). It concludes that they will have very limited impacts on the competitiveness of chemicals manufacturing companies, but may cause problems to importers.

Major exporters to the EU are concerned about the effects of the new REACH rules. An **impact analysis by the Australian Bureau of Agricultural and Resource Economics**²² (Abare, 2005) suggests that they would reduce Australian exports of key mineral products to Europe because they cover primary raw materials. However, the impact would be partly mitigated by the diversion of exports to other fast-growing markets, most notably China. The study also concluded that the new rules could lead to the relocation of metals-processing from Europe to Asia.

¹⁸ http://www.europa.eu.int/comm/dgs/energy_transport/figures/trends_2030/index_en.htm

¹⁹ http://europa.eu.int/comm/enterprise/reach/overview_en.htm

²⁰ http://europa.eu.int/comm/enterprise/reach/docs/reach/kpmg_final_report.pdf

²¹ http://europa.eu.int/comm/enterprise/reach/docs/reach/ipts_report.pdf

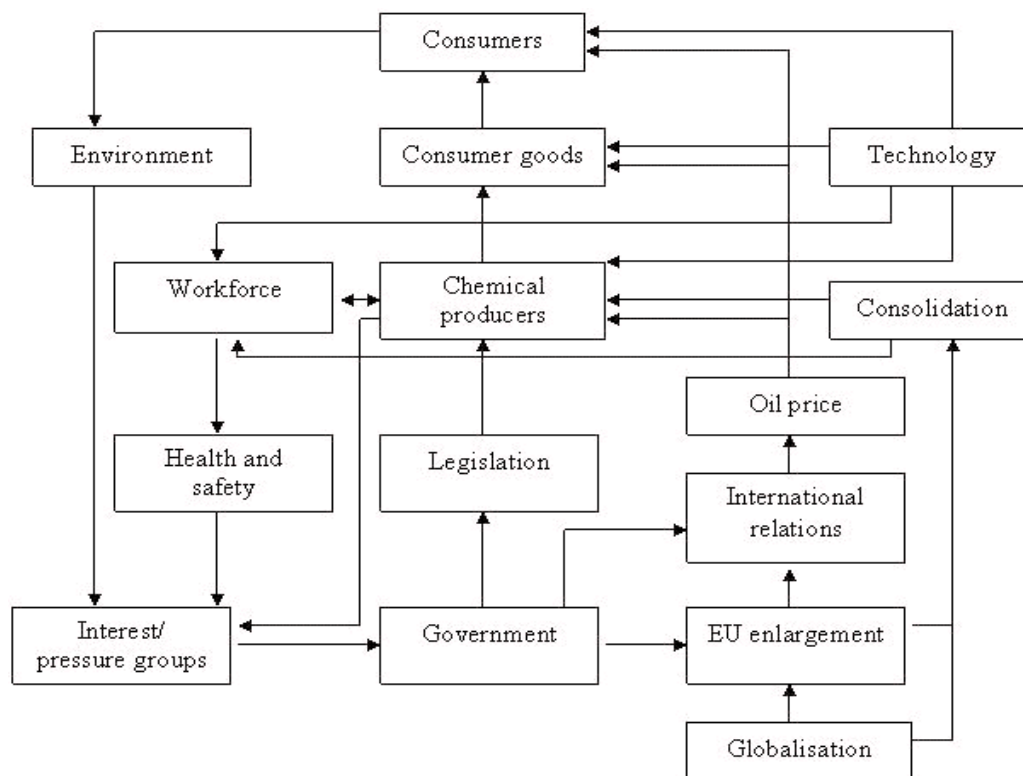
²² http://www.minerals.org.au/_data/assets/pdf_file/8900/EU_REACH_Legislation.pdf

Political drivers

DG Research and the European chemicals industry have launched a platform for a **sustainable chemicals industry**²³ (SusChem) which aims to bring together researchers from industry and academia to stimulate innovation in the private sector. The focus is on dynamic high-tech areas such as biotechnology and materials technology, but it is also to concentrate on the identification of institutional constraints on innovation.

The social partners of the chemicals industry – namely, the European Chemical Employers Group (ECEG), the European Mine, Chemical and Energy Workers Federation (EMCEF) and the European Chemical Industry Council (CEFIC) – have launched a social sectoral dialogue in order to better represent the shared views of the intra-industrial stakeholders in political decision-making. The underlying driver of this initiative was the perception that their interests had not been sufficiently considered (see **common press release on 13 July 2005**²⁴).

Figure 1: *Trend and driver linkage*



Source: *Institute for Economic Research (Ifo), Munich, 2005.*

²³ <http://www.suschem.org/content.php?pageId=2479&lang=en&PHPSESSID=0ae28842bb455fffd68114764181cb6c>

²⁴ <http://www.cefic.be/Files/NewsReleases/CeficREACH130705.doc>

Scenarios for the chemicals industry

The last few years have seen a ‘decoupling’ of pharmaceuticals from other chemicals. Whereas output in pharmaceuticals grew by a healthy 5.5% per year over 1996–2001, output in the rest of the chemicals sector grew by only 2.8% per year over the same period. Because pharmaceuticals is a relatively small part of the chemicals sector, the growth rate for chemicals as a whole was only 2.9% per year.

This decoupling has come about for a number of reasons, including the introduction of different technologies, changes in downstream markets, growth perspectives, drivers of success, approaches to innovation and changes in shareholder expectations.

The European Chemical Industry Council (CEFIC) has developed four alternative scenarios for the future development of the chemicals industry in its 2004 study on **Chemical Industry 2015: Roads to the future**²⁵ (CEFIC, 2004):

- ‘*Sunny*’ – a revitalised EU chemicals industry, with increased innovation and customer orientation;
- ‘*Cloudy*’ – a focused EU chemicals industry, strong in high-end products and sustainability;
- ‘*Rain*’ – an EU chemicals industry with no confidence in the European market;
- ‘*Storm*’ – a shrinking EU chemicals industry, not able to compete with imports.

These scenarios were based on a major study that involved over 150 chief executive officers (CEOs) and experts in the chemicals industry. The assumptions made in the scenarios are outlined below.

- The *Sunny* scenario sees a positive market situation and a highly favourable macro/political environment. These are supplemented by positive efforts by the industry to optimise downstream relations. The overall result is continued growth in the chemicals industry sector.
- The *Cloudy* scenario assumes that the chemicals industry is facing a very weak market. However, in contrast to the Storm scenario, the macro/political environment is very favourable to the industry, encouraging it to take strong initiatives to improve its overall situation. Despite the weak market, the industry is able to enhance its competitiveness and profitability.
- The *Rain* scenario supposes that despite a positive market position and a still acceptable macro/political environment, the industry fails to seize the existing opportunities and to carry out the required actions. This failure results in the deterioration of competitiveness and profitability.
- The *Storm* scenario presumes a very weak market accompanied by a very discouraging macro/political environment. Even if the chemicals industry tries to fight the bad market conditions, there is no chance of overcoming the restraints in the macro/political environment and the result is a rapid loss of global market share.

²⁵ <http://www.cefic.org/Templates/shwStory.asp?NID=472&HID=427>

Evaluation of the scenarios

The EU chemicals industry is expected to be under pressure from four sides:

- Asia, and in particular China, is increasingly taking over the production of low-cost commodities. The comparative cost advantage will spread to increasingly more sophisticated chemicals products, eroding the market for EU chemicals.
- The Middle East's oil and gas-rich countries are poised to increase their presence massively in the global market for basic petrochemicals. Industry experts estimate that 50% of total global new ethylene capacity will be built in the Middle East. The region's ethylene production has trebled since 1990 and is expected to double again by 2010.
- Product innovation and customer-specific solutions are vital for success in the speciality chemicals sector. Saturation of markets and commoditisation are real threats. Furthermore, new regulatory policy from the EU (e.g. REACH) and the lack of a real industrial policy could further erode competitiveness.
- A continued fall of the US dollar against the euro would considerably hurt the competitiveness of the EU chemicals industry, not only in the US dollar-area but also in Asia since most Asian currencies are closely tied to the US dollar.

Of the scenarios outlined above, only the *Sunny* scenario would result in growth rates similar to gross domestic product (GDP) forecasts. However, in light of the pressures just described, the assumption of a positive market seems unrealistic. It is clear that the EU chemicals industry is facing a difficult market and will continue to do so in the foreseeable future.

In the *Rain* and *Cloudy* scenarios, the pressures just described will work towards a gradual slowing down of EU chemicals production. Although growth would probably not match GDP forecasts, it is not expected to turn negative. Rather, the chemicals industry adjusts to market conditions in a supportive macro/political environment.

The Storm scenario projects a sharp reversal of the former growth in the EU chemicals sector into decline. The industry will rapidly lose share in the global chemicals market.

Implications

Geographical

The EU chemicals industry is highly globalised, exporting more than 25% of its production outside the EU. The industry cannot compete on price. This advantage is enjoyed by Asian and Middle Eastern producers. Because these countries are also in the process of building new production capacity on a large scale, they also tend to have the additional advantages of newer technology and bigger economies of scale. The EU chemicals industry is therefore likely to lose market share to other regions, especially in the less refined chemicals.

The European chemicals industry faces high tariffs in some parts of the world. The Chemical Tariff Harmonisation Agreement harmonised import tariffs in the EU and main OECD countries at a low level. However, many key emerging markets retain high tariffs, putting EU exporters of chemicals at a disadvantage.

Regulation, such as the forthcoming REACH legislation, could also become a burden if EU chemicals producers are forced to adhere to much higher safety standards than their competitors. If the regulations involve higher costs, they can put an industry at a disadvantage compared to its competitors.

Inter-industry

The chemicals industry is essential for sustainable development and growth in the European economy because of its direct and indirect impacts on various parts of the economy. The chemicals industry and its strategies have direct effects on the downstream users of chemicals. The industry is its own largest customer, but other large industrial customers include metals, mechanical and electrical industries, textiles and clothing, paper and printing products, and the automotive industry.

Apart from sourcing products and services from suppliers and producing products and providing services to industries, the chemicals industry also has an important role in enabling innovations in other industries. Chemistry is synonymous with innovation in areas such as aerospace, medicine, hygiene, nutrition, mobility, housing and clothing. New materials developed by the chemicals industry have played a key role in meeting new challenges in the development of society.

The public perception of the chemicals industry seems unaware of the fact that it has been at the centre of economic and social development since the first industrial revolution. It has offered more new products that have improved industrial productivity and raised living standards than any other industry. Although the next wave of innovation may come from elsewhere, perhaps from biotechnology or nanotechnology, the chemicals industry is likely to continue to play a central role in the economy.

Social relations

The main issue here concerns the low public esteem for the chemicals industry. Public opinion must not be underestimated – it can be a powerful ‘driver’ of the business environment. Because the public also forms the electorate of the politicians, public opinion can act as a strong catalyst for regulatory initiatives, which do not necessarily create a favourable business environment. Survey results show that the industry’s reputation has been deteriorating continually since the 1990s. This has also affected the attractiveness of the chemicals industry as a career choice and, as a result, the industry has suffered from a long-term brain drain. When experienced workers leave, there are few qualified young people to replace them.

Public opinion is, therefore, important on two fronts. First, good public relations promote good political relations and may help to reduce the regulatory burden. If the chemicals industry loses its ‘licence to operate’, the industry’s business environment will become very difficult. Secondly, if people do not want to work in the industry, talented young people will seek careers elsewhere. This will affect the industry’s ability to conduct R&D and stay ahead of innovation in other countries.

Conclusion

This article reviewed major trends in the chemicals industry sector (excluding pharmaceuticals) and considered some alternative scenarios for the future development of the sector. While the continuing importance of the chemicals industry to the European economy seems assured, the scenarios are an example of the different prospects that the sector could face in the years ahead. The last article in this series, **Chemicals sector – challenges, policy issues and the future**²⁶, reviews major policy issues and challenges that the sector currently faces, by analysing their timely, geographical and structural impact on the industry, as well as the gender dimension.

²⁶ <http://www.emcc.eurofound.eu.int/content/source/eu05023a.html>

Challenges, policy issues and the future

The third and last article in this series reviews major policy issues and challenges facing the chemicals industry sector, by analysing their timely, geographical and structural impact on the industry, as well as the gender dimension. In particular, it looks at the REACH proposal, forces driving the decline of the European chemicals industry and aspects of the unfavourable political environment.

In the present era of globalisation and capital mobility, chemicals manufacture moves to the booming markets of Asia, which profit from substantial foreign investment in chemicals production. As commodities have a substantial share in the product portfolio of the chemicals industry, the European industry has to accelerate its pace of innovation to stay in the lead. Economic policymakers for their part face the challenge of providing conditions that promote a more knowledge-driven industry with a sound basis for production in Europe. If this challenge is not met, the decline in chemicals employment will become even more pronounced in Europe.

Major policy issues and challenges

Chemicals legislation

Time profile

The proposed Registration, Evaluation and Authorisation of Chemicals (REACH) legislation is the biggest challenge currently faced by the European chemicals industry. REACH follows pressure from national governments, the European Commission and environmental agencies to review the current chemicals legislation, which does not cover substances put on the market before 1981. This has allowed hazardous chemicals to remain in circulation and an evaluation of current legislation (published in November 1998) concluded that the regulatory system was failing. Work on the development of a new integrated and coherent EU chemicals policy, which adequately reflects the precautionary principle and the principle of sustainability, resulted in the REACH legislation, proposed by the European Commission in 2003.

The draft REACH legislation led to a dispute between the industry and the Commission, which has lasted for two years. The legislation is now being considered by the European Parliament and the Council of the EU for adoption under the so-called co-decision procedure. In its current form, REACH would require companies to register some 30,000 substances with the new European Chemicals Agency. Companies would have to demonstrate that the chemical substances they use cause no harm to humans or the environment. The ultimate aim is to phase out hazardous chemicals from circulation by 2020.

Geographical

The immediate impact of REACH is on the EU and its chemicals companies. It will bring unity in legislation between countries in the single market, while preserving high levels of environmental protection. The impact of REACH in the 10 new Member States is expected to be less than in the EU15. Because the chemicals sector in the new Member States relies heavily on imports of chemical compounds from the EU15, the new rules will have very limited impact on the competitiveness of chemicals companies. However, the rules may cause problems to importers.

Major chemicals-exporting countries are also expecting REACH to affect their industries as suggests, for example, an impact analysis by the Australian Bureau of Agricultural and Resource Economics (Abare, 2005). The REACH legislation would reduce Australian exports of key mineral products to the EU because it covers primary raw materials. However, the impact would be partly mitigated by the diversion of exports to other fast-growing markets, most notably China. The study also concluded that the new legislation could lead to the relocation of metals-processing from the EU to Asia.

Structural

Initial studies on the effect of REACH, commissioned by the chemicals industry, reported a loss of competitiveness and jobs in the industry as a whole. However, two recent reports suggest that the REACH proposals will hurt the chemicals industry less than was previously feared, although the effect will still be significant. There are also reports that the industry may even benefit from the stricter environmental regulation.

A 2005 impact assessment based on a case study approach, written by KPMG and funded by the industry, argues that REACH is likely to impose 'significant' one-off costs on companies (KPMG, 2005). In one case examined, costs were expected to amount to 20% of annual turnover. Despite the high costs involved, the report suggests that the new legislation is unlikely to force companies to abandon the production of critically important chemical substances. It points out that businesses could reduce costs through collaboration with other companies or by rationalising their product portfolios.

The Commission funded report, looking at the *Implementation of REACH in the new Member States*, assessed its impact on the chemicals industry in these countries. It concluded that the legislation will have a very limited impact on the competitiveness of chemicals companies, but may cause problems to importers.

The impact of the new legislation is likely to be greater on small and medium-sized enterprises (SMEs) than large chemicals companies. The data that companies will have to submit to support their claims about the safety of the chemical substances they use requires costly and complex testing. These costs are more difficult to absorb by a smaller company. A proposed, and crucial, amendment to REACH advocates lighter data requirements for 17,500 substances, more than half the total, and the introduction of a principle of 'one substance, one registration'. In its current form, REACH will demand the registration of all chemical substances even if they have already been registered by another company. If accepted, this amendment would substantially reduce the burden of registering chemical substances.

Once the REACH legislation is adopted, it is clear that companies must focus more than before on developing new material and technical possibilities. At present, chemical substances put on the market before 1981 enjoy a competitive advantage because they have not incurred the costs of data collection and can therefore be sold at a lower price. By the same token, they do not have data about their risk potential. REACH will create transparency between producers, suppliers and their customers. Users of chemical substances will be in a position to choose substances with the lowest risk potential. It is envisaged that this will provide better prospects for innovative companies to develop and market replacements for old chemical substances. The new chemicals policy, therefore, has the potential to strengthen the competitiveness of EU chemicals companies in the increasingly sensitive world market.

Gender

REACH has the potential to change the general public image of the chemicals industry as it will phase out hazardous chemicals from circulation. As a result, companies must focus more strongly on developing new materials and technical processes, and to demonstrate their safety before they are registered with the European Chemicals Agency. However, the effect of REACH (the protection of the environment, consumers and workers from hazardous chemicals) will be shared equally between the genders.

Decline of the European chemicals industry

Time profile

The EU has traditionally been the technology leader in the chemicals industry, but some of this has been lost to the US during the 1990s. As noted in first article of this series on chemicals, while the share of R&D expenditure as a proportion of total sales has remained constant in the US and Japan since the mid-1990s, the share has been shrinking in the EU.

At the same time, the attractiveness of the chemicals industry as a career choice has been declining and the chemicals industry has suffered from a brain-drain as experienced workers have left and the young have chosen other careers. For the EU to have a sustainable chemicals industry, it must tackle the decline in both these areas.

DG Research and the European chemicals industry have launched a common initiative for a **sustainable chemicals industry** (SusChem). It is organised as a European technology platform to bring together researchers from industry and academia to stimulate innovation in the private sector. The focus is on dynamic high-tech areas such as biotechnology and materials technology, but it is also to concentrate on the identification of institutional constraints on innovation. Its aim is to pursue a holistic approach, taking into account the views and objectives of all stakeholders.

Many chemicals companies have also been working to improving the reputation of the chemicals industry. BASF, for example, is among the most active of the leading global chemicals companies, running 'Kids Labs' at schools which allow children to learn more about the chemicals that surround them at home and to develop an interest in chemistry. Similarly, Air Products, a global supplier of chemicals, industrial gases and equipment, sends 'science ambassadors' to schools and organises workshops at universities where undergraduates can get hands-on experience.

Geographical

The EU chemicals industry is expected to be under pressure from four sides:

- Asian, and in particular Chinese, chemicals companies are increasingly taking over the production of low-cost commodities. The comparative cost advantage will spread to increasingly more sophisticated chemicals products, eroding the market for EU chemicals.
- The Middle East's oil and gas-rich countries are poised to increase their presence massively in the global market for basic petrochemicals. Industry experts estimate that 50% of total global new ethylene capacity will be built in the Middle East. The region's ethylene production has trebled since 1990 and is expected to double again by 2010.
- Product innovation and customer-specific solutions are vital for success in the speciality chemicals sector. Saturation of markets and commoditisation are real threats. Furthermore, new regulatory policy from the EU (e.g. REACH) and the lack of a real industrial policy could further erode competitiveness.
- A continued fall of the US dollar against the euro would considerably hurt the competitiveness of the EU chemicals industry, not only in the US dollar area but also in Asia since most Asian currencies are closely tied to the US dollar.

Structural

Research and development (R&D) is particularly important for the chemicals industry, especially in the EU where the high cost base makes price competition difficult. Technological advances not only benefit the industry itself, but also feed into many downstream industries because its products are often intermediate goods in the production chain. This role makes the chemicals industry important for a country's competitiveness in terms of innovation.

There are at present two main challenges to innovation in the European chemicals industry. The first is the structural change in other manufacturing industries. Relocation of production to non-EU locations has meant that many industries that used to take advantage of technological advances in chemicals have gone, or at least shrunk (such as the textiles industry). Although the EU remains a leading supplier of high-tech intermediates, these too are likely to move in time as the chemicals industry in Asia becomes more sophisticated and the market for end-products grows. In most cases, basic research has remained in the EU, but the adjustment of intermediates to customer needs is carried out elsewhere.

The second challenge to innovation in the European chemicals industry comes from the deferred take-off in biotechnology. EU biotechnology has relied too much on processes that have been around for a long time, such as the fermentation of foodstuffs and beverages. It is also a small industry in the EU, amounting to no more than 3% of employment in chemicals. The next wave of innovation is expected to come from biotechnology or nanotechnology, but the EU platform for the sector is small.

Gender

New patterns of working time, such as part-time employment, sabbaticals and other flexible work practices, have become an important tool for companies to attract highly qualified applicants, especially female workers. However, the adoption of these practices differs widely across the EU. Within the EU15, the southern Member States and the new Member States lag behind the others, and this limits their potential to attract women into the labour force. Although flexible working hours would widen the pool of labour for the industry, the overall attractiveness of chemicals as a career choice has also to be addressed.

Unfavourable political environment

Time profile

According to survey results, public opinion of the chemicals industry has been deteriorating since the 1990s. Crucially, this has meant that the political environment for the chemicals industry has also deteriorated. In addition, because the public forms the electorate of the politicians, public opinion can act as a strong catalyst for regulatory initiatives, which do not necessarily create a favourable business environment.

This situation finally led to pressure from national governments, the European Commission and environmental agencies to review the current chemicals legislation that did not cover substances put on the market before 1981. An evaluation report of the chemicals legislation was published in 1998, which led to the REACH draft chemicals legislation in 2003, which is currently debated in the European Parliament.

Geographical

The world market is becoming increasingly sensitive to environmental issues. This is especially true of the developed countries and particularly the EU. The chemicals industry has traditionally been associated with high energy intensity and emissions, and has therefore been subject to regulation to varying degrees. The EU displays a disparity in environmental regulation, with the northern Member States being stricter, or in advance of, the southern Member States and the new Member States.

Meanwhile, competitors located in countries in Asia and the Middle East are faced with less strict regulation than their EU counterparts, particularly after the launch of REACH. Competitors in the US also have a 'better' political environment than the EU, although public opinion in North America is strongly against the industry.

Structural

Public opinion tends to use generalisations, which means that the perception the public has of the chemicals industry applies to the whole sector. Currently, the chemicals industry suffers from low public esteem which is due largely to the contribution that chemical substances have made to the rise in allergic illnesses and to the damage some chemicals cause to the environment. Public opinion, however, must not be underestimated as a powerful 'driver' of the business environment. Because the public forms the electorate of the politicians, public opinion can act as a strong catalyst for regulatory initiatives, which do not necessarily create a favourable business environment.

Furthermore, public opinion can also affect the industry's competitiveness with regard to the labour force. If an industry does not appeal to job-seekers, talented young people will go elsewhere and, as a result, an industry can suffer from a brain-drain when experienced workers leave and there are few qualified young people to replace them.

Gender

Surveys of public opinion have repeatedly shown that the public views the chemicals industry as a health hazard. A survey by **Eurobarometer in 2002**²⁷ in the EU15 countries found that 93% of Europeans believe that chemicals have a negative effect on health. Few surveys are concerned with the difference of opinion between males and females. However, when differences in opinion between males and females have been published, they have been statistically insignificant.

²⁷ <http://www.panda.org/downloads/toxics/detoxfactsheetoppoll.pdf>

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