
SECTOR BULLETIN: CHEMICALS



In association with:



MANUFACTURING ROUND UP

Welcome to our fourth Sector Bulletin report in partnership with Santander. Following on from our in depth looks at the automotive, aerospace and food and drink sectors, this time our focus is oriented towards the UK’s chemicals sector; delving into its components, structure, trade channels, characteristics, risks, opportunities and long-term trends.

As is tradition however, let’s first take a look at how the manufacturing sector as a whole has fared over the past year, and the key trends that have affected its performance.

The manufacturing sector, given what many were expecting in the immediate aftermath of the Referendum, has performed admirably over the last year. Business survey data, including Markit/CIPS PMI survey, as well as our own Manufacturing Outlook surveys have been overwhelmingly positive. Official data, overlooking a blip in the automotive sector in the second quarter, have also been largely upbeat, with a healthy expansion of 1.1% recorded in the third quarter’s GDP figures.

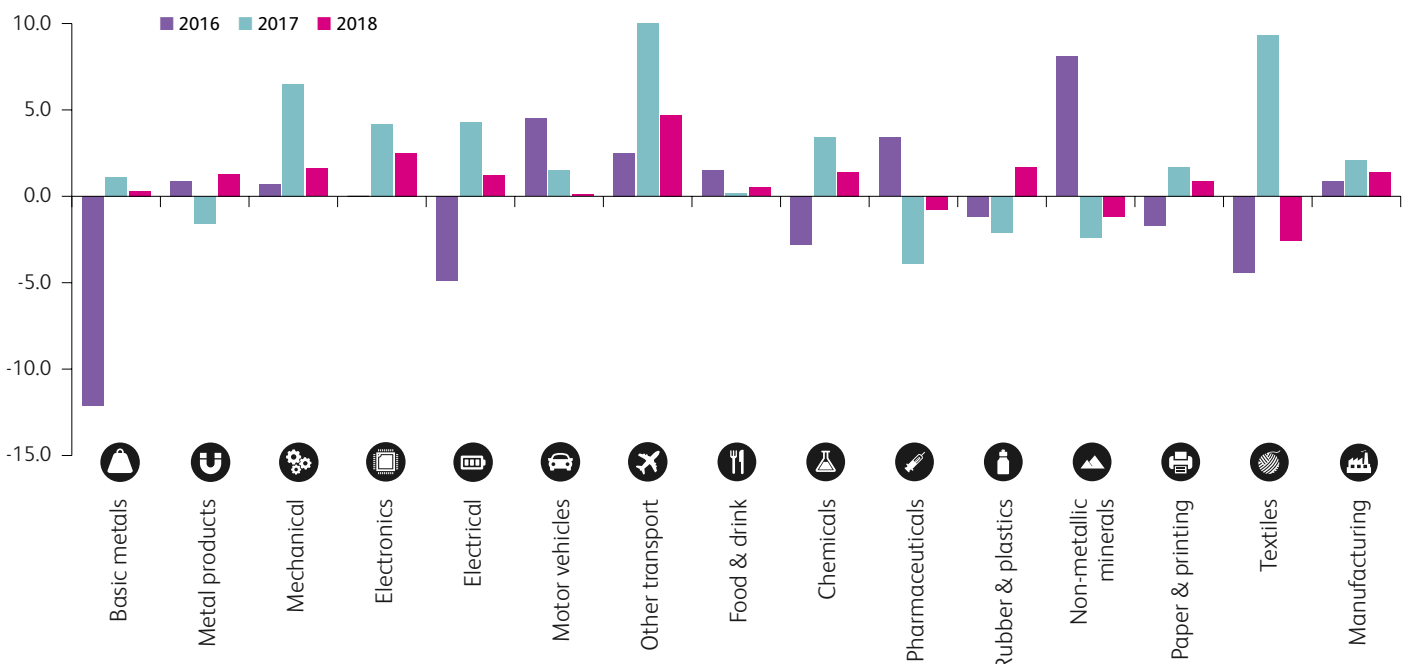
Underpinning this performance has been the improved global outlook, with demand picking-up across key export

markets in the eurozone, US and China, offsetting weaker domestic demand, as consumers are squeezed on the back of rising inflation. Along with this, the sustained depreciation of sterling is also providing a further boost to exports.

There are a number of risks on the horizon however, which may harm the current optimism. Top of the list – as it is for the whole economy – is Brexit related uncertainty and specifically the future of our trading relations with the EU. How Brexit negotiations progress will be key to manufacturers’ future investment plans, while the longstanding productivity issue and recent weak wage growth represents a further headache for UK manufacturers. Nevertheless, we still expect the sector to power through these hurdles and post positive growth of 1.4% in 2018.

Manufacturing round up

% yearly change, GVA output



Source: EEF & Oxford Economics (2017)

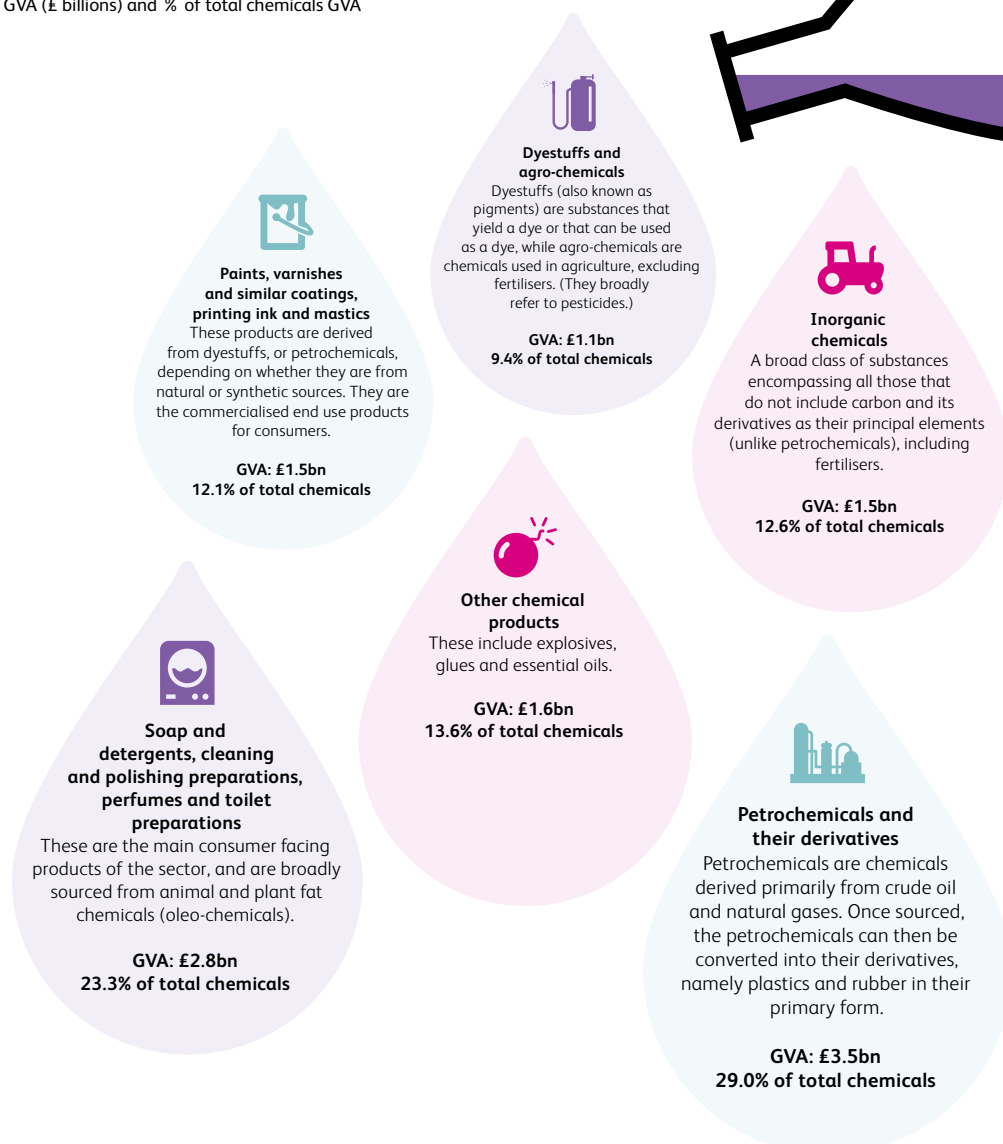
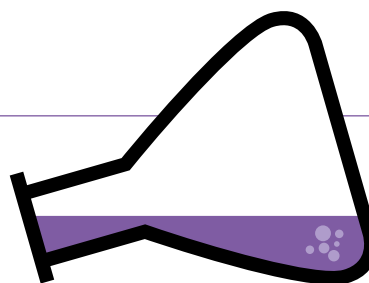
UNDERSTANDING CHEMICALS

The chemicals industry is an integral part of UK manufacturing, converting raw materials into a wide range of products, used both by consumers and as building blocks in other sectors' value chains. From shampoos and soaps, to industrial products derived from petrochemicals and dyes, the chemicals sector has a hand in almost every aspect of daily life, without us often realising.

With £12.1 billion and £21.0 billion generated in gross value added and sales respectively in 2016, the sector also makes a sizeable contribution to UK manufacturing. Furthermore the sector is growing, with output increasing by 27% since 1990, a growth rate surpassed only by the pharmaceuticals, motor vehicles and other transport sectors.

What does the chemicals sector make?

Sector products GVA (£ billions) and % of total chemicals GVA



Source: ONS (2016)

Chemicals demand

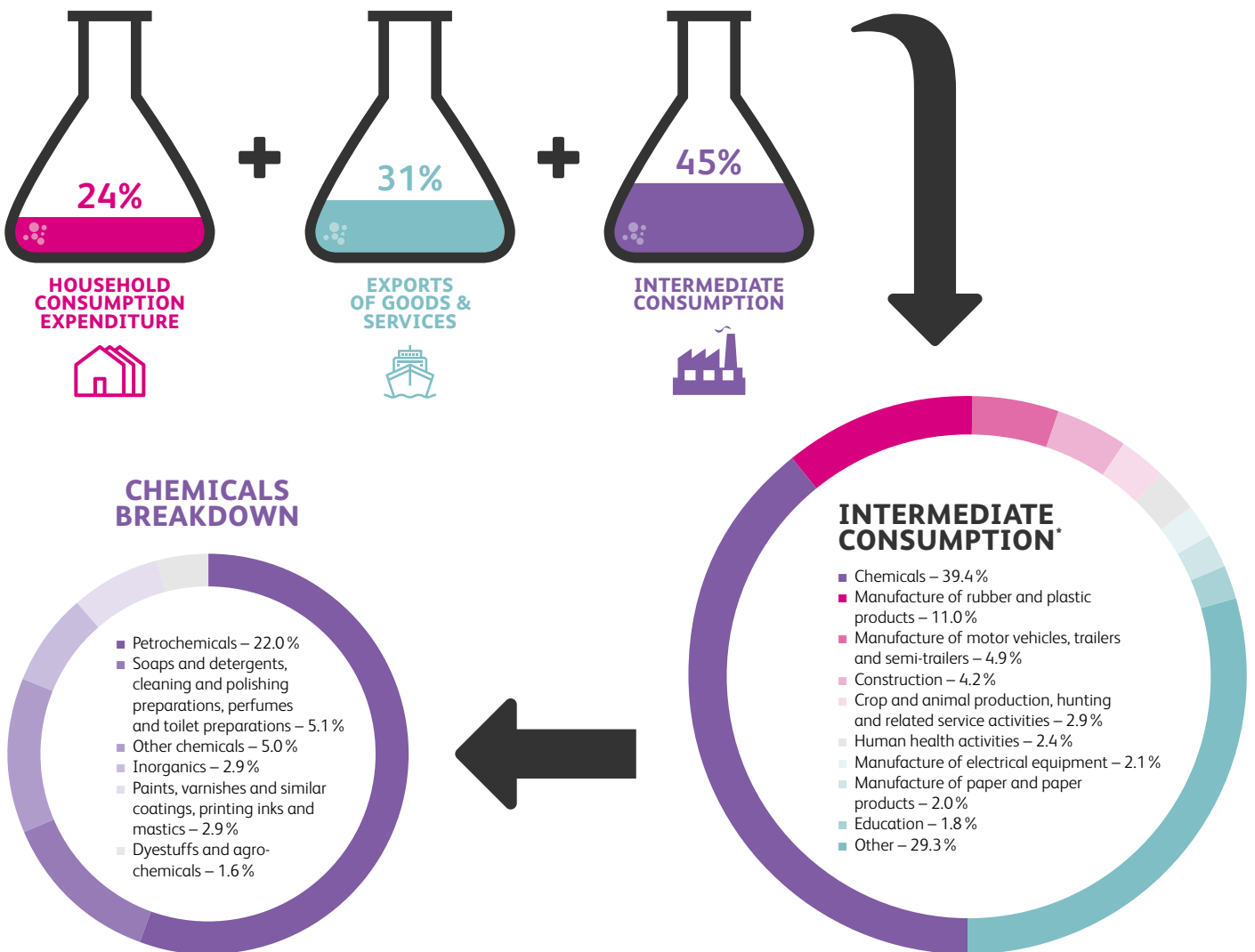
Unsurprisingly the chemicals sector, given the wide range of products it manufactures, also has a diverse demand base. The sector primarily produces intermediate goods – 45% of total production – which are

used as industrial products in the chemicals sector itself, as well as other sectors’ value chains, including rubber and plastics, automotive and construction. The majority of these products are derived from petrochemicals and other inorganic

materials. A further 24% of final demand comes straight from the consumer as the sector produces a wide range of cosmetics, perfumes, paints and inks, while 31% is sent abroad as exports.

Chemicals demand structure

Demand structure breakdown, % of final demand



*NB: Gross fixed capital formation equals 0% therefore has been omitted.

Source: ONS (2015)

What is chemicals manufacturing?

Chemicals manufacturing is a complex process, with a presence at every stage of the value chain, from source, right up to the final consumer. The sector is unique in this respect, given few others encompass such a wide range of activities.

The initial stages of the manufacturing process are typically energy intensive, as large volumes of raw material are extracted and converted into primary products.

For instance, once sourced (which itself is energy intensive), crude oil and natural gas, are transformed into petrochemicals e.g. ethylene, through a process known as “catalytic cracking”. This involves the breaking up of large hydrocarbon molecules which make up oil and natural gas compounds, into smaller more useful hydrocarbon molecules, in a thermal decomposition reaction. This segment of the sector is therefore intrinsically linked to the oil and gas industry.

Elsewhere, inorganic compounds are sourced from ores and salts, with one of the most well-known compounds, chlorine, manufactured by the electrolysis of sodium chloride (rock salt).

Natural dyestuffs, are sourced from plants and mineral ores, while oleo-chemicals, used to make cosmetics, are derived from vegetable oils, plants and animal fats. These two processes are significantly less energy intensive, than the previous two.

Once the primary products have been sourced, they go on to diverse areas in the value chain.

Petrochemicals, the largest segment of the chemicals industry, are used to produce intermediate goods, specifically plastics and rubber in their primary forms e.g. polypropylene, polystyrene and synthetic rubber through polymerization reactions. This is where the chemicals manufacturing process ends. Petrochemicals do not reach the final consumer, they instead go on into other manufacturing sub sectors such as rubber and plastics, to form useable products, which themselves go on into other sectors, such as automotive and construction. Some petrochemicals also go back into the chemicals sector itself however, for example as synthetic paints and dyes, or to make pesticides (an agro-chemical), the vast majority of which are now derived from petroleum.

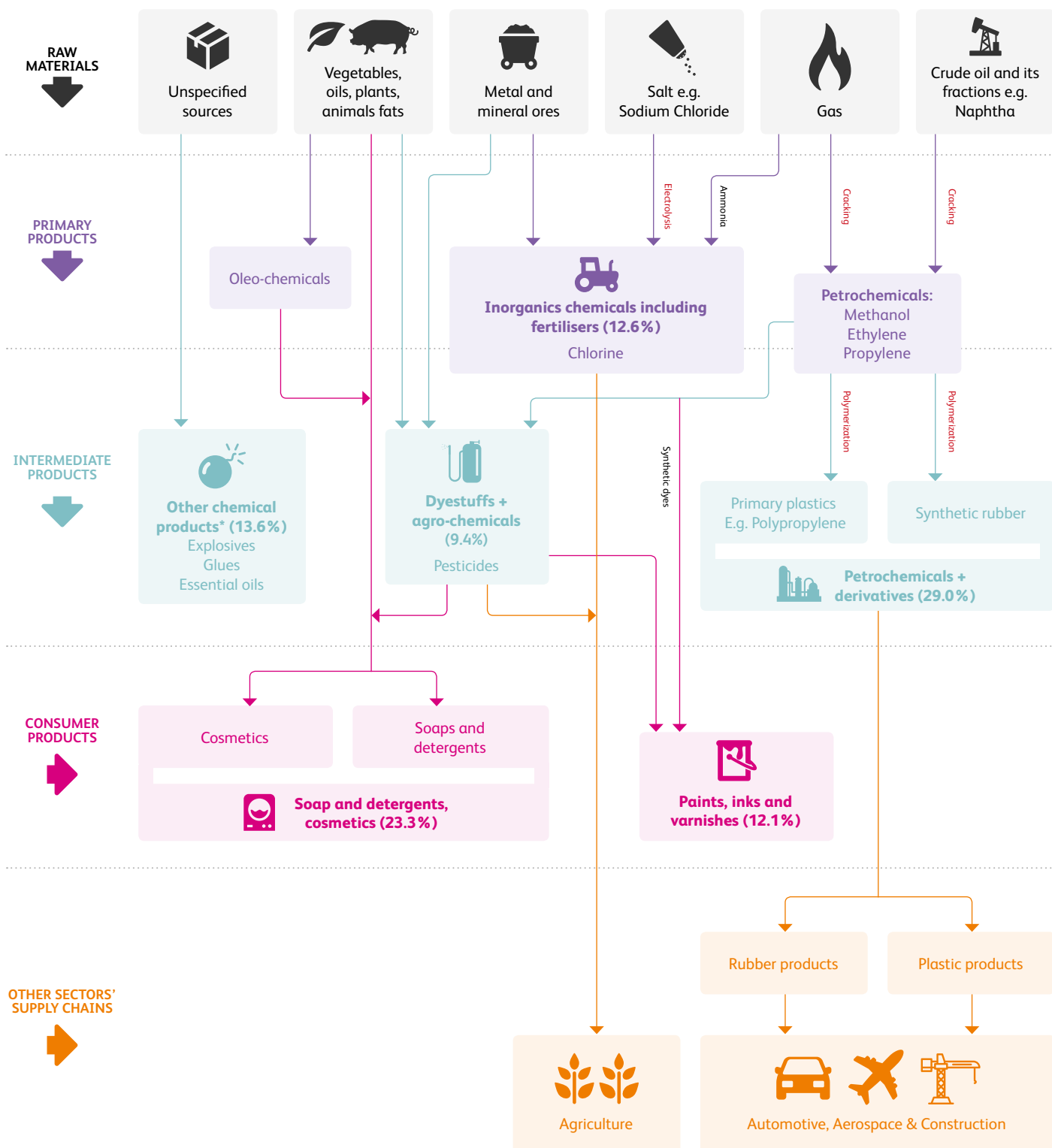
Inorganic chemicals are also used to produce a variety of intermediate goods, including fertilisers, which are then used in crop and animal production, in the agriculture sector. Pesticides follow a similar path, but have a different source as mentioned previously.

Dyestuffs, which are extracted direct from mineral ores, or other plant sources, are used to manufacture consumer facing goods at the end of the value chain, including paints, varnishes and inks, as well as contributing to the production of cosmetics. The majority of cosmetics are however produced via the conversion of oleo-chemicals (chemicals derived from plant and animal fats) at the primary stage of the process, direct into cosmetics. This is the least energy intensive segment of chemicals manufacturing.

The interlinked nature of the chemicals industry, illustrated in the following diagram, as well as its presence at every stage of the value chain, and its inputs into other manufacturing sectors, illustrates its importance, as a building block of UK manufacturing.

Structure of the chemicals sector

Structure



Key:



*Given the diverse nature of products categorised under "other chemical products", it is difficult to quantify, as well as articulate, an exact source or destination for these products. Therefore, for the purpose of this diagram, we have simplified the illustration to solely show that the vast majority of "other chemical products" are intermediate goods which enter into other sectors' value chains.

N.B numbers in brackets refer to % of total chemicals GVA

Source: ONS (2016) and adapted from A Eastwood (2011)

CHARACTERISTICS

The chemicals sector is a heavy manufacturing industry. However, unlike other traditional sectors of the same ilk, for instance basic metals and mechanical equipment, who have seen their output and share of manufacturing decline over the last 20 years, the chemicals sector has shown greater resilience, and its importance has remained broadly intact. There are a number of characteristics that have helped chemicals retain its position as a leading manufacturing sector, namely size, foreign investment and strong productivity growth.

Chemicals companies are big players

Chemicals companies, compared to the total manufacturing industry, are on average bigger, both in terms of employees and turnover.

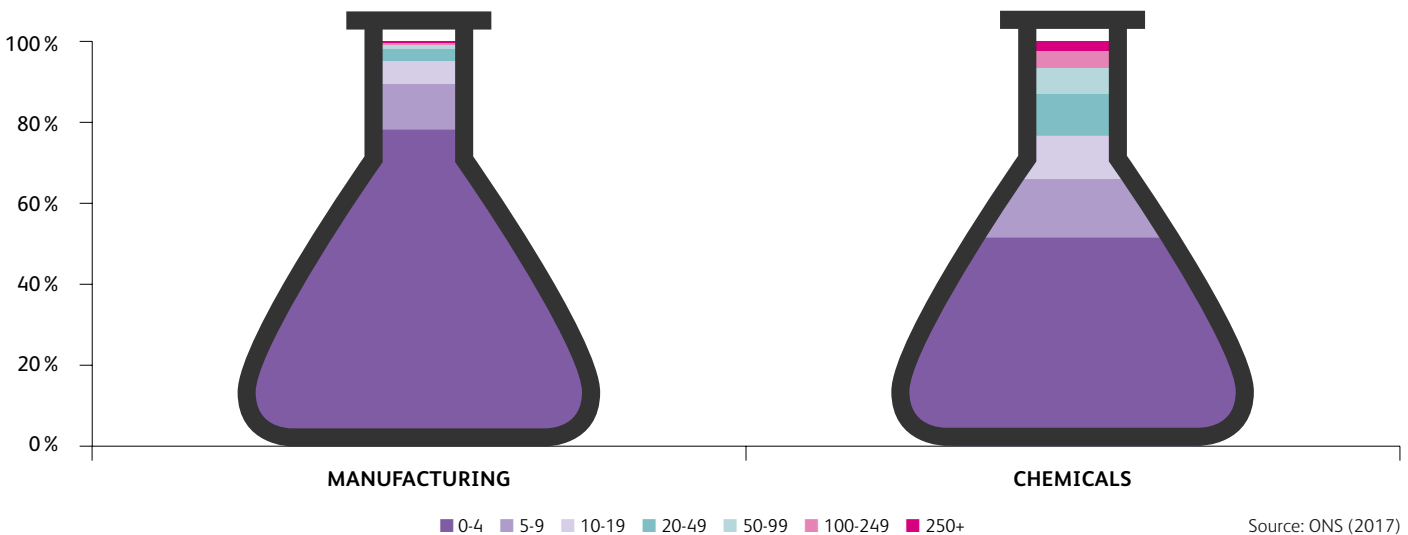
At the beginning of 2017, 36.7% of chemicals enterprises were registered in the band of enterprises with a turnover of at least £1 million,

of which 3.7% had a turnover of over £50 million. The corresponding figures for total manufacturing are much lower at 8.9% and 0.3%. As one would expect, given the revenues generated, a similar picture is apparent when considering company size, with the chemicals sector made up of a smaller number of larger companies, than the manufacturing average.

The size of the sector is also linked to its capital intensity rate which averaged 2.6 between 1996 and 2016 compared to the total manufacturing sector which scored 1.6 in the same period (capital intensity rate measured as net capital stock divided by GVA). This is indicative of a sector making large investments of a longer lifespan, typically with high sunk costs.

Chemicals manufacturers are on average bigger

Chemicals sector structure by employment size band 2017



The chemicals sector is made up of **2,810** enterprises (2.1% of UK manufacturing) yet employed an average of **107,000** workers (3.3% of UK manufacturing) in the last year.

Source: ONS and Eurostat (Q3 2016 – Q2 2017)

Foreign ownership

Another important factor in helping to explain the sector’s size and employment structure comes when considering its ownership.

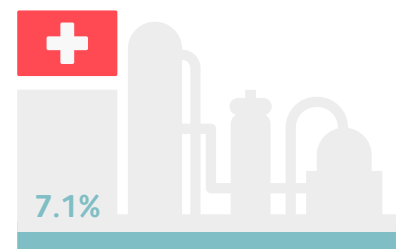
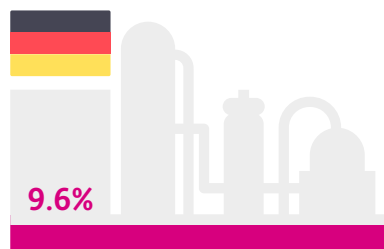
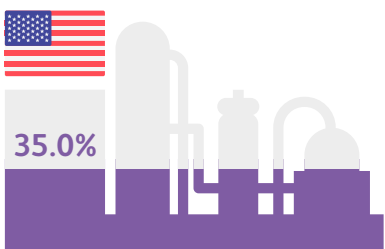
While the chemicals sector has remained an integral part of UK

manufacturing, its diverse demand base, opportunities for scale, and scope for evolution, makes it an attractive proposition for foreign multinationals. As a result the sector has become increasingly foreign owned, and is perhaps best highlighted by the breakup of

former British powerhouse Imperial Chemicals Industry (ICI). Over a tenth (10.7%) of chemicals enterprises are foreign owned, with the US, Germany and Switzerland topping the list of foreign investors. This is a significantly larger share than the 2.7% recorded in the total manufacturing sector.

Top 3 countries in terms of foreign ownership

Percentage of foreign-owned chemicals companies by country of ownership



Source: Eurostat (2014)

Foreign multinationals, given their own size and profitability, tend to employ more people, lead to higher

wages and invest more, particularly in R&D. These factors are all evident in the chemicals sector, which is often

seen to be punching above its weight in terms of its contribution to UK manufacturing.

The chemicals sector has strong fundamentals


IN 2016 AVERAGE WEEKLY EARNINGS FOR THE CHEMICALS SECTOR WERE HIGHER THAN MANUFACTURING AVERAGE

30%

INVESTMENT PER PERSON IN 2014 IN THE CHEMICALS SECTOR:

£22,500 FOREIGN OWNED  **£16,400 DOMESTIC OWNED**

THE CHEMICALS SECTOR SPENT £1 BILLION ON R&D IN 2016 (6.6% OF TOTAL MANUFACTURING R&D)



Source: ONS and Eurostat (2016)

A highly productive sector

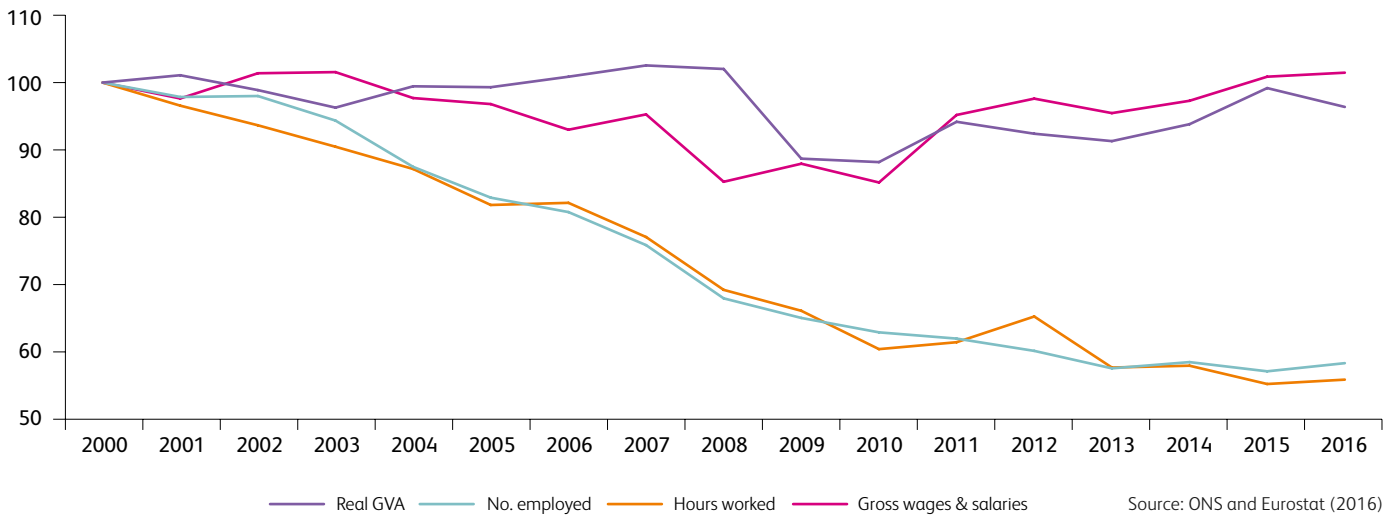
The sector’s impressive slice of R&D expenditure, given its size, has also contributed to huge gains in productivity growth over the last 20 years, as the sector keeps pace with the changing face of manufacturing.

While the sector was hit hard, like most, by the financial crash, its output has bounced back and is now broadly back to its pre-crisis level. Furthermore it has continued to negotiate the ups and downs related to exogenous factors such as fluctuating oil and

commodity prices. This relatively stable performance, combined with falling employment, has resulted in significant productivity improvements in the sector.

Chemicals GVA and labour inputs

Chemicals real GVA, numbers employed, hours worked, and gross wages and salaries (index 2000 = 100)



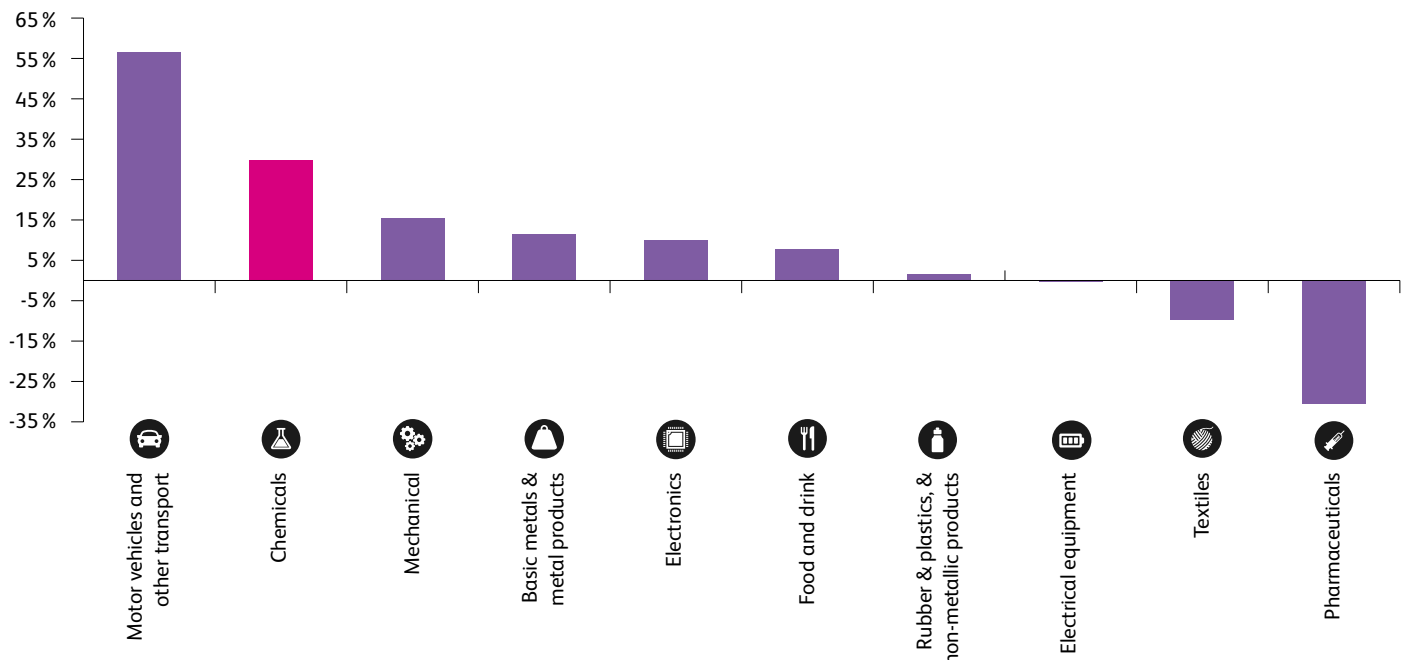
Indeed between 1996 and 2016, the chemicals sector productivity growth more than doubled (+102.2%),

outstripping growth in all other manufacturing sub sectors barring

other transport, and significantly exceeding the UK economy average.

Manufacturing productivity growth*

Output per hour growth (2009q1 – 2017q2)



*based on 4 quarters moving averages. Last observation 2017q2

Source: ONS (2017)

CHEMICALS INPUTS

The chemicals sector, as we have seen, derives the majority of its demand from other manufacturing sectors, with the chemicals sector itself its biggest customer. However, the interlinked nature of the sector is also extended to the domestic supply chain and its inputs.

The top four input products in the domestic supply chain all come from the chemicals sector, making up 53% of the sector’s supply. Top of the list are petrochemicals, representing just under a third of inputs, which is unsurprising given the hand they have in producing a spectrum of chemical products, including plastics, rubbers, pesticides and synthetic dyes. Next up

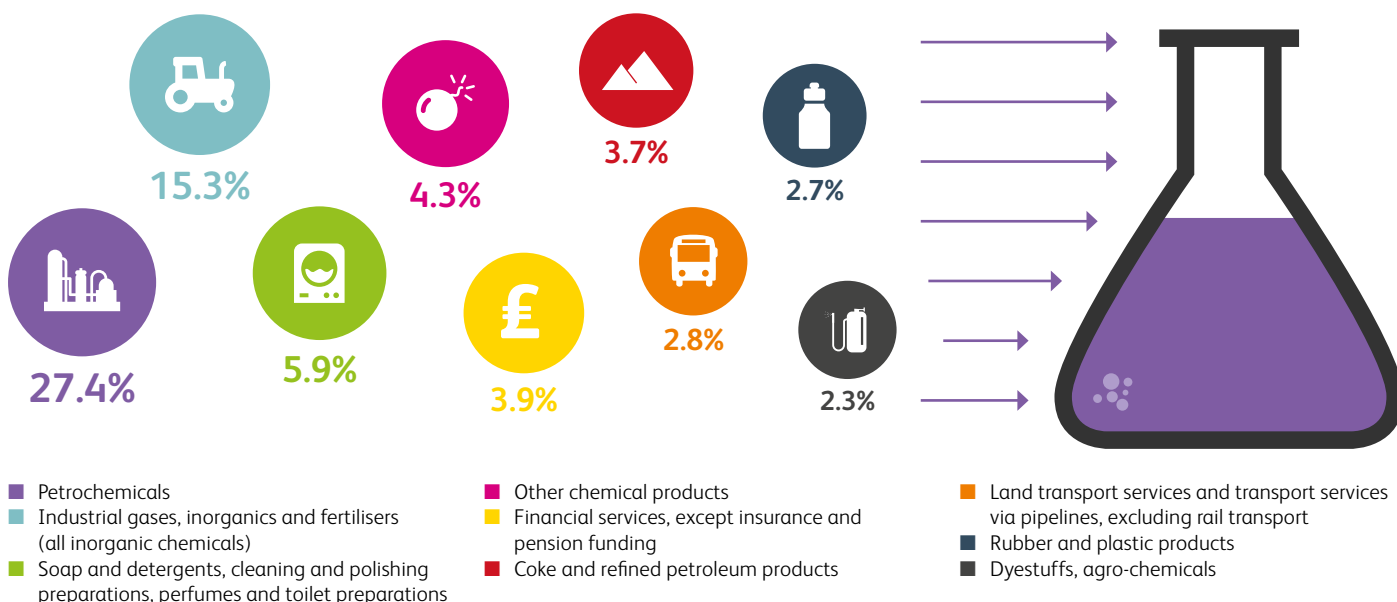
are inorganic chemicals, making up a sizeable contribution at 15%, a result of being the primary input into the production of fertilisers, a key output of the sector. The first non-chemical input comes from financial services, with a share of just 4%.

The business to business market for the UK chemicals sector is

therefore of great importance, with manufacturers constantly interacting with other manufacturers within their own sector during their production process. It also highlights the impact that a shock to one part of the sector – for instance rising oil prices for petrochemical manufacturers – can have in other parts of the supply chain and beyond.

Inputs into the chemicals sector

Top products going into the chemicals sector, % of total



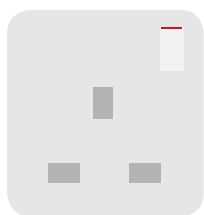
Source: ONS (2015)

Energy consumption

An important input that is not captured in the previous statistics is energy consumption. The chemicals sector, and particularly manufacturers at the source of the value chain, are highly energy intensive.

In 2015 the UK chemicals sector consumed 2.9 million tonnes of oil equivalent (TOE), the second highest energy consumer amongst manufacturers after the basic metals sector. The sector, and its profitability, is therefore heavily influenced by energy prices.

Encouragingly, despite retaining its position as one of the most highly energy intensive sectors, the chemicals sector’s energy consumption has actually fallen by around 40% since 2007, while its industrial production has remained broadly stable, illustrating a more efficient use of resources.

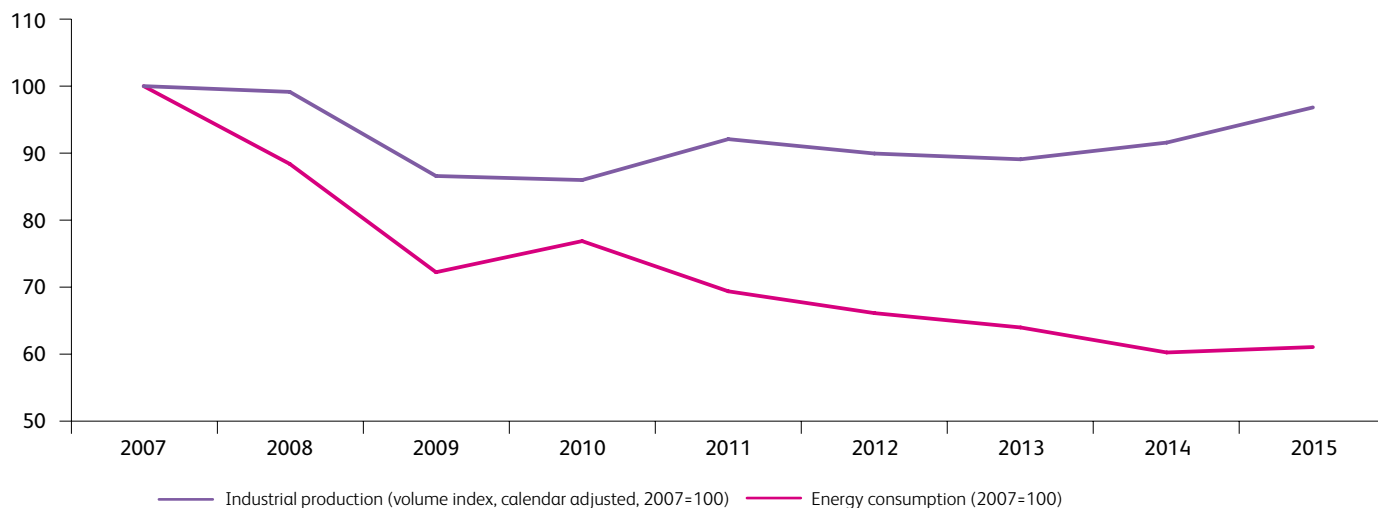


IN 2015 THE CHEMICALS SECTOR CONSUMED 2.2% OF TOTAL UK ENERGY AND 11.9% OF TOTAL MANUFACTURING ENERGY.

Source: Eurostat (2015)

Chemicals industrial production and energy consumption

Industrial production (volume index, CA) and energy consumption. (2007=100)



Source: Eurostat (2015)

TRADE

Chemicals, unlike many other manufacturing sub sectors, has historically run a trade surplus. Indeed, between 1996 and 2006, the average surplus was equal to a healthy £1.2 billion per annum. The last 10 years however, has seen a reversal of these trends, as the sector has increasingly imported goods and raw materials at a faster rate than it has managed to export. Consequentially the sector has seen its surplus eroded, and between 2007 and 2016, it ran an average deficit of £1 billion per annum.

While this is not a particularly large deficit, and in 2016 the deficit was less than this average at £745 million, it does represent a noticeable swing, with the UK becoming increasingly reliant on imported goods.

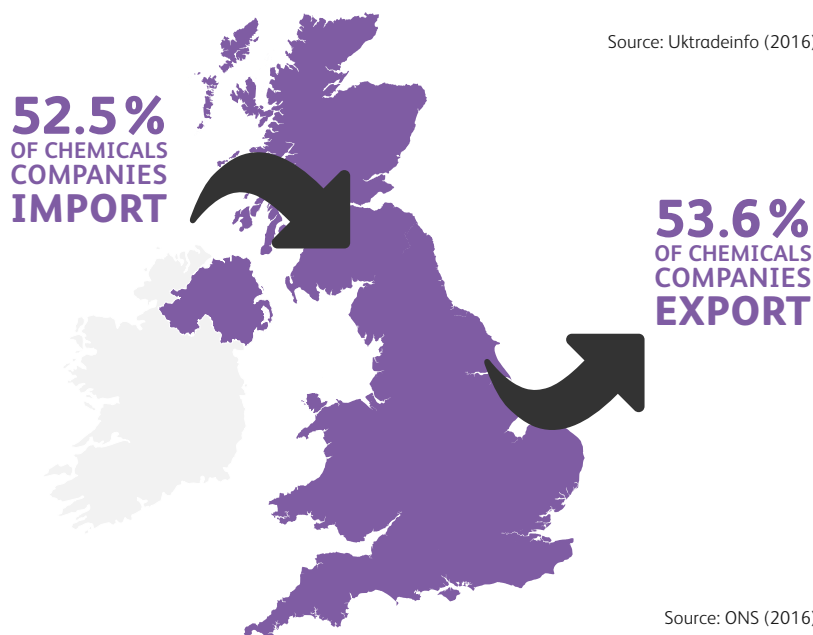
The chemicals sector runs an overall trade deficit

Chemicals trade balances by product (£ billion)



Source: Uktradeinfo (2016)

Despite this shift, the chemicals sector remains one of the most open to business, with trade essential to its makeup and performance. Indeed in 2016, chemicals had the highest proportion of exporting companies of any sector (53.6%) and the second highest proportion of importing companies (52.5%).



Source: ONS (2016)

The Rotterdam – Antwerp effect

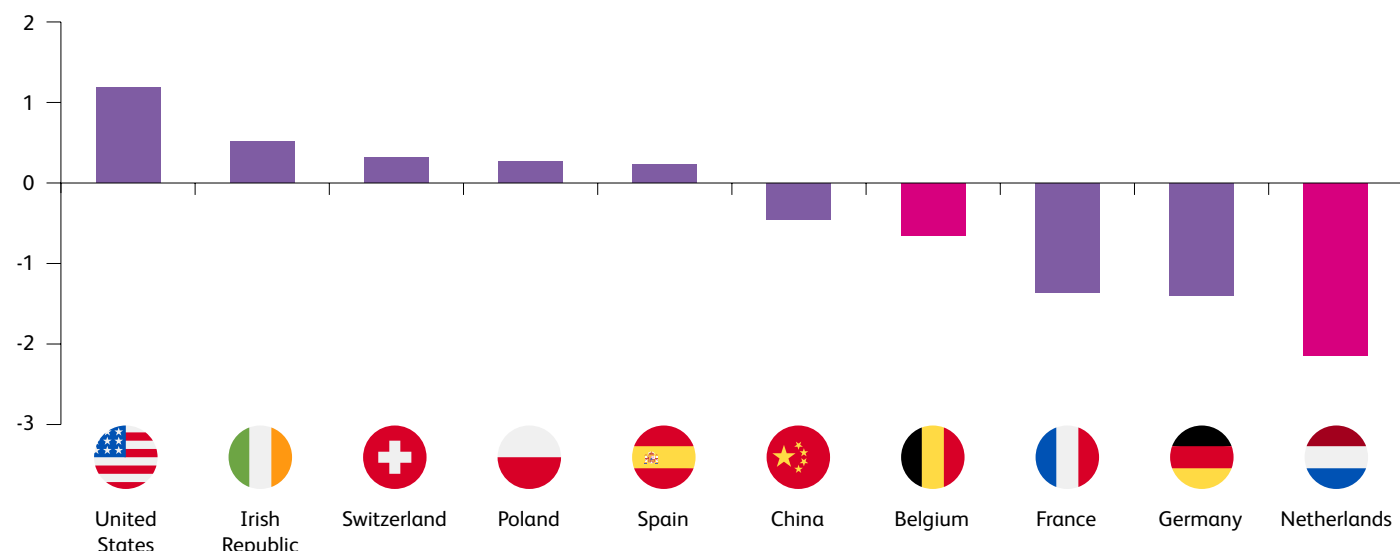
Before moving on to take a closer look at the sector’s import and export trends in more detail, it is interesting to note the large deficits

the chemicals sector records with the Netherlands and Belgium, £2.1 and £0.6 billion respectively. While these countries do have well established chemicals industries, these figures

are greater than one would expect, given the countries’ size. There is however an explanation for this: the Rotterdam – Antwerp effect.

Chemicals trade balances with our top trade partners

Trade balance, £ billion



Source: Uktradeinfo (2016)

The Rotterdam – Antwerp effect is a phenomenon which suggests that trade data for the Netherlands and Belgium is often inflated, due to the role their huge ports, in Rotterdam

and Antwerp, play within transporting goods across the EU. According to EU laws, extra-EU trade must be recorded in the country where the port of arrival/departure is located

even if this is not its final destination. It is therefore reasonable to assume that trade with these countries suffers from an element of distortion. Consider the following example:



Trade is recorded as a UK import from the Netherlands and as a Dutch export to the UK.

IMPORTS

The chemicals sector imports significantly from across the world, in what is a globally connected system. From heavy intermediate goods such as petrochemicals, to end use products like soaps and detergents that will go straight into our shops, the UK is reliant on chemicals imports in order to satisfy its demand, both from final consumers and other sectors.

In 2016, the chemicals sector imported products to the value of £25.7 billion. In terms of products, petrochemicals are the UK's greatest import by some distance at 45% or £11.5 billion, and is reflective of dwindling North Sea oil reserves, and the UK's increasing need

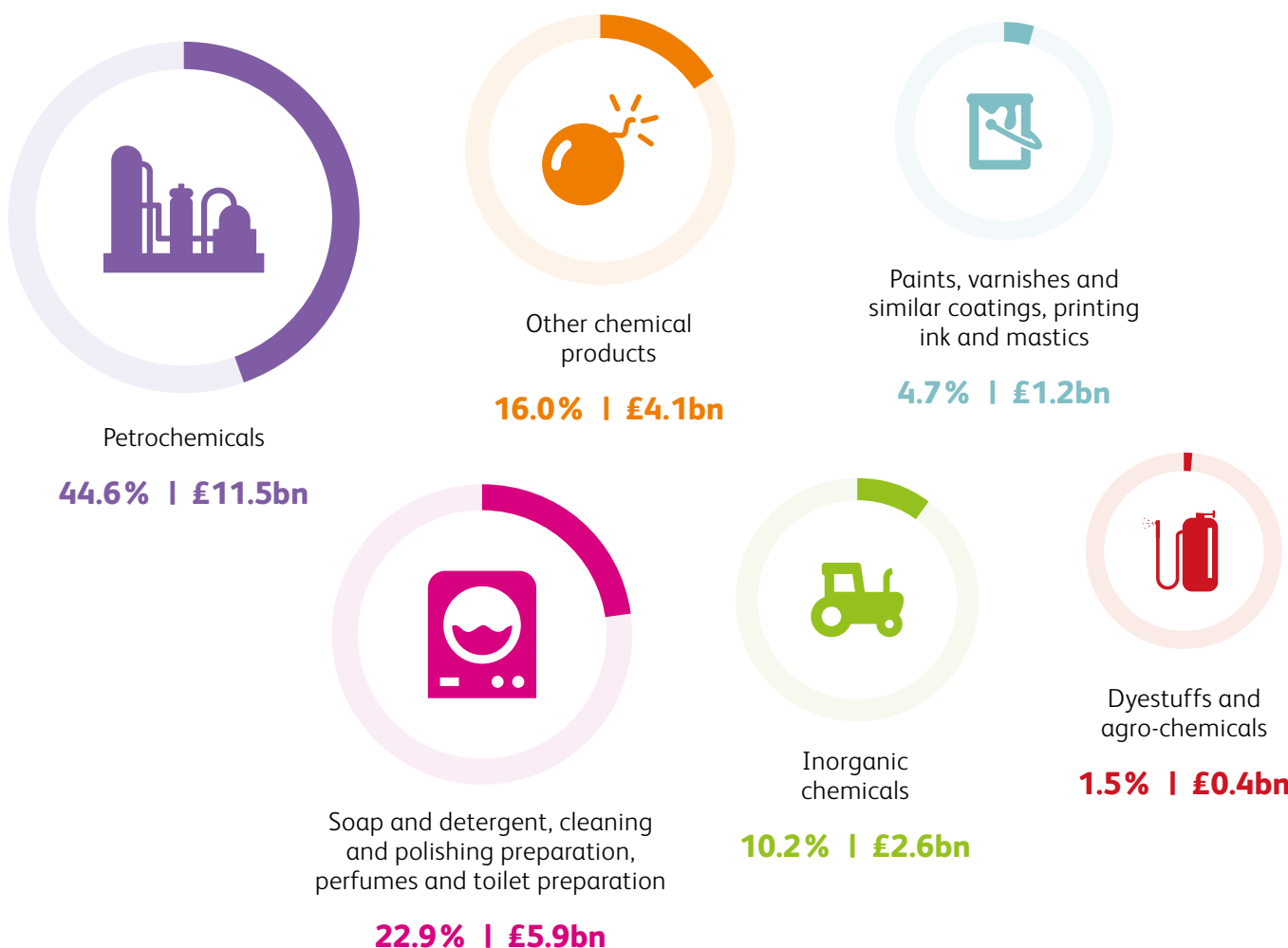
to locate alternative sources. Second is soaps and detergents, which together with petrochemicals form 67% of chemicals imports.

The EU is predictably, given its proximity and the Rotterdam –

Antwerp effect, the UK's top source for imports, with eight of the top ten import markets located in the bloc. The US and China make up the rest of the top 10, a list which is virtually unchanged when we consider exports in the next section.

Top imported products by value

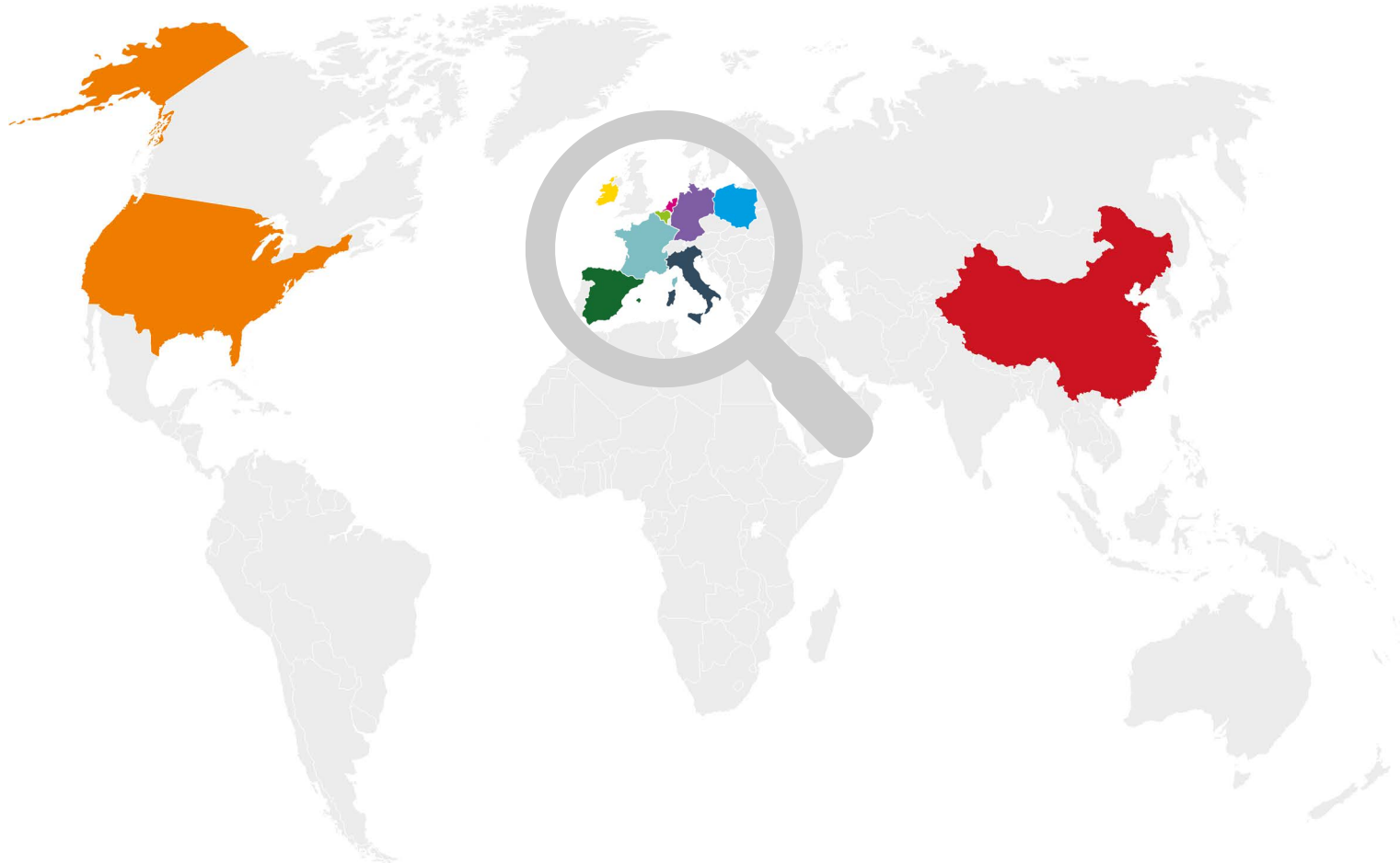
£ value and % share of total chemicals imports



Source: Uktradeinfo (2016)

Top 10 import markets

£ value and % of total chemicals imports



Germany:
17.7% | £4.6bn



Netherlands:
15.5% | £4.0bn



France:
11.9% | £3.1bn



Belgium:
10.0% | £2.6bn



United States:
8.9% | £2.3bn



Irish Republic:
4.5% | £1.2bn



China:
4.5% | £1.2bn



Italy:
3.7% | £1.0bn



Spain:
2.8% | £0.7bn



Poland:
2.1% | £0.5bn

Source: Uktradeinfo (2016)



29%
OF TOTAL SUPPLY INTO
CHEMICALS PRODUCTION
IS IMPORTED



Source: ONS (2015)

Sterling depreciation hitting manufacturers' margins

Given that the chemicals sector imports heavily from across the world, and according to the OECD has one of the highest import intensities of exports at 33%¹, the recent sterling depreciation has had a significant impact on manufacturers and

their margins. Indeed since the EU referendum and up to October 2017, imported input prices (the price manufacturers pay for their imports) have risen between 9.6% and 13.6%. This is a hefty increase and represents a challenge for manufacturers. Do they increase their output prices and risk a fall in demand, or keep output

prices stable and take the hit on margins? With output prices up 7.8% in response, it appears manufacturers, while passing on some of their costs, are wary of what significant price rises could mean for them in what is a highly competitive market. They are therefore deciding to take at least some of the brunt on their margins.

PPI prices growth since the EU referendum

% change in producer prices



*lowest and highest PPI growth for chemicals sector products

Source: ONS (2017)

¹Import intensity of exports is defined as the share of imported inputs in the overall exports of a country, and reflects the extent to which a country is a user of foreign inputs. Figure relates to 2011.

EXPORTS

Despite not being a leading exporter globally (the UK is ranked 21st in terms of chemicals exports worldwide²) and running an overall trade deficit, the chemicals sector still derives a significant portion of its final demand and value, from overseas sales. Indeed, in 2016 the sector generated £25 billion from exports, and since the turn of the century, has seen its exports grow by over 50%, illustrating that UK chemical products remain high in demand.

The US is the leading destination for chemicals exports, with 14% of total exports heading over the Atlantic. However despite this, Europe, as it was for imports, is the sector's most important market, with eight of the top ten export destinations located on the continent, seven of which are members of the EU. They together account for over 50% of

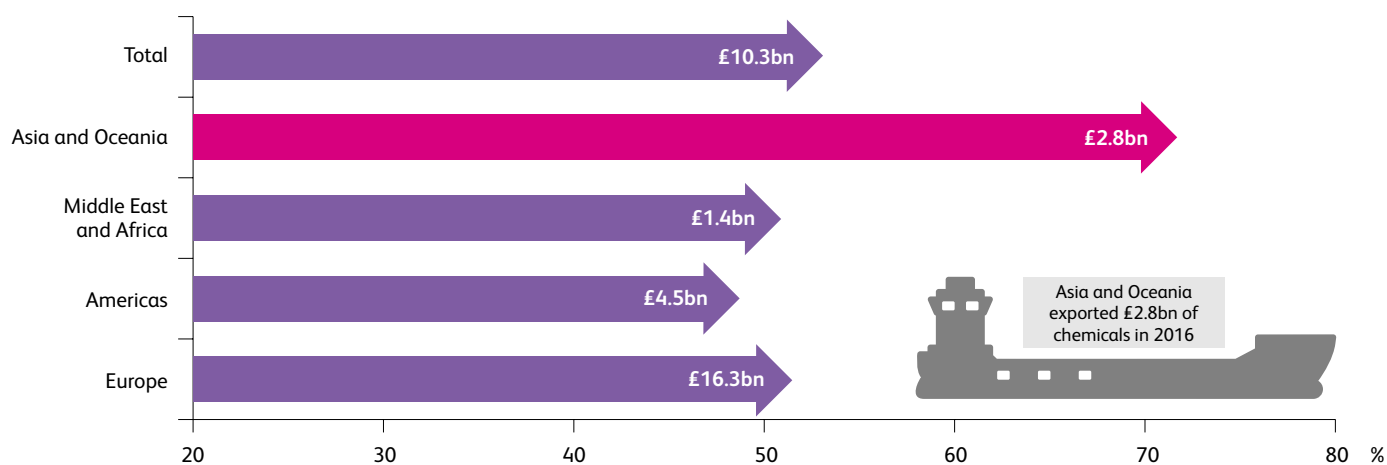
total chemicals exports. China makes up the final place in the top 10, accounting for 2.8% of total exports.

Despite its relatively low share, China is expected to grow in importance as a destination for chemicals exports, as demand in the region continues to grow at a substantial rate. In fact, despite growth being healthy across

all regions, it is Asia and Oceania which has seen the greatest growth rate in terms of exports, with demand up 71% from its level in 2000. This helped to contribute to a trade surplus in the region in 2016 and represents a growing and somewhat untapped market for the sector (see long term trends).

Chemicals export growth by continent

% growth rate 2000 – 2016, £ billion value of exports (2016)



Source: Uktradeinfo (2016)

In terms of products, petrochemicals and their derivatives, as they did for imports, make up the bulk of exports, at 42% or £10.6 billion. This dynamic may appear unusual – the UK's top import good is also its top export good. However this can be explained when considering the difference between “petrochemicals” and their “derivatives”. The UK imports large sums of petrochemicals, given the comparative advantage other

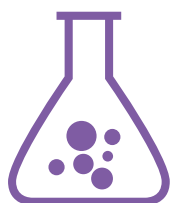
countries have in producing them due to their access to natural resources – oil and natural gas. Petrochemical manufacturers in the UK then take these petrochemicals before converting them through polymerization reactions into their derivatives i.e. plastics in their primary forms. They then export these derivative products across the world. Hence we end up with the scenario of our top import and export good being the same.

Elsewhere consumer products – soap, detergents and other cleaning products – make up a fifth of exports, while inorganic chemicals such as fertilisers, and paints and varnishes are evenly split, making up 7% each of total goods exported. Other chemical products, which include explosives and glues, make a sizeable segment, at 20% of all exports.

²UNCTAD – Merchandise trade matrix – product groups, exports in thousands of dollars, annual, 1995-2016

Top 10 export markets

£ value and % of total chemicals exports



United States:
14.0% | £3.5bn



Germany:
12.7% | £3.2bn



Belgium:
7.7% | £1.9bn



Netherlands:
7.4% | £1.8bn



France:
6.8% | £1.7bn



Irish Republic:
6.7% | £1.7bn



Spain:
3.8% | £1.0bn



Italy:
3.0% | £0.7bn



China:
2.8% | £0.7bn



Switzerland:
2.7% | £0.7bn

Source: UKtradeinfo (2016)

Top 10 high growth markets



Country	% Growth in exports (2010-2016)*
China	66.0%
Mexico	60.1%
Poland	39.2%
Irish Republic	31.4%
Denmark	26.9%
Czech Republic	25.3%
Singapore	25.2%
UAE	23.0%
Sweden	21.7%
South Africa	20.6%

*>0.5% of share of total exports

Source: UKtradeinfo (2016)

REGIONAL PERFORMANCE

The chemicals sector has a presence across all UK regions. However, there are a number of regions, which have historically been regarded as the beating heart of the industry, given their access to raw materials and energy supplies.

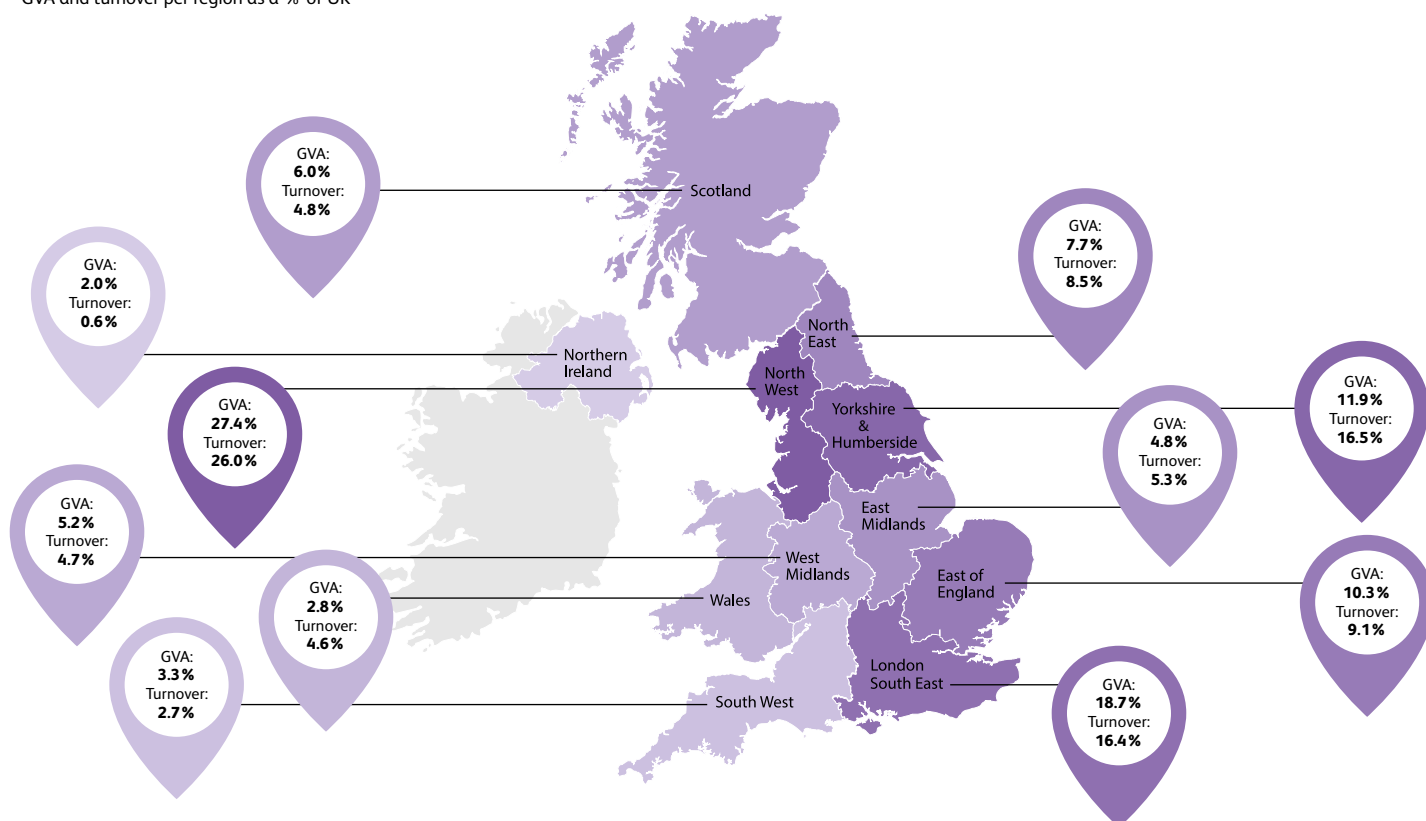
For instance in the 19th century, the chemicals sector saw huge developments in the North West, because of local salt, limestone and coal, together with navigable waters. Later on, as crude oil and its fractions grew in importance, refineries were built in coastal locations in the North East, Yorkshire and Humberside and the East of England.

Today these regions remain important clusters, given that the same range of factors that influenced locations in the 19th century are still relevant today – access to raw materials, reliable energy supplies and good communication networks. The North West however demands the lion’s share of both production and turnover – 27 % and 26 %

respectively. In recent years, London and the South East has also grown in importance, as some major chemicals companies, such as INEOS and LyondellBasell locate their headquarters and operations in the capital.

Output and turnover in chemicals across UK regions

GVA and turnover per region as a % of UK



Source: ONS (2015)

RISKS

The chemicals sector is a well-established industry, with strong fundamentals and characteristics, as we have seen. However despite this, the sector, as with all other manufacturing sectors faces a range of challenges it must overcome over the coming years, in order to cement its position as the bedrock of industry. These risks are not just Brexit related. In fact most of the risks highlighted are long term issues that have been hampering the sector for decades.



High energy costs

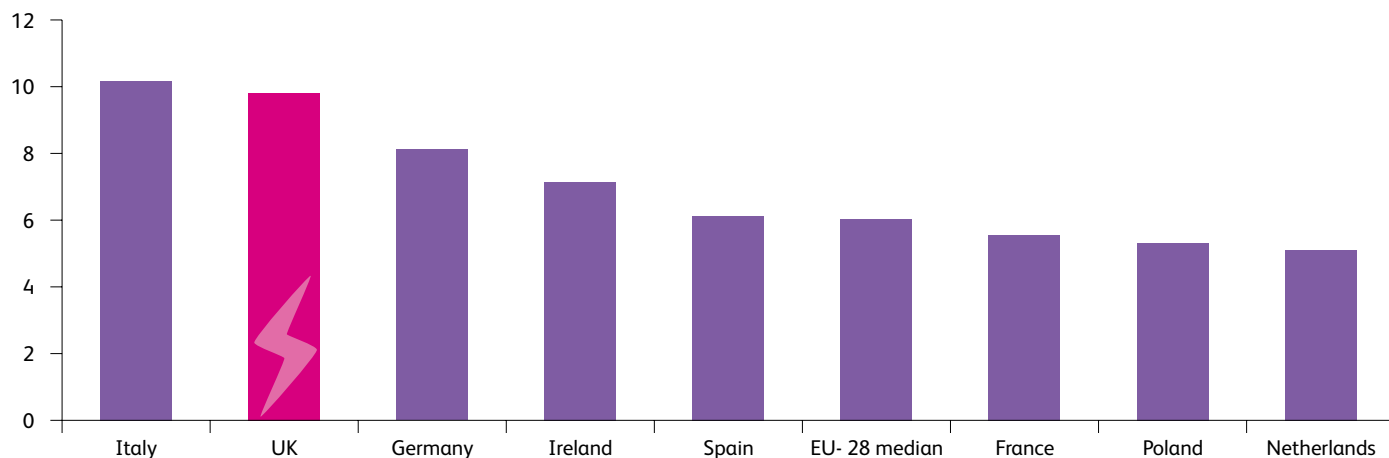
High energy prices are a concern for many sectors, but they hold particular significance for the chemicals industry. Energy forms a substantial

cost for many chemicals companies, due to the nature of their production processes, particularly those at the source of the value chain. Therefore any increases in energy prices, notably electricity and gas, hit the cost base of chemicals manufacturers, squeezing profitability in the process. This has been a continuous concern

for chemicals manufacturers in the UK, with numerous sources including Eurostat demonstrating that UK industrial electricity prices are amongst the highest against our international competitors, including Germany, France and the Netherlands, and have been rising significantly since 2013.

Electricity prices across the EU

Electricity prices for large industrial consumers (including taxes), p/kwh



Source: Eurostat/BEIS (2016)

There are numerous explanations for this, from differing climate change policies to the varying cost of transporting electricity. The fundamental problem for manufacturers is that managing energy costs are to a large extent beyond their control. Therefore other measures need to be taken to maintain their margins, through sales generation and reducing other overhead costs.



Brexit

The UK electorate's decision to leave the European Union has thrown up risks across all manufacturing sectors, and chemicals is no different. While the often cited risks of tariff impositions and reduced access to EU labour is a concern for the sector,

especially given that 31% of final demand is derived from exports, perhaps the greatest risk that has arisen is regulatory based, which itself has implications for trade.



Source: Uktradeinfo (2016)

Regulatory framework

The UK is currently part of the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) – the EU wide chemicals registration system. REACH, which came into effect in 2007, aims to protect human health and the environment from the use of chemicals, an important system given the toxic nature and volatility of some chemical products.

Retaining access to this system is a priority for chemicals manufacturers, and our members, given the increased administrative, as well as infrastructure costs that would arise by leaving it. Indeed nearly 70% of manufacturers in our recent survey said that they are either directly

or indirectly impacted by REACH regulations³.

The issue is complicated by the fact that the nature of the REACH framework, and particularly how it was written, means it will be difficult to transpose directly into UK law, for instance through a line in the Great Repeal Bill. REACH was written from the perspective of participants being within the EU, with much of the legislation also relating to member state co-operation, mutual obligations, oversight and controls, and crucially freedom of movement of products⁴. It essentially can only function under a single market system. Companies are therefore facing significant uncertainty over the

validity of current REACH registrations once the UK leaves the EU, and with that, the prospect of reduced ability to trade with the EU.

There are also further concerns, given the degree of foreign ownership in the sector, what the longer term implications for the industry could be. If little or no clarity is gained regarding future trading relations, the sector is at risk of losing some of its biggest players when the next investment cycles come around. This will have detrimental effects across the supply chain.



Oil, political tensions, price volatility, and a weak currency

A large portion of the chemicals

sector (specifically petrochemicals) is innately linked to the oil and gas sector. This throws up a number

of risks, namely price volatility and supply constraints.



1) POLITICAL TENSIONS CAN THREATEN SUPPLY:

North Sea oil is diminishing. In 2016 the sanctioned base of recoverable reserves fell by around 8% to just under 6.3 billion barrels of oil equivalent (boe), while the unsanctioned reserve base fell even further, by over 30% from 3.7 billion to 2.5 billion boe⁵. How long these reserves will last is up for debate, but with 1990 being the last year that more reserves were found than

produced, it is clear that the industry is in steady decline.

The UK is therefore becoming increasingly reliant on imports of crude oil and natural gas, either via pipelines from Europe, specifically from Russia, or the Middle East. This growing reliance represents a risk, which has been inflated in recent times by growing geo-political

tensions across the globe. The concern is that given its importance to the UK, countries could see oil as a strategic resource, and for instance, restrict supply if tensions escalate. This would have detrimental effects to the whole economy, and within the chemicals sector specifically, its ability to produce petrochemicals, currently its largest export good. Locating alternative sources is fast becoming one of the sector's top priorities.

³EEF Energy and Climate Survey (2016)

⁴Environmental Audit Committee – The Future of Chemicals Regulation after the EU Referendum (2017)

⁵Oil and Gas UK - Economic Report (2016)



2) PRICE VOLATILITY:

Fluctuations in commodity prices, primarily crude oil, impact the supply and demand economics of international markets, and can be a key driver of growth. For instance oil price volatility can reduce planning horizons, cause firms to postpone investments or even change their business model.

Chemicals manufacturing is one of the most exposed sectors to these trends, and hence most at risk. In recent years however, the collapse in oil prices has broadly been seen as a benefit to the sector, given that crude oil is major cost driver in the petrochemical industry. Petrochemical manufacturers in the chemicals

industry will therefore be closely following efforts to get the oil price back up to its pre-2015 level, given the implications it will have for their business.



3) WEAK STERLING

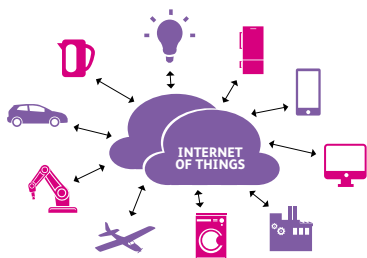
As a final remark it is also worth noting that in 2016, 94% of petroleum and petroleum products

imports were invoiced in US Dollars. It is clear therefore how a weak currency may put the sector under

pressure for commodities not replaceable with other goods.

OPPORTUNITIES

Despite the risks highlighted, the chemicals sector's importance, not just to the final consumer but also to a host of other manufacturing sectors, protects it from significant demand fluctuations and ultimate decline. Consequentially manufacturers in the sector are well positioned to take advantage of a number of opportunities on the horizon, in order to grow their output, as well as crucially improve their production processes.



Digitalisation

As with all other manufacturing sectors, 4IR technologies, the Internet of Things, and Artificial Intelligence are all growing in importance and influence. However the term “data

are the oil of the future” is perhaps most relevant for the chemicals sector. According to a 2016 PWC report, digitalisation in the industry has the scope to reduce costs by up to 3.9% within 5 years, with further improvements beyond. The big opportunities lie in optimisation but also better security and importantly smart manufacturing. Smart manufacturing, for instance the introduction of closed loop sensors, have the ability to improve logistics,

reduce waste and avoid delays. This is crucial for the chemicals sector, given its highly complex and interlinked structure, across the value chain.

Digitalisation also offers manufacturers the chance to mitigate rising energy prices, a key risk we highlighted beforehand. Big data analysis can be used to quantify large sums of data instantly, allowing manufacturers to “buy” energy at the most cost effective moment.

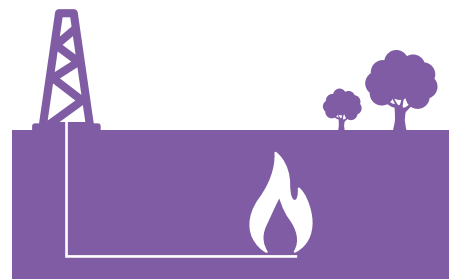
Shale gas

The recent development of the shale gas market has revolutionised world commodity markets over the last few years, with the US in particular benefiting from a “shale boom”.

In the UK, shale gas, and specifically the process of fracking, has been the source of much debate over the last five years. While the extraction of shale gas can have positives in terms of job creation, cost reduction

and crucially reduced dependency on Russian gas, there are strong arguments against. Specifically the environmental damage that can occur from fracking, which has resulted in a significant NIMBYism culture around the few shale gas basins in the UK with strong extraction potential. What's more political parties are split on the issue.

However, recent government action to overturn local council objections



to a fracking scheme in Lancashire, could pave the way for more schemes of a similar nature, and is a debate which is growing in momentum.



Environmental Policies

New regulations are rarely seen as good news for businesses. However the push toward environmentally friendly policies can represent an opportunity for chemicals manufacturers, over the longer term.

As underlined in the next section, the demand for low-impact products and production processes is growing, and governments are increasingly introducing new regulations to this effect. This may mean higher costs in the short term for manufacturers, but it may also result in manufacturers pushing to achieve greater efficiency and productivity, key drivers for prosperity in the

long-run. Opportunities also lie in the development of new bio products, with more environmentally conscious customers increasingly demanding that their products do not impact on the environment. A clear example is the proposed ban on diesel cars which may result in a push not only towards electric cars but also towards low-impact fuels.

LONG TERM TRENDS

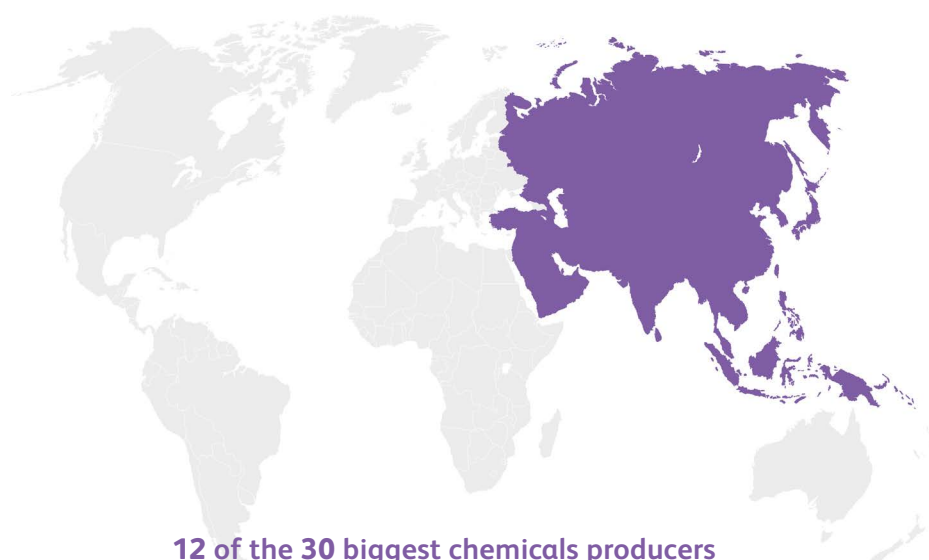
In order to maintain its position as a key manufacturing sector, in what is an ever evolving industry, chemicals manufacturers must grasp and get ahead of the curve of a number of long term trends.



Emerging markets

Long term growth in the chemicals industry, as is the trend throughout manufacturing, hinges on the sector's ability to harness the opportunities that emerging markets represent.

The globalisation of the industry has occurred at a rapid pace, as more and more manufacturing activities shift to the Far East. While this can represent a risk to some incumbent UK chemicals manufacturers, the opportunities on offer are great. Chief among these come from the current technology gap in these regions' chemicals industries, which is hampering their performance and growth. For instance many Chinese firms do not invest significantly in



12 of the 30 biggest chemicals producers are Asian, generating 56.6% of the world market⁶

R&D and rely primarily on imported technology. As a result, the Chinese government is actively encouraging joint ventures with foreign enterprises. The UK, as a historic player in the chemicals industry, as well as one who invests significantly in R&D, could find its technology and know-how in high demand.

Furthermore, growing demand in these regions, as more and more of chemicals' end use markets such as automotive relocate there, as well as an expanding middle class, represent a relatively untapped demand base, if UK chemicals manufacturers can position themselves to take advantage.



Green Chemistry

Green chemistry is an area of research that has steadily grown in prominence over the last 20 years, as manufacturers increasingly look to satisfy stricter legislation and more environmentally conscious consumers.

The term broadly describes the efforts of the chemicals industry to reduce the negative impact that chemicals manufacturing has on the environment through emissions and waste, by developing alternative products and processes. One of the most influential trends has been the move to bio-based feedstocks.

For instance, the majority of solvents have historically been derived from

petroleum. In recent years however the element D-limonene has seen its uptake increase as manufacturers look to move towards "greener inputs". D-limonene is the main component of oil extracted from citrus fruit rinds, a biomass feedstock, and can be used as a suitable alternative to a range of petrochemically-derived solvents. The advantages of D-limonene are that it is non-mutagenic and readily biodegradable. It is also of lower

⁶Cefic European Facts & Figures (2016)

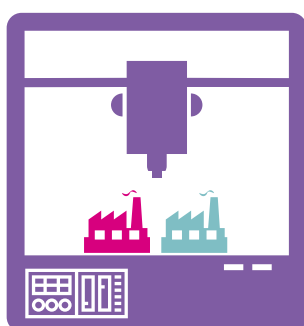
toxicity than its petrochemically-derived alternatives and as such is a much safer, environmentally friendly chemical.

It is not just the reduced environmental impacts that are encouraging manufacturers to improve their processes however. In many instances, changes which

reduce the environmental impact of a process also lead to an increase in the profitability of the process. For example, if a new catalyst is developed that reduces the operating temperature and pressure for the manufacturing process, less energy is consumed which is good both for the environment and for the manufacturer.



The global market for green chemicals is on track to grow from \$11bn in 2015 to \$100bn in 2020⁷



3D printers

3D printing is becoming a crucial technology in manufacturing, and the chemicals sector is no different. Several chemicals players are already investing together with 3D printing manufacturers to develop chemical products suitable for this technology.

Producing polymers, resins or powders able to satisfy client's needs and to run efficiently in a 3D printer can be a great source of revenues for chemicals companies, and provide a game changing boost for innovative manufacturers in terms of efficiency, cost saving and on customised production.

ABOUT OUR SECTOR BULLETINS

Our sector bulletins give an insight into individual manufacturing sub-sectors. They offer commentary and data on how the sector breaks down, its geographic spread across the UK, as well as their outlook with regards to the UK and global economy. They provide an easy to read, and informative document, which should help to build understanding of specific sectors and how they connect to the rest of the economy.

If there is anything else you would like to see in our next bulletin, please email your suggestions and comments to enquiries@makeuk.org

You can also follow us online:

makeuk.org

⁷Making the Business & Economic Case for Safer Chemistry (Report for the American Sustainable Business Council and Green Chemistry & Commerce Council – 2015)



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