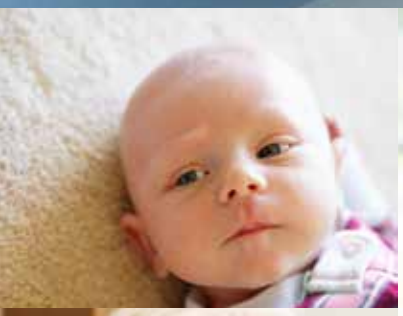
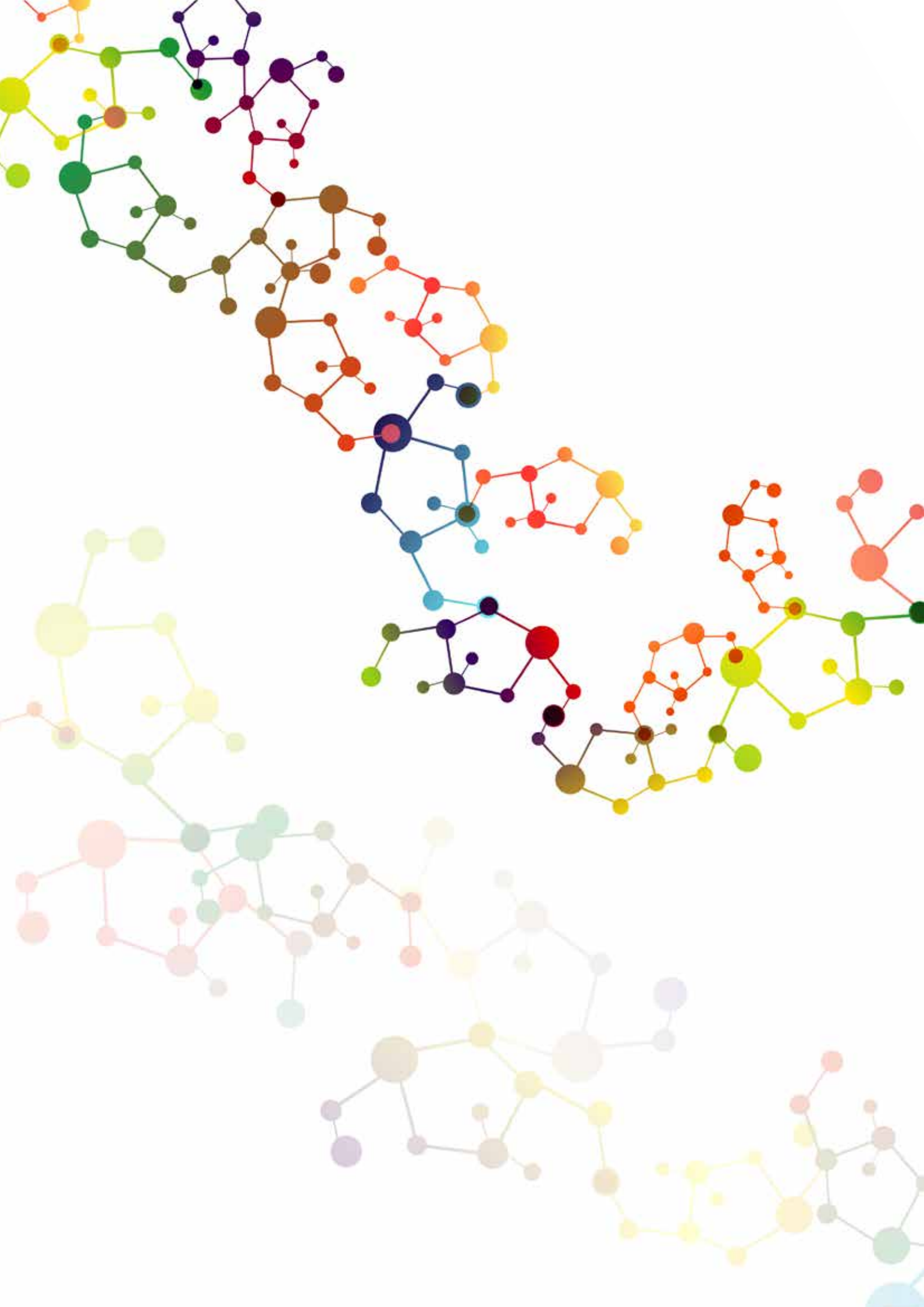
CHEMISTRY COUNCIL

SUSTAINABLE INNOVATION FOR A BETTER WORLD



Our Strategy for delivering chemistry-fuelled growth of the UK economy



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Government

The chemicals sector is a vital part of the UK economy and an enabler of a sustainable future for all. Contributing £17.8bn in GVA in 2016 and directly employing 140,000, it is one of the largest manufacturing sectors with a turnover of £48.7bn (2016). It is an innovative, vibrant and competitive sector in which chemistry is harnessed to create the molecules, materials and feedstock that enable multiple sectors, including automotive, aerospace and medicines; for that reason, it earns the enviable title as the "industry for industries".

At this challenging yet opportune time, the chemicals sector is particularly well placed to support the innovation that underpins our ambitious plans to make the UK fit for the future as part of our Industrial Strategy.

The Chemistry Council plays a very important role in the relationship between industry and Government. Through this collaborative, industry-led group we can engage directly with industry leaders as they work to shape future direction for the sector, maximising its competitiveness and ensuring it is able to contribute to the delivery of an economy that works for all.

The Chemistry Council strategy for the chemicals sector closely aligns with the goals of our Industrial Strategy. The industry's strong presence in the North East, the North West, Yorkshire and Humber and central Scotland as well as across the UK provides vital jobs to the local economy, and the high-skill, high-value jobs created offer great opportunities for and investment in our people. This closely reflects our vision of the UK's future as laid out through the five pillars of our Industrial Strategy.

2018 sees a refresh of the strategy which has been developed by the industrial partners of the Chemistry Council and is very much part of its vision. It places its historic foundations of science and innovation at the very heart of its future and seeks to address the greatest societal trends impacting the industry and our country. These mirror and support the Grand Challenges within the Industrial Strategy.

As the Chemistry Council co-chair, I am keen to see our continued partnership with the industry grow further still, and I am confident that together we can work to ensure greater confidence for investment, growth and future business opportunities.

Richard Harrington MP
Minister for Business and Industry
Chemistry Council (Government) Co-chair

Industry

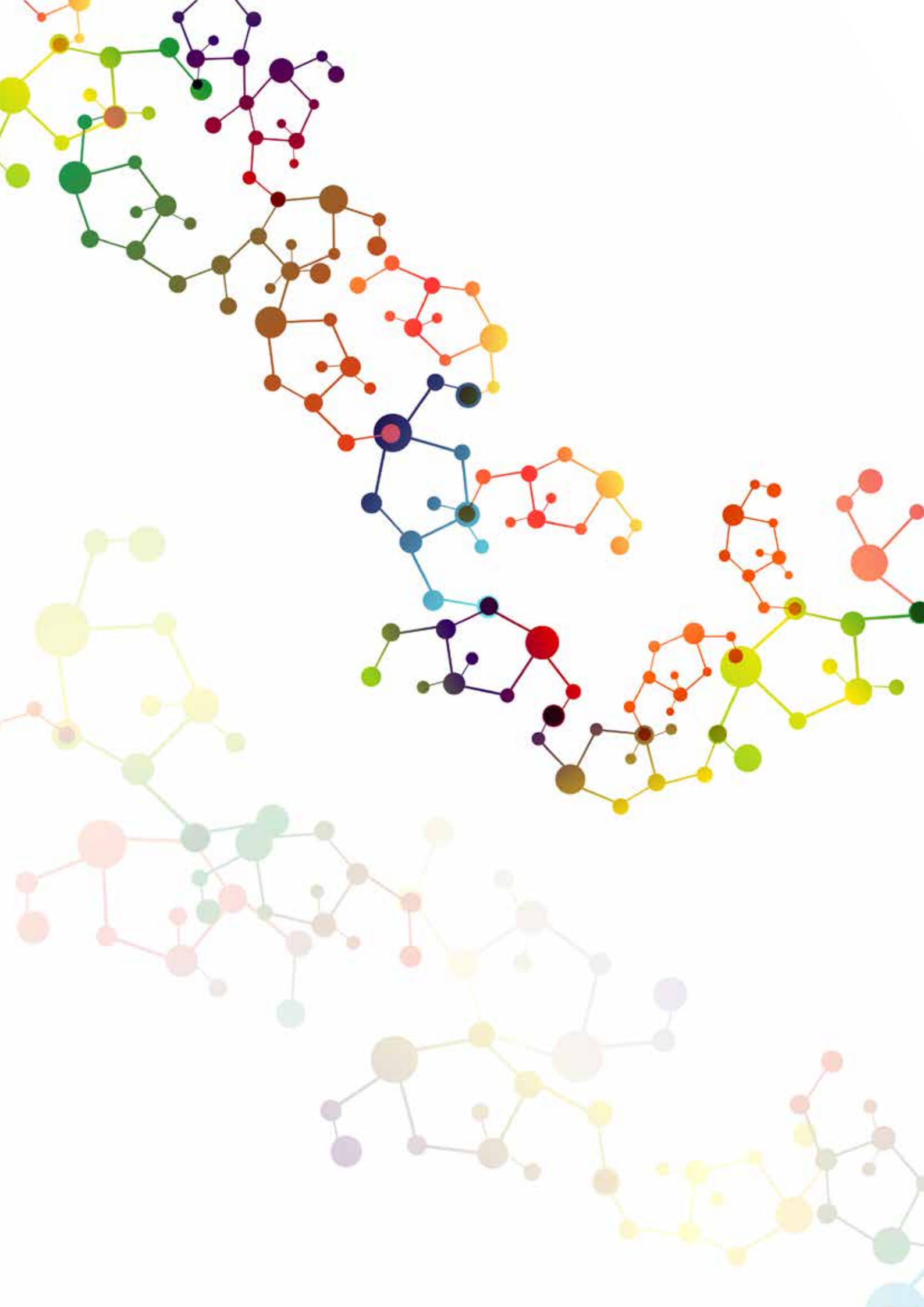
The chemical industry represents one of the largest and most diverse industry sectors in the UK. Companies in the sector, big and small, play a leading role in all stages of the supply chain. This is done by utilising a myriad of technologies and supplying a diverse range of mission critical materials and innovative products for industrial and consumer needs. The sector plays an important role in linking critical parts of the supply chain. From energy and feedstocks, to advanced materials, fine chemicals, life sciences and consumer products. It is the 'industry for industries', being both its own biggest customer and a provider of materials and technologies to other important sectors such as aerospace, automotive and construction. As such, delivery of our strategy is critical to the delivery of the UK's industrial strategy.

The strategy places at its heart an emphasis on developing more of a 'create and make' culture in the UK. The UK is an ideal location on the global stage to 'create' world class innovation and 'make' the next generation disruptive technologies. Our aim is to meet the unmet future needs of our customers. We will do this by capitalising on the rich knowledge in our skill base coupled with a thriving entrepreneurial spirit in our member companies and academic institutions.

The creation of the United Nations Sustainable Development Goals (SDGs) and the global commitment to tackle climate change through the Paris Agreement give us a terrific opportunity to transform our industry. We, as an industry, have an important role in ensuring we make the materials of the future in a more sustainable way. This will include having a greater emphasis on the sourcing of renewable raw materials, ensuring the products we make are free from pollutants and innovating to reduce the carbon footprint of our processes. Moreover, we have a growing responsibility to society at large to reduce the environmental burden of our activities on our local communities. Reducing carbon dioxide emissions, water usage and waste are just some of the things we will focus on. The successful companies of the future will be those that can deliver strong and consistent financial performance whilst at the same time reducing the environmental burden of our actions on the world at large.

It is crucial therefore, that we work closely with Government to respond to these environmental challenges with a creative mindset, speed, but above all else, with a great sense of purpose. This strategy places a strong emphasis on investing in a sustainable future. We will work closely with government and we look forward to delivering chemistry-enabled growth for the UK through a more vibrant innovation and manufacturing base.

Steve Foots
CEO Croda International
Chemistry Council (Industry) Co-chair



The Chemistry Growth Partnership (CGP) was established in 2013 as a Government/industry partnership. It published its first strategy in 2013[1] and since then it has made progress in a number of areas:

Accelerating innovation: formulations for the future

Formulation is a key capability in designing effective products – in particular for health and well-being applications. The CGP identified that cementing and enhancing world-class UK expertise in formulated products was key to delivering the innovation growth identified in the strategy. The business case for a National Formulation Centre was established, with commitment from a number of multi-national companies and SMEs complementing £28million of funding from the UK Government.

The National Formulation Centre, based in Darlington, was set up by the Centre for Process Innovation (CPI) and opened in March 2018. It is part of the UK's Catapult network and provides critical infrastructure and facilities to support scale up and commercialisation of formulations to a range of industries.

Building supply chains: boosting UK exports

The CGP, with the support of the Department for Business, Energy and Industrial Strategy (BEIS), Department for International Trade (DIT), and the Chemical Industries Association (CIA), has led major UK trade missions to the USA and continental Europe, helping to build and strengthen commercial links between UK suppliers and major global pharmaceutical and agrochemical customers. In addition, the North East of England Process Industry Cluster (NEPIC) and DIT have jointly carried out 10 trade missions to India.

Securing cost-competitive energy supply

Through the CGP, Government and industry have worked together to help deliver improved energy costs for energy intensive industries (EII). This was delivered through a £7bn EII compensation package (announced in the Budget 2013), its conversion to an exemption (announced in the Autumn Statement 2015) and subsequently implemented from 2017.

Supporting clean growth: developing low carbon systems

The CGP worked across Government to develop a Decarbonisation and Energy Efficiency Roadmap Action Plan for the chemicals sector, published on 3 October 2017[2]. The plan is supported by an Innovation Study, produced by the Society of Chemical Industry (SCI) for the CGP in 2017[3].

The CGP is also providing support for the Clean Growth Strategy and the emerging Bioeconomy Strategy.

Building engagement

Throughout this process, the CGP has evolved. As part of this strategy, new Working Groups focused on Innovation, Supply Chains, and the Regions have been established to ensure broader engagement of the business community and relevant stakeholders.

A strong platform for a refreshed strategy

In 2018 the CGP, now renamed the Chemistry Council, revised its strategy designed to deliver its vision to build a better world through being at the forefront of commercialising sustainable chemistry innovations.

Ineos: *"The bulk of our investment has been in the renaissance of the Grangemouth site putting it among the leading integrated petrochemical complexes in Europe."*

Synthomer: *"We have invested in a new R&D facility based in Harlow UK; two new pilot plants supporting product development in our Speciality Chemicals portfolio and additional investment in our manufacturing capability to deliver additional capacity in our Styrene / Acrylic water based Polymer business."*

1 CGP, Strategy for Delivering Chemistry-fuelled Growth for the UK Economy (2013)

2 Chemicals Sector, Industrial Decarbonisation and Energy Efficiency Roadmap Action Plan (2017)

3 CGP/SCI, Developing a Low Carbon Future for the Chemical Industry (2017)

The Chemistry Council is a joint Government/industry forum, enabling discussion on how best to deliver long term growth for the sector based on this strategy. The Council represents the chemicals sector – one of the UK's largest and most diverse industry sectors, ranging from basic and specialty chemicals for industrial use to consumer chemicals including personal care and pharmaceuticals[4]. Companies in the sector are active across all stages of the supply chain, using multiple technologies and supplying a diverse range of essential materials and innovative products for industrial and consumer needs.

Businesses within the sector generate £17.8bn Gross Value Added, with a turnover of £48.7bn[5]. They provide direct and indirect employment for around 400,000 people in many different regions of the UK and invest significantly in science and engineering research and development.

The sector is unique, linking critical parts of the supply chain – from energy and feedstocks (raw materials), to advanced materials, fine chemicals, life sciences and consumer products. It is the 'industry for industries', being both its own biggest customer and a provider of materials and technologies to other important sectors such as aerospace, automotive and construction.

The Chemistry Council vision and strategy

The Chemistry Council Vision is to build a better world through being at the forefront of commercialising sustainable chemistry innovations. This is building on the vision laid out in the 2013 Strategy.

We will deliver this vision through accelerating innovation and the commercialisation of sustainable, chemistry-led solutions that drive economic growth and deliver benefits for society.

Our strategy comprises three workstreams:

- **INNOVATION** – Accelerating innovation and the commercialisation of sustainable, chemistry-led solutions in the UK
- **SUPPLY CHAINS** – Creating new, innovative supply chains
- **REGIONS & INFRASTRUCTURE** – Accelerating the pace of regional growth

These workstreams will be supported by key enablers that will:

- Secure competitive Energy and deliver Climate Change Solutions
- Ensure the right Skills and Knowledge are in place to deliver growth
- Encourage appropriate Regulation to support innovation
- Deliver a Fiscal Environment and supporting incentives to boost a "create and make" climate in the UK

Supporting the UK Industrial Strategy

The Chemistry Council strategy is a critical part of the UK Industrial Strategy, it supports delivery of the four Grand Challenges and enables other sector strategies. It underpins many cross-cutting Government strategies, such as the Clean Growth Strategy, the 25-Year Environment Plan and the development of a vibrant Northern Powerhouse.

Industry Government Partnership

Our strategy sets out a compelling case for action from both industry and Government to secure and build upon the UK's competitive advantage in the global market to deliver growth.

The strategy sets ambitious goals which will not be achieved through a 'business-as-usual' attitude. Significant changes will have to take place to deliver growth and to commercialise substantial step-change technologies in the UK. We will be using the strategy as the basis for the development of a proposal for a sector deal. Our proposal will provide further details on these programmes and the projects within them.

4 Divisions 20 50 21 of the Standard Industrial Classification: basic chemicals, agrochemicals, paints and coatings, soaps and detergents and cleaning preparations, toiletries and cosmetics, speciality chemicals for industrial use and pharmaceuticals

5 ONS Annual Business Survey (ABS) 2016 published Nov 2017

For the Chemistry Council to deliver its strategy and achieve its goals, a series of priorities have been selected by a number of dedicated working groups focused on our key themes and enablers. These are:

Innovation priorities

1. Accelerating the rate of innovation and supporting the commercialisation of innovation in the UK through four innovation themes and 12 underpinning programmes, supporting the four UK Grand Challenges (Clean Growth; Materials for Mobility; Ageing population; and AI and Big Data) within Government's Industrial Strategy: These four themes are:
   - Delivering Advanced Materials and Molecules
   - Creating a pipeline of Green Supply Chains
   - Facilitating new Energy Storage and Distribution
   - Increasing productivity through Digitisation and Big Data
2. Supporting measures to underpin the innovation themes and programmes will be:
   - Securing significant funding and industry/Government partnership in order to facilitate collaboration between companies and academia to work together to develop and implement large-scale innovation programmes with supporting critical technology and skills.
   - Providing incentives to support investment in large scale R&D facilities in the UK by multinationals supporting the Government's target of 3% of GDP spend on R&D in line with other countries.
   - Providing fiscal structures to support SMEs to grow to full scale manufacture in the UK. The current facilitators such as capital allowances and the patent box should be strengthened to ensure that they are competitive with other countries. Structures such as flow-through shares have proven to be successful in other countries and should be considered.
   - Ensuring existing institutions are strengthened and well connected.

Supply Chain priorities

3. Supporting Clean Growth by rebuilding cost competitive and carbon efficient supply chains.
4. Ensuring strategic raw materials are identified and are in place to support inward investment in the UK.
5. Developing strong links to the key downstream sectors of automotive, aerospace and construction, and ensuring they have access to a pipeline of new materials to support delivery of their sector strategies.
6. Working with automotive and battery stakeholders in the supply chain to specify and deliver innovative products, in conjunction with the Innovation Working Group.

Regional priorities:

7. Driving Regional Economic Development

Increasing competitiveness of the location for existing manufacture and new manufacture by:

(i) Supporting unconventional gas production, such as shale gas.

(ii) Introducing private wire network arrangements.

(iii) Establishing Free Ports.

Facilitating inward investment by:

(iv) Building marketing capabilities for each region.

(v) Ensuring strategic raw materials are in place, utilising new technology. *cont…*

Regional priorities cont...

8. Supporting Clean Growth

Supporting Clean Growth by:

(vi) Establishing regional Carbon Capture, Storage and Utilisation facilities.

(vii) Establishing regional Recycling Hubs for polymers and other materials.

(viii) Supporting the development of local Hydrogen Economies.

(ix) Supporting regional Industrial Symbiosis programmes.

(x) Providing business parks for SMEs to grow.

(xi) Supporting new technology deployment with accelerator/demonstration facilities.

Energy and climate change priorities

9. Providing solutions for the UK to have the lowest energy costs in Europe.
10. Supporting appropriate policies to enable safe exploitation of unconventional gas – including a Shale Environmental Regulator – and enable the industry to undertake programmes and achieve proven flows to the grid by 2020.
11. Ensuring free and fair access to the EU's internal energy market (IEM) post-EU exit.
12. Ensuring that EU ETS Phase 4 provisions minimise production and investment leakage. At the same time develop a low-cost UK alternative to the EU ETS and rationalise the UK climate policy mix post-EU exit.
13. Implementing the actions in the Chemical Industry Decarbonisation and Energy Efficiency Roadmap Action Plan according to the agreed timings.

Skills priorities

14. Engaging with wider society and school children in particular to promote the industry through programmes such as Children Challenging Industry and the Catalyst Science Discovery Centre. Research has shown that we need to engage with young people by Year 9 if we are to inspire them to seek careers in our sector.
15. Working with Government and other organisations, including Science Industry Partnership / Life Sciences and Industrial Sciences Trailblazer, to ensure the apprenticeship levy delivers for our sector.
16. Addressing the specific need for more professionally accredited technicians and apprentices through an employer-owned, demand-led system facilitated by the Science Industry Partnership.
17. Promoting training and qualifications that meet robust and professionally verified standards including the 'Cogent gold standard' as a brand for excellence in chemical industry skills.
18. Reinforcing and strengthening improvements in higher level graduate, masters and post-graduate level training by working closely with the Institute of Chemical Engineers and the Royal Society of Chemistry to deliver this and accredit qualifications.
19. Continuing to lobby for freedom of movement and hence access to the specialist skills the sector needs to deliver its strategy and remain globally competitive.
20. Encouraging take-up of SCI's Bright SCIdea Entrepreneurs Challenge Programme.
21. Defining our Emotional Intelligence requirements.
22. Accelerating the Apprenticeship Programmes.
23. Utilising the CATCH facilities in Yorkshire and Humber to ensure new process operators are industry ready.
24. Linking to the existing innovation infrastructure to support regional innovation.

Regulation priorities

25. Creating a regulatory climate and culture that strengthens international competitiveness and growth and drives social and environmental progress
26. Securing the appropriate balance between retaining future regulatory alignment as we exit the European Union and pursuing a more flexible regulatory approach beyond exit, to drive more effective economic, social and environmental outcomes.
27. Encouraging the adoption of an "Innovation Principle" in UK law, ensuring that the impact on innovation as a driver of jobs and growth is addressed and assessed when considering policy or regulatory decisions

Finance Priorities

28. Fiscal environment
    a. Maintaining the commitment to reduce corporation tax to 17% by 2020 and for that level to be regularly reviewed over the next decade as the impact of the country exiting the European Union becomes clearer.
    b. Maintaining the international competitiveness of allowances and wider support such as the Patent Box in terms of rate and extending the scope to a wider range of IP.
    c. Aiming to extend the more supportive capital allowance regime for plant and machinery beyond the end of 2020.
    d. Extending the current R&D capital allowance to offer a payable credit.
29. Access to finance
    a. Attracting ten large (£50-250m) and ten smaller (£10-50m) commercial-scale chemical manufacturing facilities in the next five years. At an intervention rate of 10-15%.
    b. Supporting investment in mature energy efficient technologies with longer payback and for the development, demonstration and deployment of new low carbon technologies. This starts with an effective Industrial Energy Efficiency Scheme for mature technologies.
30. Co-ordinated and Expert Support
    a. Delivering dedicated, coordinated and expert support to boost manufacturing investment in the UK and export performance around the world.

To track progress to 2030 opposite the Chemistry Council priorities, performance will be measured against a series of economic indicators, reinforced by a close connection to the United Nations Sustainable Development Goals SDGs) to help address the sector's contribution towards not only economic but also environmental and social goals.

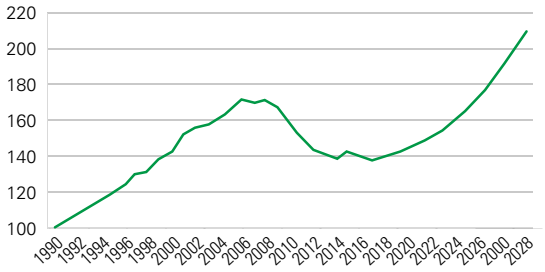
Economic Key Performance Indicators

Measuring the vision in economic performance

The Chemistry Council will measure the sector's economic performance against turnover, exports, investment and employment. Recent UK performance has been modest with production, investment and employment yet to recover pre-recession levels and a growing trade deficit as growth in imports outpaces that of exports.

While there are many positives to locating in the UK, negatives include: a reliance on imported gas; uncompetitive energy costs; a fiscal environment for investment and R&D; and a less integrated approach to attracting inward investment. There is also uncertainty around the regulatory framework for chemicals and EU market access post-Brexit.

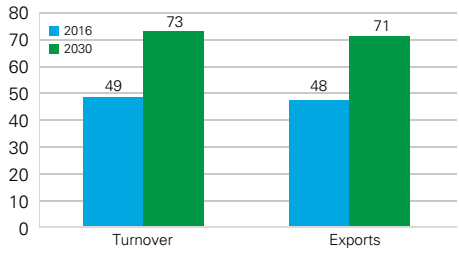
Chemistry sector* production indexes, 1990=100



** Basic and speciality chemicals for industrial use to customer chemicals including personal care and pharmaceuticals*

Chart 1

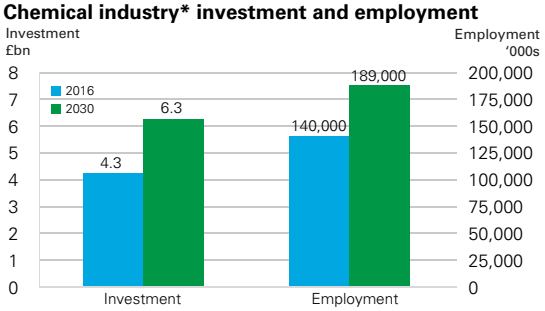
Chemical industry* turnover and exports £bn at 2016 prices



** Basic and speciality chemicals for industrial use to customer chemicals including personal care and pharmaceuticals*

Chart 2

Chemical industry* investment and employment



** Basic and speciality chemicals for industrial use to customer chemicals including personal care and pharmaceuticals*

Chart 3

Growth vision in numbers

The growth vision has been translated into KPI goals to demonstrate ambition. The KPI goals reflect the contribution of our three priority work streams: innovation, supply chains, and regions and infrastructure. They also include a contribution from the development of UK shale gas reserves.

By 2030, these drivers contribute a 50% increase in the sector's production index on 2016 levels (chart 1). By the end of this period, sector production is growing at 5% p.a. Growth of this level has only been matched once since 2000 so "business as usual" will clearly not be sufficient.

There is an equivalent increase in turnover and exports to £73bn and £71bn (chart 2). The increase assumes similar growth in the contribution to home sales as sales to overseas markets. While each of the drivers support this, we anticipate that creating new innovative supply chains priority will make a particularly strong contribution to home sales.

A boost to the capacity growth element of the sector's capital spend sees annual investment increase from £4.3bn to £6.3bn by 2030 (chart 3). As above, all drivers contribute. We expect the UK development of secure supplies of shale gas will make the UK a more investable production location as it has in the US. There is also a 35% rise in direct employment levels after allowing for the benefit to productivity from innovations and investments, including through regional growth.

These projections assume a smooth Brexit and that all the enablers for our growth priorities are addressed. These include secure and competitive energy, the right skills and knowledge, new financial structures (eg: to support "create and make" in the UK) and appropriate regulation to including the inclusion in UK law of an "Innovation Principle".

The Council looks forward to working with the Government to address these enablers as it progresses the implementation of its industrial and Clean Growth strategies and responds to the challenges from Brexit.

Sustainability 2030

The Chemistry Council strategy is focused on delivering a sustainable future for the industry, for the UK economy and for society at large. The challenges and opportunities are enormous. By 2030, the world's population will have increased by 1 billion, reaching 8.5 billion; almost two thirds of the world's population will live in cities and global growth will likely increase the demand for food by 35%, water by 40%, and energy by 50%. However, the prize is an estimated US$12 trillion market opportunity in four economic systems alone: food and agriculture; cities; energy and materials; and health and well-being.

Since 2015, the world has had a framework of goals and targets that set out how we can safeguard the environment, end poverty and deliver prosperity for everyone. These 17 Sustainable Development Goals (SDGs) are led by the United Nations but were developed by many contributors and achieving them is a responsibility for all.

Figure 15: United Nations Sustainability Development Goals

The sector has a significant direct or indirect contribution to make towards the majority of these goals, but is particularly focused on supporting the delivery of SDGs 2 (Zero hunger), 3 (Good health and well-being), 6 (Clean water and sanitation), 7 (Affordable and clean energy), 12 (Responsible consumption and production) and 13 (Climate action).

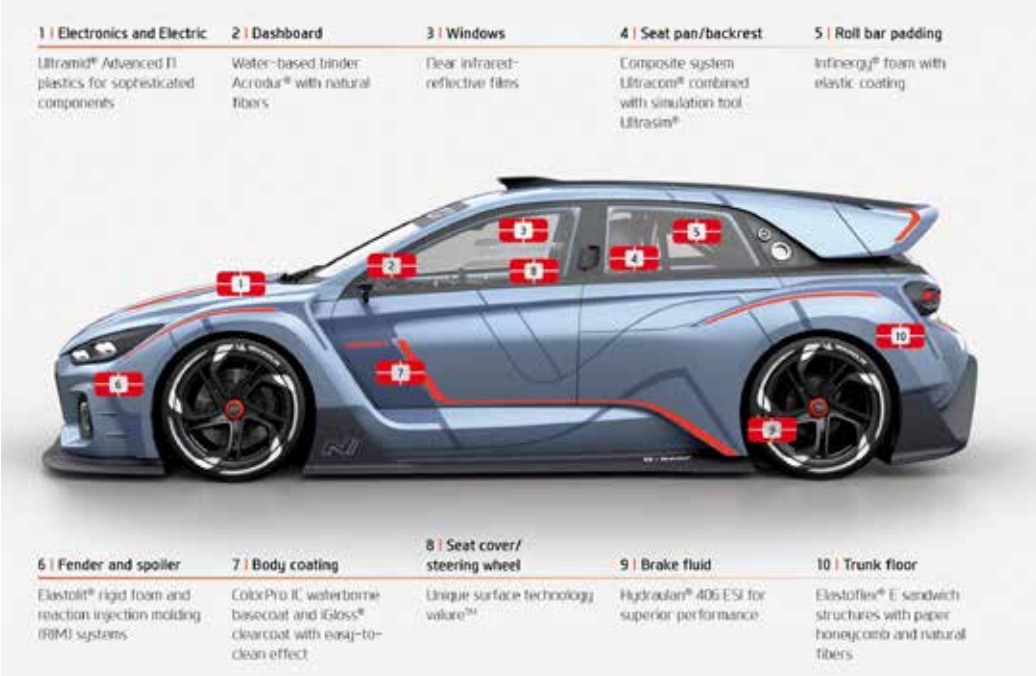
The ambitious and time-bound agenda that the SDGs represent goes beyond business as usual. Contributing to the goals and leveraging the business opportunities in a UK context will require collaboration between a critical mass of companies at industry level and Government. With this in mind, the Chemistry Council recommends that, as a first step, businesses within the sector individually map themselves opposite the six specific SDGs (and others of particular relevance) to help identify both vulnerabilities and opportunities. Looking out to 2030, the Chemistry Council will also aim to measure the UK industry's contribution towards the SDGs, linking closely to the SDG Roadmap being developed by, amongst others, the European Chemical Industry Council (CEFIC) in collaboration with the World Business Council for Sustainable Development (WBCSD).

Summary of sustainability goals

- Businesses within the sector to individually map themselves opposite the six specific SDGs (and others of particular relevance) to help identify both vulnerabilities and opportunities
- Chemistry Council to measure the UK industry's contribution towards the SDGs, linking closely to the SDG Roadmap being developed by, amongst others, the European Chemical Industry Council (CEFIC) in collaboration with the World Business Council for Sustainable Development (WBCSD)

Chemistry in our lives: automotive

Acting as one company BASF has the broadest offering to the automotive industry



BASF
We create chemistry

Chemistry in our lives: food production

With a growing world population, pressure is on the agricultural community to increase food production. Some 20 to 40 per cent of the world's potential crop production is lost annually because of weeds, pests and diseases, so chemical treatments that reduce loss and improve healthy crop yields are vital. A plentiful supply of affordable fresh produce is essential for a healthy population.

Sustainable innovation for a better world

Chemistry is a fundamental science involving the study and design of molecular structures based on the chemical elements. The manipulation of these elements into complex products, which are safely and sustainably manufactured at scale, is the core activity of the businesses represented by the Chemistry Council. These complex products are at the heart of a wealth of everyday items we take for granted today; items that have a positive impact on our world.

The sector uses synthetic and natural raw materials and transforms them into a wide range of intermediate and finished products, often via complex multi-step processes requiring a high degree of engineering and process control. Around 96% of all manufactured goods have chemical industry content[6]; and biotechnology has an increasing role to play.

Our world is changing. Global MegaTrends and the four Grand Challenges laid out in the UK's Industrial Strategy[7] demand disruptive innovation. The need to create more sustainable but increasingly demanding products and new sources of sustainable energy requires a pipeline of innovative and sustainable materials to be delivered.

Delivering new fuel sources such as hydrogen for transport vehicles, creating completely new and more sustainable energy systems, and ensuring that the health and well-being needs of the UK's and the world's population are all dependent on successful delivery of the Chemistry Council's strategic innovation programme.

The industry for industries

The sector is critical and underpins much of UK industry, linking energy and feedstocks to pharmaceuticals and consumer products. The diversity and range across the sector facilitates innovation within the sector as well as within important customer sectors for the UK such as automotive, aerospace and life sciences. Effective connectivity between sectors will create a critical advantage for the UK.

Strong, lightweight composites that make efficient wind energy and air travel possible; new materials to increase battery performance for electric vehicles; and new, competitive supply chains will facilitate the delivery of other sector strategies.

As such, the chemistry sector is the industry for industries, providing a key contribution to the successful delivery of other UK industry strategies. Focusing on supporting these sectors with new, innovative and competitive raw materials is a core part of the Chemistry Council's strategic programme on supply chains.

The importance of place

The sector has a strong regional focus, with four key clusters around the North East, North West, Yorkshire and Humber, and central Scotland. The sector is a critical part of the Northern Powerhouse.

Connecting regions to each other and to the Local Enterprise Partnerships (LEPs) is important to the delivery of the Chemistry Council strategy. A Regional Working Group has been established, driving the delivery of new technology and to facilitate connectivity with other industries and regions.

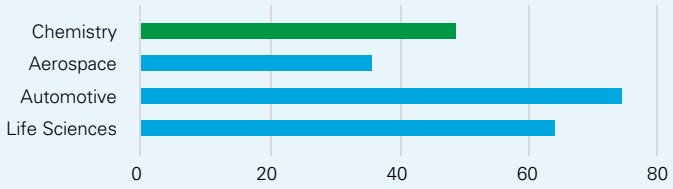
Driving the move to a hydrogen economy, building new facilities for carbon capture, storage and utilisation, facilitating integrated, low-carbon supply chains, industrial symbiosis and infrastructure improvements are all key parts of the strategy's programme to boost our regions' economic sustainability.

6 www.americanchemistry.com/Our_Industry/

7 HM Government, UK Industrial Strategy: Building a Britain fit for the future (2017)

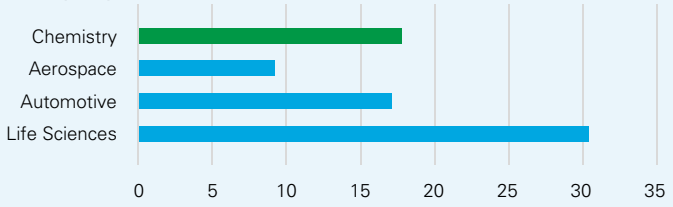
*Note: **Chemistry** data includes industrial and consumer chemicals; personal care and pharmaceuticals (SIC20 and SIC21) unless otherwise indicated*

Figure 2 : Industry turnover (£bn)



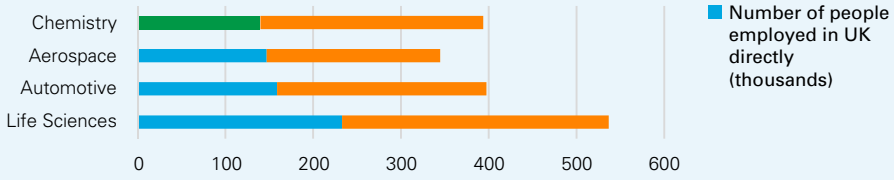
Source: Claim from Life Sciences Industrial Strategy (2017) and ONS (2016)

Figure 3 : UK GVA (£bn)



Source: The Economic Contribution of the UK Life Sciences Industry (2017) and ONS (2016)

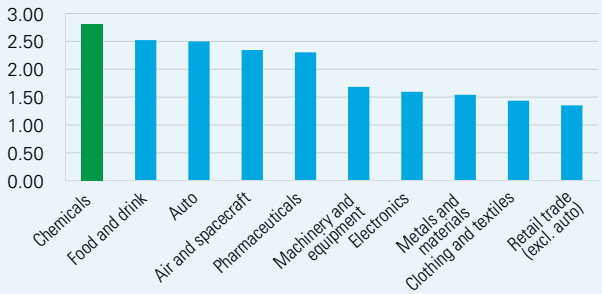
Figure 4 : Number of people employed in the UK (thousands)



Source: Claim from Life Sciences Industrial Strategy (2017) and ONS (2016)

Figure 5 : Employment multipliers, 2013

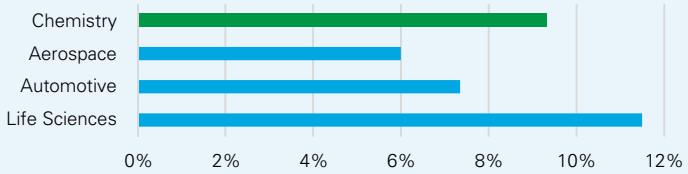
Indirect jobs = (Employment multiplier - 1.0) * Direct jobs



** Chemicals data includes chemicals and pharmaceuticals (SIC20 and SIC21) unless otherwise*

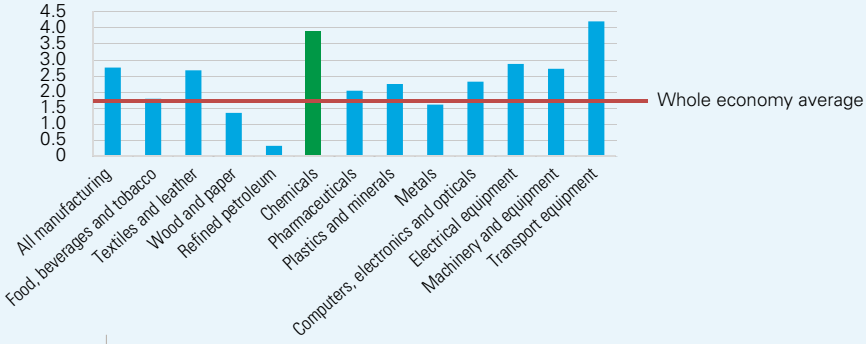
Source: ONS (2013)

Figure 6 : Exports as a % of UK goods and services



Source: Claim from Life Sciences Industrial Strategy (2017) and ONS 2016)

Figure 7 : UK Manufacturing – average annual productivity growth, 2000-2017



Source: ONS
Note: Chemical manufacturing excludes pharmaceutical manufacturing

Sustainable innovation for a better world

The chemical sector today consists of more than 1,000 companies[8] – including large global multinationals, medium sized companies, and small enterprises. Between them they span the whole supply chain, from energy and feedstocks to pharmaceuticals and consumer products.

A substantive and valuable sector

The sector is one of the major contributors to the UK economy, generating £48.7bn industry turnover and £17.8bn Gross Value Added (GVA) (figures 2&3)[9]. This is comparable to the contributions of the life sciences, automotive and aerospace sectors.

One of the largest employers in the UK

The sector is responsible for sustaining nearly 400,000 jobs (Figure 4) throughout the country[10]. For every direct job, around two more are supported in purchased services and supply chains, resulting in 140,000 people employed directly and 254,000 people employed indirectly (Figure 5).

A major manufacturing exporter

With annual exports of £50bn, and accounting for 10% of exported goods and services, chemistry companies represent the nation's top manufacturing export earners (Figure 6).

A contributor to productivity growth

The sector has shown strong productivity growth, surpassing the average productivity growth rate of UK manufacturing during the period 2000-2017. The UK's productivity in this sector for the period 2000-2014 was higher than the average of the EU, making the UK more productive than Germany, France, and Italy. It is in the country's interest to ensure that this productivity growth continues if the sector is to continue to enhance its contribution to the UK economy and compete with other global producers.

8 ONS (2017), excluding micro enterprises 1-9 employees

9 ONS (2016) and The Economic Contribution of the UK Life Sciences Industry (2017) and Strategy Documents

10 ONS (2016)

The Chemistry Council's strategic programme on innovation is led by a Working Group of 11 senior representatives from industry (multinationals and SMEs) operating at different points in the chemistry sector supply chain. Its work is supported by the Society of Chemical Industry (SCI), a society that works at the interface of academia and industry. The Innovation Working Group, led by Harry Swan, Managing Director of Thomas Swan & Co Ltd, has developed an Innovation workstream spanning four innovation themes under which sit 12 programmes.

Introduction

The Chemistry Council vision is to build a better world through being at the forefront of commercialising sustainable chemistry innovations. The strategic programme on innovation will re-energise the sector, driving step-change growth from the adoption of new technologies.

Its 12 programmes are focused on delivering innovation that is sustainable through the use of renewable products, the creation of new processes and the development of circular economies.

Four Grand Challenges

The Chemistry Council Innovation Strategy supports the UK's stated Grand Challenges[11]. These offer potential areas for future investment, which will benefit both society and the economy. The four Grand Challenges are:

Four Chemistry Council Innovation Themes

These Challenges are interlinked and innovation in one area can be facilitated by innovation in another. Consequently, the Chemistry Council Innovation Working Group has developed four innovation themes addressing one or more of the Grand Challenges:

- Advanced Materials and Molecules
- Green Supply Chains
- Energy Storage and Distribution
- Digitisation and Big Data

Within these themes the Innovation Working Group has focused on identifying programmes for which there is a clear market opportunity and societal benefit, and where the chemistry sector can have direct impact on delivering economic value to the UK.

The Innovation Working Group has consulted with multiple companies, universities and relevant societies on these sub-programmes.

11 HM Government, UK Industrial Strategy: Building a Britain Fit for the Future (2017)

Figure 8 : The Chemistry Council Innovation Working Group
Map of innovation programmes

Link to UK Industrial Strategy Grand Challenges	Innovation Themes and Programmes	
 CLEAN GROWTH  AGEING SOCIETY  AI AND DATA ECONOMY  FUTURE OF MOBILITY	***Advanced Materials and Molecules***	Sustainable Materials for Consumer Products
		Sustainable Packaging
		Advanced Materials for Health and Well-being
		Advanced Materials for Composites
		Formulation for the Future
 CLEAN GROWTH	***Green Supply Chains***	Waste to Feedstocks
		Industrial Symbiosis and Research Efficiency
 CLEAN GROWTH  FUTURE OF MOBILITY	***Energy Storage and Distribution***	Enabling the Hydrogen Economy
		Advanced Materials for Batteries
 AI AND DATA ECONOMY	***Digitisation and Big Data***	Digitisation of Supply Chains
		New Process Technologies
		Big Data in Design

Theme 1: Advanced Materials and Molecules

CLEAN GROWTH

AGEING SOCIETY

FUTURE OF MOBILITY

AI AND DATA ECONOMY

Demands on products are rising, both in terms of functionality but also environmental profile, and new advanced materials and molecules must be designed to meet societal needs. Developing a healthy pipeline of new, innovative materials that are renewable and sustainable is at the heart of the Chemistry Council Innovation Strategy.

The global market for advanced materials is substantial, estimated at US$42.8Bn (2015) and is forecast to grow at a rapid rate of 10.4% compound annual growth rate (CAGR), increasing to $102.48bn by 2024[12]. This presents a significant opportunity that relies on innovative new materials and molecules being defined, designed, manufactured and formulated into end products. Generating a strong pipeline of innovative and sustainable materials will enable new products and features to be created and delivered to a wide variety of end markets.

The Chemistry Council Innovation Working Group has identified five key programmes in this theme, which together address many of the Challenges outlined in this document:

(i) Sustainable Materials for Consumer Products

Facilitating the circular economy, this programme seeks to create materials with recyclable and/or biodegradable properties, or that are produced using sources that can be regenerated. Sustainable materials are required for a wide range of end markets, from fuels, coatings, agriculture and home and personal care. High priority markets have been identified in consumer products. Meeting increasing consumer demands for renewable but high performance products will deliver both societal and economic benefit and materials to be addressed have already been identified. New sustainable raw materials, new sustainable manufacturing routes and delivering a cradle-to-cradle approach to managing products through their lifecycle are all features of this sub-programme.

CASE STUDY: BioEO

CRODA

Innovation you can build on™

THE CHALLENGE: Providing sustainable feedstocks

THE INNOVATION: In 2017, Croda commissioned the new ECO plant at its Atlas Point manufacturing site in Delaware, USA. The ECO plant produces ethylene oxide using biologically derived ethanol, or 'bio-ethanol'. Ethylene oxide is an important raw material, as it enables the production of sustainable and bio-based lower carbon ethoxylates, which are widely used in products such as detergents, cleaners, cosmetics, agricultural products, textiles, and paints.

12 https://www.transparencymarketresearch.com/advanced-materials-market.html

(ii) Sustainable Packaging

The desire to move to sustainable packaging and the elimination of single-use plastics, in particular for consumer products, is a global trend. Ensuring robust but sustainable packaging requires new product innovations but also requires the same cradle-to-cradle approach to managing products through the cycle from raw material to waste material. This programme will be supported by the delivery of new recycling technologies, addressed in programme (vi). The UK packaging market alone is estimated to be worth £11bn.

(iii) Advanced Materials for Health & Well-being

Advancements in chemistry continue to be important in the medicinal area. In addition,this programme seeks to focus on exploiting the UK's building capability in biotechnology and biocatalysis. Opportunities to create new energy and cost-efficient pathways to existing materials is the target. The UK currently has around 225 companies in this sector, generating around £2.9 billion of revenues[13]. Currently ranked 8th globally in biotechnology[14] continuing to build the UK's capability and focusing on translating knowledge across the sectors represented within the Chemistry Council will support revenue growth.

(iv) Advanced Materials for Composites

Materials define the core functionality of a composite. Utilising new materials, such as graphene, and designing new multifunctional materials and additives for composites will support other key sectors of the UK economy such as aerospace, automotive, and construction.

(v) Formulation of the Future

Formulation is the complex science of creating the finished products, often from multiple ingredients with competing characteristics. It is a critical underpin to delivering a wide range of products such as cosmetics, food and drinks, pharmaceuticals and coatings. The market is sizeable, with the global market estimated at US$1 trillion[15].

The UK already has significant core capability in this area – both academically and industrially. Within the universities there are a number of Centres for Doctoral Training (CDTs) in Formulation. The SCI and the Royal Society of Chemistry (RSC) support the translation of the knowledge from academia into industry and significant investment has been made to address scale-up with the Materials Innovation Factory at Liverpool University and, more recently, the Chemistry Council-sponsored investment in scale-up facilities at the CPI National Formulation Centre. Recognising the infrastructure that has been built, this programme is seeking to utilise all existing infrastructure more effectively in order to accelerate the commercialisation of final products in the UK.

Collectively these programmes stretch across all end markets, from aerospace and automotive to life sciences and consumer goods. Consequently, innovation in chemistry and biotechnology across these programmes would accelerate growth in numerous sectors adding significant value to the economy.


CLEAN GROWTH


AGEING SOCIETY


FUTURE OF MOBILITY


AI AND DATA ECONOMY

13 A report by Capital Economics for BBSRC, EPSRC, Innovate UK, the Industrial Biotechnology Leadership Forum and the KTN, Biotech Britain: An assessment of the impact of industrial biotechnology and bioenergy on the United Kingdom Economy (2015)

14 Scientific American, WorldVIEW: A Global Biotechnology Perspective (2016)

15 CPI article, The Diversity and Synergies of Formulated Products (2017)

Theme 2: Green Supply Chains

CLEAN GROWTH

For the UK to address the Clean Growth Grand Challenge, innovation will be required to create greener supply chains creating a closer connectivity between different industries. Innovative approaches will reduce, reuse and recycle waste at all stages in the supply chain and new sustainable feedstocks need to replace unsustainable feedstocks. The community represented by the Chemistry Council is uniquely placed at the forefront of the move to building greener supply chains. It sits at the heart of many industrial supply chains and can deliver technologies to enable the recycling and re-use of waste streams, and consume certain recycled waste as new feedstocks, thus facilitating a cradle-to-cradle approach.

We have identified two key programmes to support the move to greener and more sustainable supply chains:

(vi) Waste to Feedstocks

There is a significant opportunity to not only create economic value from key waste streams, but also greener supply chains. Three waste streams have been identified as offering the biggest potential for value added recycle and re-use, these being plastics, steel, and precious metals. This sub-programme will seek to assess how to access the waste streams, the technologies required to recycle these waste streams and the potential for the companies to utilise the recycled materials back into valuable and sustainable raw materials.

(vii) Industrial Symbiosis and Resource Efficiency

Resource efficiency is already a strong focus for many companies with consideration for all the resources used through the manufacturing process to delivery of the end product. The Chemistry Council Innovation Working Group is seeking to accentuate this focus on resource efficiency by supporting companies to ensure resource efficiency within their own organisation and support cross-company and cross-sectoral collaboration to recycle and re-use by-products and waste streams, known as Industrial Symbiosis. This approach has been championed in the UK by Ineos, working with partners in other industrial sectors to share resources that would otherwise have been considered as waste.

Collectively these sub-programmes will lead to a reduced use of landfill and unsustainable raw materials and will give the UK manufacturing industry access to new sustainably sourced raw materials. This theme has economic, environmental and societal benefits to the UK.

CASE STUDY: Industrial Symbiosis

INEOS
THE WORD FOR CHEMICALS

THE CHALLENGE: Increasing the sustainability of supply chains by collaborating across industries to make better use of waste streams.

THE INNOVATION: Companies working collaboratively can utilise waste products and energy as new feedstocks. Ineos and the EPOS project brought together industrial partners in the sectors of steel, cement, chemicals, minerals and engineering.

Theme 3: Energy Storage and Distribution

CLEAN GROWTH

FUTURE OF MOBILITY

In order to power our homes and transport more cleanly and efficiently, innovative chemistry-led solutions will deliver the products and infrastructure to enable the move to more efficient and low-carbon energy storage and distribution systems. Innovation in chemistry underpins the Clean Growth and Future of Mobility Grand Challenges.

The global market for energy storage is forecast to grow to US$7-10bn by 2025[16] and a potentially larger market could be available if a hydrogen economy is developed. Disruptive innovation is needed if the UK is to cease the sale of petrol and diesel cars by 2040 and realise the economic and environmental opportunities from electric vehicles.

For these reasons, two key programmes have been highlighted as priorities for chemistry innovation under this theme:

(viii) Enabling the Hydrogen Economy

Using hydrogen as an energy carrier would provide a new source of low carbon energy. However, for a hydrogen economy to be developed effectively, innovative new technologies which can efficiently and inexpensively derive and process the hydrogen will be required. This programme will seek to work with the Chemistry Council Regional Working Group and other organisations involved in developing hydrogen economies to address some of the technology hurdles that will need to be addressed in order to create commercially viable hydrogen economies.

(ix) Advanced Materials for Batteries

Current battery technology is limited, so vehicles dependent on this technology do not match the performance of those powered by an internal combustion engine. Chemistry innovation is needed to develop new materials such as the core anodes and cathodes. Increased battery performance to address issues of capacity, charging speed and lifetime will ensure that a future with electric cars becomes a reality. This programme will seek to work with existing infrastructure, such as the UK Battery Industrialisation Centre, to produce the new materials needed to manufacture viable electric cars to replace current fossil fuel-based vehicles.

Demand for lithium is rising rapidly and new sources will be required to meet accelerating demand. The UK has natural lithium resources both in the ground and in the sea, as lithium is present in high concentrations in the North Sea aquifers. Technology capable of extracting lithium from seawater is not yet at commercial scale, and innovations are required to improve the efficiency of the extraction techniques to potentially allow the UK to tap into this market opportunity whilst securing a strategic raw material.

CASE STUDY: Batteries for Automotive

Johnson Matthey
Inspiring science, enhancing life

THE CHALLENGE: Today's battery performance is limited, impacting the take up of electric vehicles.

THE INNOVATION: Johnson Matthey has applied its chemistry expertise to rapidly develop an innovative new battery cathode material called eLNO™. This next generation product is already generating extremely positive feedback from customers during testing. Designed to enable large scale adoption of pure battery electric vehicles with greater range and lifetime, eLNO is helping to improve lithium-ion batteries to meet a critical need for industry, consumers and society.

16 IHS Markit report

Theme 4: Digitisation and Big Data

AI AND DATA ECONOMY

The adoption of digitisation and big data will generate a step-change in productivity and could precipitate the creation of new business models. Innovations in this area are being taken up by industry, with 80% of 360 chemical companies reporting an increase in investment in digital technologies for plants, in particular on plant management and product quality[17]. The Innovation Working Group believes that there is significant untapped potential in this area, as outlined in the Made Smarter Review[18].

Three programmes have been identified under this theme:

(x) Digitisation of Supply Chains

Incorporating digital technology throughout the supply chain would allow industry to manage products throughout its supply chain, improving product traceability and providing efficient cash-flow management. This sub-programme seeks to establish the future potential from digitising supply chains.

(xi) New Process Technologies

The sector has had a long record in developing and commercialising new processes and is constantly seeking innovation in process design. The adoption of new process technologies such as continuous flow technology will provide a step-change in capital cost, materials management and throughput, whilst new process technologies such as 3D printing create the opportunity to create new business models such as personalised products and localised manufacture. This programme is focused on accelerating the use of continuous flow techniques across different processes and on delivering the opportunities presented by 3D printing.

(xii) Big Data in Design

Big data is already used within the pharmaceutical industry for molecular design. Its application could be an important underpin to accelerating innovation in other sectors, in particular where complex design is required. This programme will assess the potential for big data to be used in other applications.

Together, the development and application of these technologies will help the Chemistry Council accelerate innovation into industry for the benefit of society.

"The vision would be for an automated system to take you round the loop multiple times without human interaction –this would require to suggest the next compound to be made, automated retrosynthesis to determine how to make it, automated synthesis/ robotics to physically prepare the material and the packaging, and automated analytical testing to measure the compound against the desired response."

The Chemistry Council Innovation Working Group 2018

17 Accenture report: Industry X.0: Unlocking the Power of Digital in Plant Operations (2018)

18 Siemens, Made Smarter Review (2017)

Underpinning Accelerated Innovation

Facilitating Commercialisation of Science in the UK

The Chemistry Council businesses invest over £10bn globally each year on innovation and R&D. The UK has a core strength in the R&D centres located in the UK, and universities that are globally renowned for their scientists and engineers. Facilitating the translation of science into industry and then supporting scale-up to full scale manufacture in the UK is critical to ensuring the long-term value from innovation is delivered in the UK.

However, the annual Bloomberg report[19] of most innovative national economies ranked the UK as 17th in 2018, with South Korea coming top of the list. The UK ranks 20th for the percentage of GDP spent on research and development, and only ranks 40th in terms of the value added by manufacturing as a percentage of GDP. This suggests that more support is required to encourage the commercialisation and manufacture of technology in the UK.

Recognising the need to boost R&D spend as a percentage of GDP, Government has responded by increasing the level of public spend, with a commitment to raise R&D intensity to 2.4% by 2027 and 3% thereafter. Alongside this commitment, support in the form of incentives is required.

Countries such as Ireland have adopted deliberate fiscal incentives to encourage companies to base their R&D centres there. Significant tax breaks have resulted in a movement of businesses to these areas and similar incentives should be considered for the UK.

Whilst structures such as the Patent Box and the Seed Enterprise Investment Scheme (SEIS) are welcomed, specific incentives should be considered to support start-ups to prosper and grow into large scale manufacturing organisations in the UK, thus ensuring the return on investment in innovation is delivered in the UK. Structures such as flow-through shares[20] have been highlighted as potential vehicles that have proven successful in other countries.

Strengthening and Connecting Institutions

The UK has impressive capabilities to generate fundamental science, universities (supported by societies such as the RSC), societies, such as SCI, designed to support the translation of science into industry, and a range of Catapult Centres to support the scale up to full scale manufacture. Building awareness of and ensuring connectivity between the current assets will ensure they are utilised effectively.

Innovation Skills of the Future

Sector technologies are undergoing radical change and this will require new skills to support innovation. A healthy pipeline of young scientists and engineers, adequately equipped to take on the challenges of the future, is critical. For industry, these scientists and engineers need to be equipped not only with a depth of subject matter expertise but the broad skills to enable them to work with a diverse range of new technologies.

19 Bloomberg article, 'The U.S. Drops Out of the Top 10 in Innovation Ranking' (2018) Available at: https://www.bloomberg.com/news/articles/2018-01-22/south-korea-tops-global-innovation-ranking-again-as-u-s-falls

20 SCI Response to Industrial Strategy Green Paper (2017)

Chemists, biologists and engineers need to have an appreciation of subject areas such as digital technologies, informatics, computational science and formulation science. In addition, building entrepreneurial skills at an early age will help spur a new generation of innovators.

Supporting the development of core technologies

Delivery of this innovation Strategy is underpinned by advancements in a number of core technologies, these being:

Chemistry – Green Chemistry, Smart Chemistry and Catalysis

Biotechnology – Industrial Biotechnology, Biocatalysis and Synthetic Biology

Process and Digital Technologies – Digitisation, Big Data and Novel Processes

By encouraging innovation and the development of technologies and programmes across these challenges, the growth rate of the industry will increase, benefiting the country economically, socially and environmentally.

Summary of innovation priorities

1. For the Chemistry Council to deliver its strategy, it needs to accelerate the rate of innovation and support the commercialisation of innovation in the UK.

   This will be done through four innovation themes:

   - Delivering **Advanced Materials and Molecules**
   - Creating a pipeline of **Green Supply Chains**
   - Facilitating new **Energy Storage and Distribution**
   - Increasing productivity through **Digitisation and Big Data**

   These themes comprise 12 programmes which support the four UK Grand Challenges within Government's Industrial Strategy:

   - Delivering **Clean Growth**
   - Delivering new **Materials for Mobility**
   - Enhancing health and well-being for an **Ageing population**
   - Creating competitive advantage by innovative use of **Data and Digitisation**

2. Underpinning the innovation programmes will be:

   - Securing significant funding and industry/Government partnership in order to facilitate collaboration between companies and academia to work together to develop and implement large-scale innovation programmes with supporting critical technology and skills.
   - Providing incentives to support investment in large scale R&D facilities in the UK by multinationals supporting the Government's target of 3% of GDP spend on R&D in line with other countries.
   - Providing fiscal structures to support SMEs to grow to full scale manufacture in the UK. The current facilitators such as capital allowances and the patent box should be strengthened to ensure that they are competitive with other countries. Structures such as flow-through shares have proven to be successful in other countries and should be considered.
   - Ensuring existing institutions are strengthened and well connected.

Figure 9

Automotive (batteries)

Market trend: Move to E/Vs battery technology is developing. Currently most of the sophisticated chemicals required are imported.

Link to chemistry: *Cathode:* metal oxide or phosphate containing lithium
Anode: Graphite
Electrolyte: Organic carbonates

Chemistry Council involvement: Mitsubishi Ionic is restarting its electrolyte formulation plant in Teesside. This presents us with a local supply opportunity.

Automotive (light weight)

Market trend: Lighter vehicles required to reduce emissions and improve range of E/Vs.

Link to chemistry: *Coatings:* methyl methacrylate
Airbags: sodium azide
Bumpers: polypropylene
Headlamp lenses: polycarbonate
Tyres: solution-styrene-butadiene rubber
Screenwash: ethylene-glycol
Fuel tanks: high-density polyethylene
Emission control: catalysts

Chemistry Council involvement: Many potential opportunities but need closer involvement with key stakeholders in order to articulate the chemistry needs.

Construction

Market trend: Lower energy buildings, faster build times.

Link to chemistry: *PVC doors and windows:* polyvinyl chloride
Paint: titanium dioxide
Insulation: expanded polystyrene
Perspex: polymethyl methacrylic
Tyres: solution-styrene-butadiene rubber
Safety hats: acrylonitrile butadiene styrene
Pipes: high-density polyethylene
Low voltage insulation: low-density polyethylene

Chemistry Council involvement: Closer involvement with Chemistry Council is required. Sector Strategy for Construction is delayed, and we should wait until this is complete.

Aerospace

Market trend: New aerostructures, improved joining technologies, better use of composites and multiple materials

Link to chemistry: *Seat fabrics:* polyamide
Paint: titanium dioxide
Coatings: methyl methacrylic
Fuel tanks: high-density polyethylene
Fuel additive: 2,4-Dimethyl-6-tert butylphenol
Doors and frames: carbon fibre

Opportunity: Understand chemistry inputs to Aerospace Technology Institute technology roadmaps. Need to signpost opportunities to the UK industry.

Medical

Market trend: Increased requirements and emergence of important manufacturing technology.

Link to chemistry: *Hip replacement cement:* polymethyl methacrylic
Non-latex gloves: nitrile butadiene rubber
Antiseptic wipes: benzalkonium chloride
Sedative: benzodiazepine
Eye drops: chloramphenicol
Dentures: polymethyl methacrylic
Cough medicine: dextromethorphan

Chemistry Council involvement: Requirements well articulated by Life Science Industry. Support and signposting only.

The Chemistry Council Supply Chains Working Group includes senior representatives from the industry (multinational and SME), heads of cluster organisations and Government institutions (Centre for Process Innovation, Innovate UK, Department for International Trade). The group has been led by BASF's UK Country Head, Richard Carter.

Introduction

The sector takes both synthetic and natural raw materials and processes them into a wide range of intermediate and finished products. These products are consumed by companies in the chemistry sector and supply and customer industries, as shown in Figure 10 below, showing we are the industry for industries.

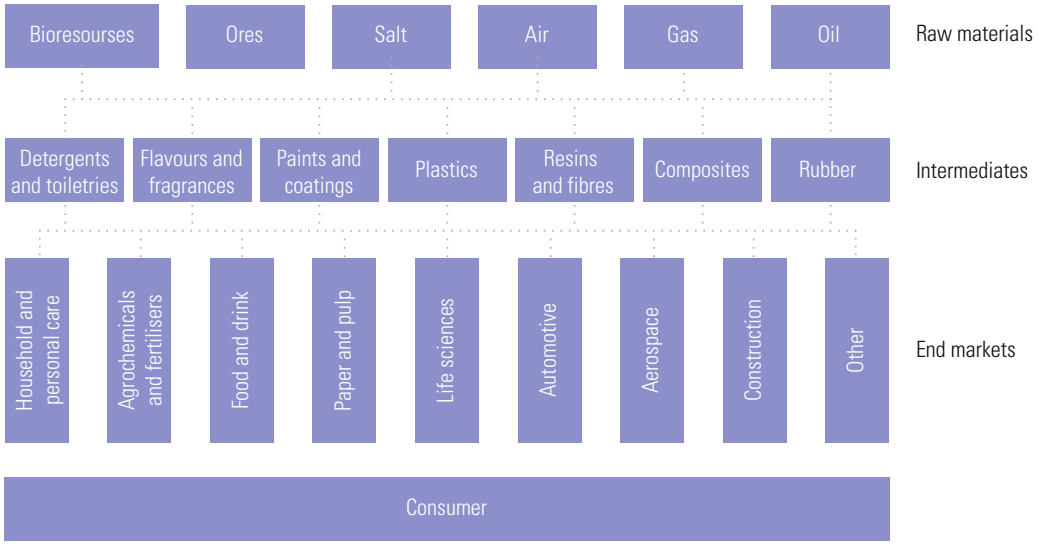


Figure 10 : UK Chemical Industry Supply Chain

Strength and innovation in the supply chains are important to delivering the UK's Industrial Strategy.

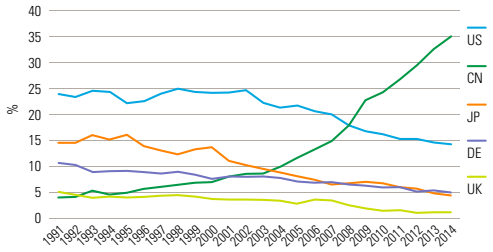
The Chemistry Council Supply Chains Working Group is focused on delivering programmes within two core themes:

- Securing and Strengthening Existing Supply Chains.
- Building New Innovative Supply Chains.

Theme 1: Securing and Strengthening Existing Supply Chains

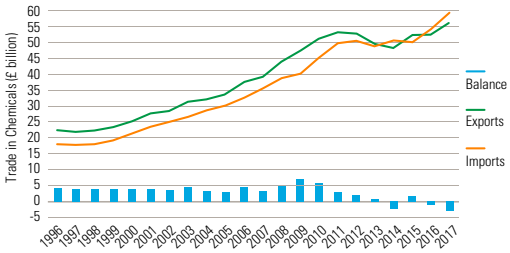
The UK has traditionally had strong integrated supply chains across industry. However, these have become fragmented due to a loss of key assets and this has resulted in supply chains that are inefficient both from a cost and a carbon perspective due to the need to import and export multiple times to produce a finished product. As a consequence the UK industry has fallen behind global competitors, as shown in Figures 11 and 12, and has failed to realise its share of global growth.

Figure 11 : Percentage of world chemical industry sales by country 1991-2014



Source: Cefic

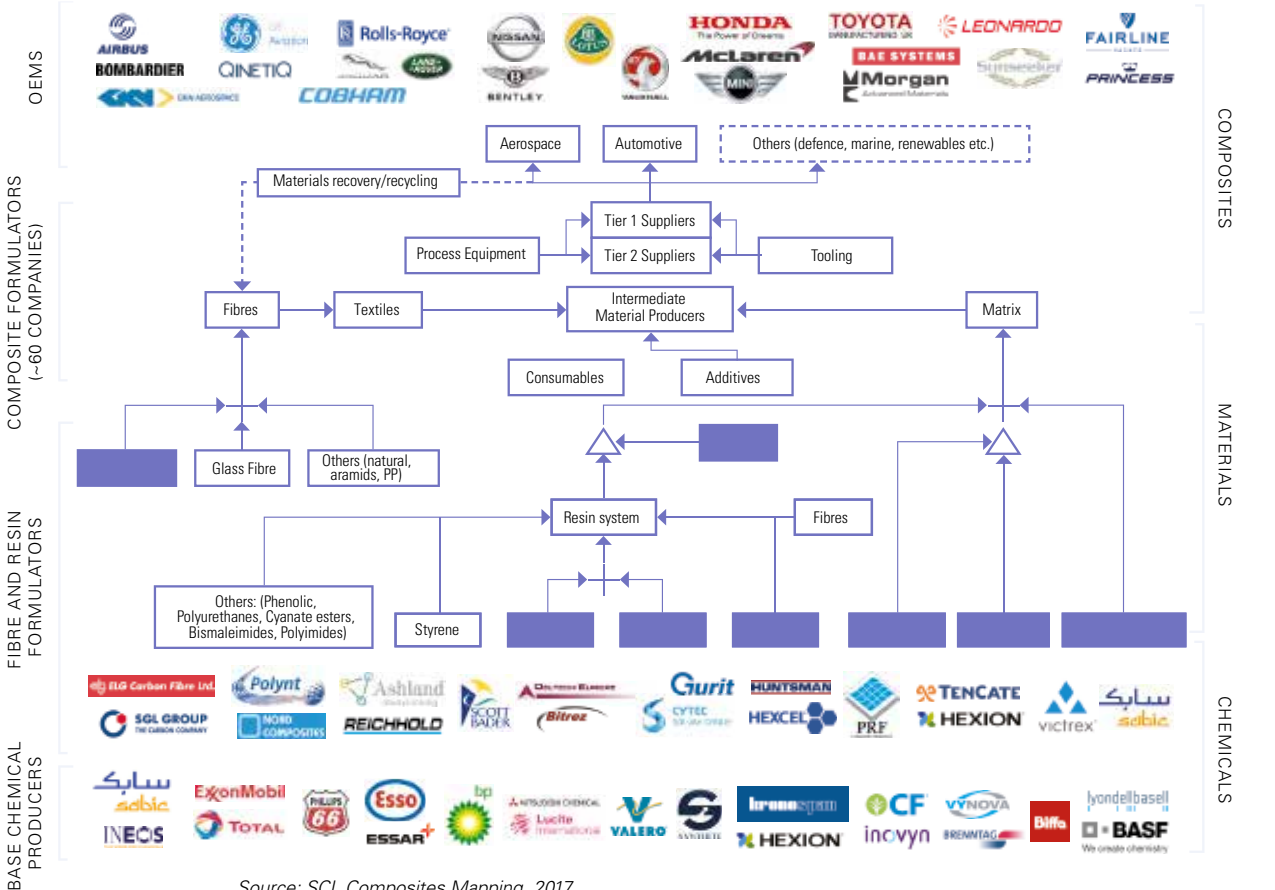
Figure 12 : UK chemical sector trade balance: Goods trade in chemicals and related products, UK, 1996 to 2017



Source: HMRC UK trade information 2017

Opportunities to rebuild supply chains through onshoring or supporting investment in new technologies that support rebuilding supply chains will be identified between the Supply Chain and Regional Working Groups.

Figure 13 : The UK Composites Supply Chain: Delivering products for mobility



Source: SCI, Composites Mapping, 2017

Theme 2: Building New Innovative Supply Chains

The integrated nature of industry supply chains should be a source of competitive advantage for the UK if the industry sectors work together to deliver innovative new supply chains.

Figure 13 shows the UK Composites Supply Chain and the interconnectivity between the chemistry and materials companies, and end users in automotive and aerospace sectors. Ensuring that new innovations are delivered to these downstream sectors by the Chemistry Council community will strengthen all parts of the supply chain and provide security of supply of critical raw materials.

The Chemistry Council Supply Chains Working Group is establishing connections with downstream sectors to identify opportunities and will work with the Chemistry Council Innovation Working Group to provide new materials for these sectors. The building of new supply chains will support growth and ensure security of strategic raw materials.

An example of this is the recent work of the Supply Chains Working Group connecting with downstream sectors to address the needs and opportunities of materials for batteries. The E4tech Report identified an opportunity for the chemical supply chain in this area valued at £2.7bn/year[21].

The Supply Chains Working Group will work with the Innovation Working Group to identify innovative product opportunities for batteries.

A summary of priorities of the Supply Chains Working Group is shown below:

Summary of Supply Chain Priorities

3. Supporting Clean Growth by rebuilding cost competitive and carbon efficient supply chains.
4. Ensuring strategic raw materials are identified and are in place to support inward investment in the UK.
5. Developing strong links to the key downstream sectors of automotive, aerospace and construction, and ensuring they have access to a pipeline of new materials to support delivery of their sector strategies.
6. Working with automotive and battery stakeholders in the supply chain to specify and deliver innovative products, in conjunction with the Innovation Working Group.

21 E4Tech report, 'The UK Chemicals and Process Supply Chain for Process Manufacture' (2018)

REGIONS AND INFRASTRUCTURE: ACCELERATING THE PACE OF REGIONAL DEVELOPMENT

The importance of place is critical to the Chemistry Council as the manufacturing is regionally dispersed. In 2018 it established a new Regional Working Group to support regional growth and development. This group is led by Paul Booth OBE, chairman of the Tees Valley Unlimited LEP, and has representatives from the regional clusters, Scotland and links to the LEPs.

Introduction

The Regional Working Group has developed a strategy consisting of programmes based around two core themes of:

- Driving Regional Economic Development
- Supporting Clean Growth

The Working Group has also highlighted a number of priorities related to skills which have been captured within the Skills and Education section of this strategy.

Theme 1: Driving Regional Economic Development

Although the Chemistry Council is widely dispersed across the UK, there are four regions where there is a significant amount of industry. These regions represent a large proportion of manufacturing and employment in the sector (Figure 14) and are:

- Teesside in the North East
- Ellesmere Port, Runcorn and Rocksavage in the North West
- Grangemouth in Scotland
- Yorkshire and Humber

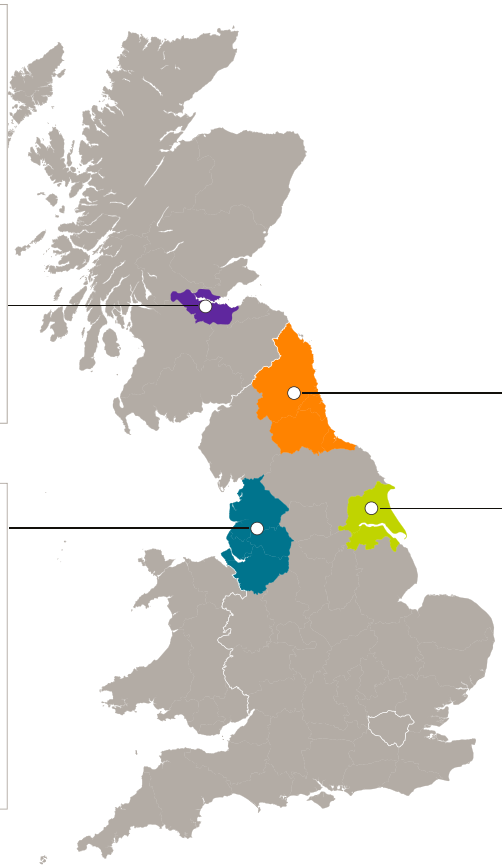
The regional clusters are supported by industry-sponsored regional groups such as NEPIC (North East of England Process Industry Cluster), CSS (Chemical Sciences Scotland), CNW (Chemicals Northwest) and CATCH/YCF (Your Connected Future). Regional economic growth and productivity could be enhanced and driven by modest funding of these regional cluster bodies.

These four regional clusters have significant assets and capabilities that could be further enhanced to support growth in industry and jobs. Current assets include:

– Deep sea ports for import/export of materials
– Key raw materials
– Invested and under-utilised infrastructure such as underground pipelines
– Storage and logistics capabilities
– Range of industry, technology and services
– Skilled workforce
– Industrial symbiosis and waste optimisation capability
– Engineering and technical support for businesses

Three key programmes have been identified to drive economic growth and productivity, these being supporting shale gas production, introducing private wire network arrangements, and establishing free ports. Regional growth will come from a focus on building cost-competitive locations for investment, with appropriate facilities and capabilities to support SME growth and export growth.

Figure 14 : Map of four key regional clusters[22]



SCOTLAND

Chemical Sciences SCOTLAND

Representative: Chemical Sciences Scotland
GVA: £1.4bn
Employed: 10,200
Turnover: £3.1bn (All stats for SIC 19,20,21 in 2016)
Key facilities:
- Large scale manufacture
- CMAC Future Manufacturing Research Hub Industrial Biotechnology Innovation Centre
- Forth Valley College
- Medicines Manufacturing Innovation Centre

NORTH EAST

nepic

Representative: NEPIC
GVA: 2.1bn
Employed: 39,000
Turnover: £12bn
Key facilities:
- Large scale manufacture
- Wilton complex and Centre Science Park
- CPI (National Biologics Manufacturing Centre, National Formulation Centre & Printable Electronics Centre)
- Materials Processing Institute
- TWI. Technology and Training Centre

NORTH WEST

Chemicals northwest

Representative: Chemicals Northwest
GVA: £6.0bn
Employed: 37,000
Turnover: £11.bn
Key facilities:
- Range of manufacturing from petrochemicals to specialities
- Ellesmere Port complex

YORKSHIRE AND HUMBER

CATCH YCF

Representative: CATCH and YCF
GVA: £1.8bn
Employed: 21,000
Turnover: £4bn
Key facilities:
- Skills development facility
- Saltend Chemical Park
- Chemical and energy industries

Northern Powerhouse

Total turnover in Northern Powerhouse – £27bn
Number of companies – 728
Number of Employees – 96,000

Source: Consultations with Chemistry Council Regions Working Group (2018)

Note: It should be noted that whilst some of the sector is located outside these four clusters, they are important for driving growth, establishing new technologies at a commercial scale and supporting inward investment.

22 Office for National Statistics (2015) licensed under the Open Government Licence v.3.0. Contains OS data Crown copyright. Updated with industry knowledge from the Chemistry Council companies

Theme 2: Supporting Clean Growth

The regional organisations in association with LEPs and with national support are critical to facilitating the delivery of the Clean Growth agenda as well delivering the Northern Powerhouse goals.

The regional clusters are the locations to deliver Carbon Capture, Storage and Utilisation facilities, regional Recycling Hubs and support the delivery of the Hydrogen Economy. The close vicinity of companies in clusters supports the establishment of regional Industrial Symbiosis programmes and creates an environment that allows SMEs to grow. With appropriate support, high-tech business parks could be created, and the resources marketed to offshore companies.

The Northern Powerhouse

The Chemistry Council companies are key in underpinning the Northern Powerhouse.

Summary of regional priorities:

7. Driving Regional Economic Development

Increasing competitiveness of the location for existing manufacture and new manufacture by:

(i) Supporting unconventional gas production, such as shale gas.

(ii) Introducing private wire network arrangements.

(iii) Establishing Free Ports.

Facilitating inward investment by:

(iv) Building marketing capabilities for each region.

(v) Ensuring strategic raw materials are in place, utilising new technology.

8. Supporting Clean Growth

Supporting Clean Growth by:

(vi) Establishing regional Carbon Capture, Storage and Utilisation facilities.

(vii) Establishing regional Recycling Hubs for polymers and other materials.

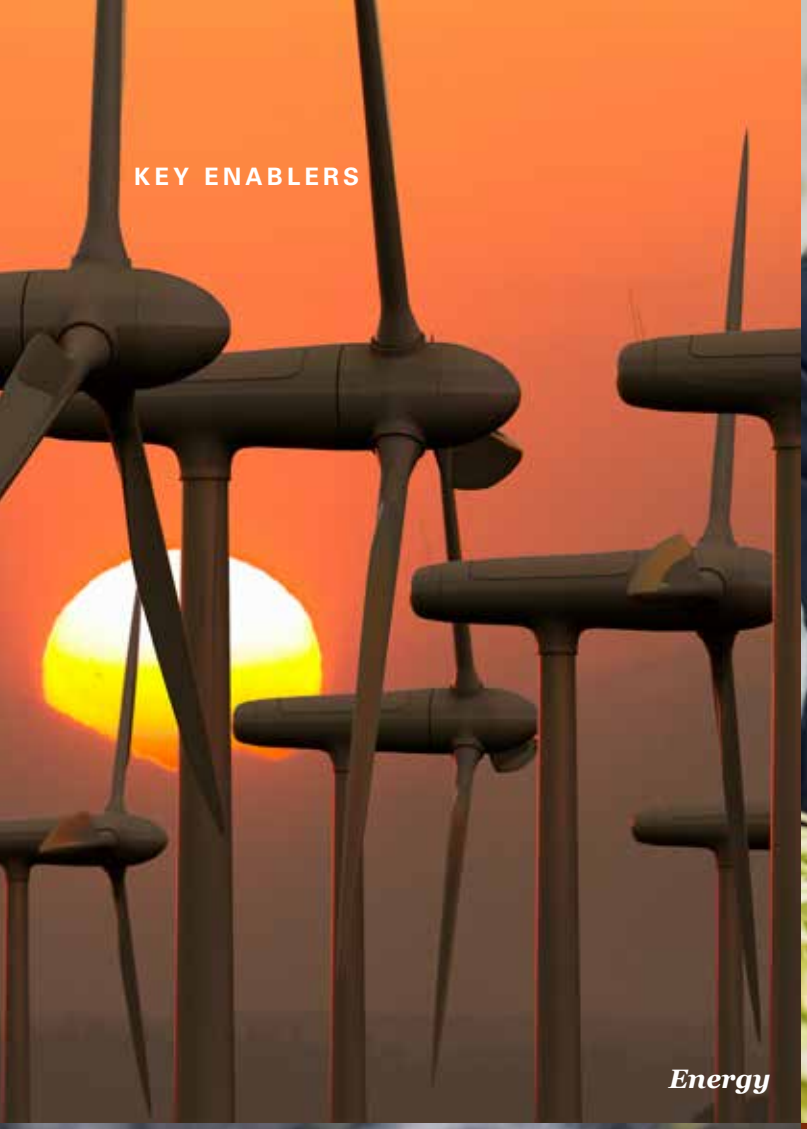
(viii) Supporting the development of local Hydrogen Economies.

(ix) Supporting regional Industrial Symbiosis programmes.

(x) Providing business parks for SMEs to grow.

(xi) Supporting new technology deployment with accelerator/demonstration facilities.

KEY ENABLERS



Energy

Education and skills

Finance

Regulation

Chemistry-led solutions underpin renewable energy, low emission transportation, energy-efficient homes and businesses, and sustainable agriculture. It lies at the heart of the UK's development of a low carbon economy and its drive for clean growth.

Although parts of the sector are considered to be energy intensive, the sector overall is a critical enabler of climate change solutions. For every tonne of carbon emitted from production, two tonnes of carbon are saved through the climate solutions our sector enables[23].

Industry needs competitive and secure supplies of energy for fuel and raw material feedstocks. This means striking an affordable balance in the energy mix between natural gas, clean coal, new nuclear, and renewable sources. Manufacturers also need a level playing field with respect to climate policy costs.

There have been a number of positive developments since the 2013 CGP Strategy. This includes the UK Clean Growth Strategy[24] and its cost-effective approach to decarbonisation (including a joint Chemical Sector Roadmap Action Plan), and its dual focus on low carbon opportunities, while ensuring affordable and internationally competitive energy.

The Industrial Strategy White Paper also names clean growth as one of its Grand Challenges. It further confirms the Government's continued support for developing the UK shale gas industry to enhance competitiveness and build up supply chains. And it offers sector deals that will strengthen industries like automotive, which are key customers for climate solutions.

Government and industry stakeholders must now work together to realise the opportunities under these strategies and to highlight challenges yet to be addressed.

The Chemistry Council Energy Working Group is headed by Tom Crotty, Director at Ineos, and is focused on:

- Ensuring Cost-competitive Energy and Feedstocks
- Ensuring Security of Supply of Energy and Feedstocks
- Providing Climate Change Solutions.

23 https://www.americanchemistry.com/Policy/Energy/Climate-Study/Innovations-for-Greenhouse-Gas-Reductions.

24 HM Government, The Clean Growth Strategy: Leading the way to a low carbon future (2017)

Theme 1: Ensuring Cost-competitive Energy and Feedstocks

Cost-competitive energy for use as fuel and feedstocks (raw material) are critical to all parts of industry, both upstream businesses in which energy accounts for up to 70% of operating costs, and less intensive downstream chemical businesses, who are still significant energy users and also depend on supplies of basic chemical inputs.

The UK is significantly behind other major industrial nations with respect to cost competitiveness and this factor has, arguably, significantly accelerated the decline of industry in the UK and prevented the UK from enjoying its share of global industrial growth. However, the sector has experienced record growth despite the tough conditions.

Competitive Electricity

The UK has made good progress in decarbonising supplies; however, this has led to uncompetitive prices. For industry, as large users, electricity prices are now over 50% higher than in competing European Member States, putting UK industry at a distinct disadvantage to major competitors[25].

An energy cost review for Department for Business, Energy and Industrial Strategy (BEIS) concluded that prices are higher than necessary because low carbon policies have 'picked winners' and there have been inefficiencies in the procurement of network infrastructure. The report makes a series of recommendations to simplify policies and make them more effective, and these recommendations should be implemented.

In the meantime, the Chemistry Council supports the work by BEIS to maximise the scope of energy-intensive activities qualifying for relief from policy related costs.

Competitive Gas

Over the past decade, US development of shale gas has precipitated extraordinary economic benefits, with an estimated US$202 billion of chemical sector investment forecast by 2020[26] to harness its use as fuel and feedstock.

Shale gas has the potential to make the most significant and immediate contribution to the UK economy and specifically to regional development, with an estimated £3.3bn annual spend at peak development and precipitating 64,500 jobs[27].

Since 2017, imports of ethane feedstock – including supplies from US shale – have been helping to sustain the economics of the UK's three ethylene crackers in the north east and Scotland, which are critical building blocks for the country's manufacturing base.

25 BEIS publication showing comparison of energy costs (2018) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/662858/table_541.xls and https://www.gov.uk/government/statistical-data-sets/international-industrial-energy-prices

26 https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/developing-shale-oil-and-gas-in-the-uk

27 https://www.americanchemistry.com/Search.aspx?srchtext=shale+gas/

Theme 2: Ensuring Security of Supply of Energy and Feedstocks

As North Sea supplies decline, the UK is increasingly reliant on imported gas. Imported gas currently provides 60% of supplies and our dependency could reach 75% by 2030[28]. The development of UK shale reserves could increase security of supplies of gas, whether for use as a fuel or feedstock.

Shale gas extraction within a robust regulatory framework presents significant opportunity for the UK with minimal environmental impact. Community benefits from developing such resources would also be significant. As the cleanest-burning fossil fuel[29], gas has an important role to play in electricity generation and as a source of heat during the low-carbon transition. The Industrial Strategy White Paper also signals work to explore shale's potential contribution to Clean Growth through deployment with technologies such as carbon capture, use and storage, and the hydrogen economy.

Progress in developing shale gas in England has been slow and policy needs to be developed at a national level. The Government has taken action to streamline the planning process and is considering how to implement a single Shale Environmental Regulator; both actions will help support the successful development of shale gas reserves. Although progress is slow, this year has seen the start in Lancashire of exploratory drilling with hydraulic fracturing.

Securing Energy outside of the EU

Withdrawal from the EU has implications both for energy markets and climate change related policy costs.

Free and fair access to the EU's internal energy market (IEM), and, in the case of nuclear, recognition under Euratom, are vital to support competitive and secure supplies of electricity and gas. In the absence of a reciprocal agreement, the UK also needs to ensure there is fair access to the IEM; i.e. that there are no non-tariff barriers.

Turning to EU climate policies, the most significant instrument is the EU Emissions Trading Scheme (EU ETS). We believe the Government should work with industry to ensure that EU ETS Phase 4 provisions minimise production and investment leakage. At the same time, the UK should develop a low-cost UK alternative to the EU ETS that not only delivers CO_2 emission reductions but supports the ability of UK industry to compete on a global basis. In the interests of competitiveness and growth, the UK's future approach should be no more ambitious than that of the EU ETS.

EU exit also underlines the need to rationalise the UK climate policy mix and maximise the scope and level of relief from renewable policy and carbon price impacts on power costs. Carbon pricing as a means of reducing carbon emissions is a good mechanism, but there needs to be a level playing field internationally; not a UK-only tax on fossil fuel inputs to electricity generation.

Theme 3: Providing Climate Change Solutions

Following the landmark Paris Agreement, which confirmed the need for keeping global warming to 'well below 2 degrees Celsius' by the end of the century, the transition to a global low-carbon economy is gathering momentum.

The Chemistry Council can play an important role in delivering these programmes. A study for the International Council of Chemical Associations (ICCA) estimates that, with the right business and policies, the solutions provided by the global chemistry-based industry could reduce emissions by 2.5 GtCO2e per year in 2030 – a reduction equivalent to the total emissions from France, Germany, Italy, and the UK combined[30].

28 https://www.ey.com/Publication/vwLUAssets/Getting_ready_for_UK_shale_gas/$FILE/EY-Getting-ready-for-UK-shale-gas-April-2014.pdf

29 https://www.igu.org/natural-gas-cleanest-fossil-fuel

30 www.cefic.org/Documents/RESOURCES/Reports-and-Brochure/Ecofys-the-essential-role-of-chemicals.pdf

However, in order to realise such opportunities, it is critical that the sector can remain competitive during the UK's low-carbon transition by becoming more energy efficient and reducing its greenhouse gas (GHG) emissions.

The Chemistry Council welcomed the publication, in October 2018, of the Chemical Industry Decarbonisation and Energy Efficiency Roadmap Action Plan[31]. The Chemistry Council Working Groups have an important role in overseeing and co-ordinating delivery of several actions and tasks identified in the roadmap.

The actions in the plan align with the Chemistry Council's growth priorities (innovation, creating new competitive supply chains, and regions and infrastructure). Actions include the increased use of bio-resources, waste and captured carbon and hydrogen as a feedstock, clustering and carbon capture and storage, and the development and scale-up of innovative decarbonisation and energy efficiency technologies. Indeed, some of the work, such as innovations in energy storage, could generate enablers for climate solutions in other sectors.

The work underway by the Office of National Statistics to develop a national materials database would support this strategy by making businesses in the chemical sector aware of the availability across the UK of material and waste resources for use as feedstocks. In particular, by providing information at a granular level the database will allow industry to develop the business-cases to drive investment in the use of waste and other material resources.

The action plan also builds on the sector's long track record for energy efficiency improvements under voluntary agreements and, most recently, the Climate Change Agreements. Indeed, since 1990 the sector has improved its energy efficiency by 42%[32]. This has been achieved through a range of cost-effective actions, such as installing combined heat and power generation (CHP). CHP supplies a third of our electricity needs.

While much of the potential from implementing established technologies has been realised, some remains – albeit with long paybacks. Action plan commitments to implement an Industrial Energy Efficiency Scheme and a Waste Heat Recovery Scheme would therefore enable these near-term opportunities to be realised.

Summary of energy and climate change priorities

The Chemistry Council will work with Government and industry stakeholders to:

9. Provide solutions for the UK to have the lowest energy costs in Europe.
10. Support appropriate policies to enable safe exploitation of unconventional gas – including a Shale Environmental Regulator – and enable the industry to undertake programmes and achieve proven flows to the grid by 2020.
11. Ensure free and fair access to the EU's internal energy market (IEM) post-EU exit.
12. Ensure that EU ETS Phase 4 provisions minimise production and investment leakage. At the same time develop a low-cost UK alternative to the EU ETS and rationalise the UK climate policy mix post-EU exit.
13. Implement the actions in the Chemical Industry Decarbonisation and Energy Efficiency Roadmap Action Plan according to the agreed timings.

31 www.gov.uk/government/uploads/system/uploads/attachment_data/file/651230/chemicals-decarbonisation-action-plan

32 CIA, Chemical Sector Climate Change Agreements (1990-2010)

Access to people with the right skills is one of the sector's key priorities. Chemistry sector businesses rely on skilled people to drive productivity and growth. In return, they have always provided a high level of workforce training to further develop individuals' skills and meet the demands of stringent health and safety regulation.

This skilled people requirement includes:

- Attracting talent into the industry and providing training that also takes account of the overall demographics in the sector
- Continually upskilling and retraining our existing workforce to meet the demands of the future
- Having the ability to access specialist skilled people (e.g. for R&D projects and capital projects) on a global basis

Attracting new talent, both vocational and academic is a challenge we face and the industry has an ageing workforce leading to a high replacement demand. We need to present the industry as a positive career choice. The sector also wants to see more emphasis placed upon encouraging young people to study sciences, engineering and technical subjects at school, college and university.

Changing technologies and ways of working, coupled with longer working lives, are putting increasing focus on lifelong learning and intensifying the demand for new skills. The chemical industry globally, and especially in this country, has a high skill level. However as the Director for Education and Skills at the Organisation for Economic Cooperation and Development (OECD), Andreas Schleicher, said recently "Technology is racing ahead of the skills people have". A population with the right mix of skills can help ensure globalisation translates into jobs and productivity gains, according to the OECD's Skills Outlook 2017 report. On a local level the UK can learn from this outlook.

Digital skills

The rapidly expanding demand for digital skills coupled with Industry 4.0 will drive the need for digitally skilled entrants and upskilling of the existing workforce. Digital in its fullest sense (including data analysis, augmented reality, and robotics/process automation) is a key enabling technology for the chemical sector. For example, Accenture has said "95% of chemical companies driving a digital strategy have seen tangible financial value of utilizing digital in their operation".

Emotional intelligence

The handling of business relationships, both internal within organisations and external with stakeholders is as important as technological development. Skills at communicating the case for positions held, and especially listening to others including stakeholders have risen to the top of the leadership agenda in all organisations. They are also important skills in all levels of businesses. Emotional intelligence of our people including empathy, self-awareness and general social skills are critical to our offering and to our growth.

Investing in apprenticeships

The Government's Industrial Strategy White Paper has committed to providing a technical educational system that rivals the best in the world. The Chemistry Council strongly supports this and believes that at apprenticeship level we could learn much from Germany. Their dual vocational training programme gives students theoretical education in the classroom, coupled with real-world experience on the factory floor. On seeing this system in action earlier this year, the US Government doubled federal spending on apprenticeship programmes to $200 million. The institutes that Germany has set up to educate its apprentices are being used increasingly to retrain older workers and keep their minds fresh.

The Industrial Strategy technical education policy includes the introduction of T levels and a series of apprenticeship reforms. If the industry is to benefit from these policies, they need to be fit for purpose with wider flexibilities than currently available. In the UK the chemicals sector has engaged in recruiting and training apprentices, and is now working through the reforms.

Early indications from the recent Science Industry Partnership Apprenticeship survey are that the Process Industries are only recovering less than 14% of the available levy tax. Employers want to see a wider range of process industries appropriate Standards, more flexibility with respect to upskilling, and increased local training provision. Going forwards it is also key that process industry standards continue to be funded at realistic levels.

Brexit and skills

Leaving the European Union presents both a challenge and an opportunity for the UK's skills landscape.

The EU's Horizon 2020 programme plans to invest €77 billion between 2014 and 2020. It is one of the largest public Research & Development (R&D) funding programmes in the world, accounting for 8% of the EU budget. The Government has said it wants to fully associate with it after we leave the EU.

Some of the specialist skills required are not yet available in the UK. We need to achieve as near as practically possible, freedom of movement for certain jobs within the overall workforce. Getting the best can help secure employment for the rest. Allowing chemical businesses to bring in specialist contractor teams for a limited period to undertake essential maintenance and overhaul activity in shutdown and turnaround situations is essential. As with Horizon 2020, agreeing to scientists who are employees of companies moving freely between the EU and UK is critical to our sector. Chemical businesses need scientists and engineers. Movement of scientific and engineering skills around companies delivers growth. We also want to ensure multi-national companies can move their staff – particularly graduate and management trainees – between different countries to gain experience and develop skills. EU exit should not hinder development experience and global mobility. It is important we achieve this so we can compete on a European and global stage.

Securing our current and future workforce

The UK has an impressive network of scientific institutions, producing a strong pipeline of young professionals. The Northern Powerhouse alone is home to 32 higher education institutions, educating 522,000 students. We have high ranking universities across the country teaching chemistry. It is important that industry and academia continue to work closely together to ensure a pipeline of qualified scientists and engineers are available to work in or alongside industry.

These academic institutions are supported by a variety of industrial and scientific institutions working at different stages along the pipeline to encourage children, students, and young professionals into industry.

These industry institutions include:

- The Children Challenging Industry Programme, which works in schools to encourage young people to consider careers in science and industry.
- RSC, which sets professional standards and runs professional development programmes for chemists.
- SCI, which works at the interface of academia and industry and runs a variety of programmes to support the recruitment of scientists and engineers into industry and builds entrepreneurial skills.

- Cogent, which sets the gold standard for manufacturing through its impressive apprenticeship scheme.
- IChemE, which sets professional standards and runs development programmes for chemical engineers.
- CATCH, which works with industry, schools, young people and wider stakeholders to develop a pipeline of young people ready for a career in the chemical industry through development of industry-led programmes.

It is critical that these institutions are supported to maintain a strong pipeline of scientists and engineers talent to industry. With a significant amount of manufacturing jobs in the regions ensuring a skilled workforce in place for future manufacturing is critical. Many companies already support a range of skills programmes, but increased support is needed to accelerate programmes and secure a pipeline of skilled workers for the future. This will require the utilisation of regional facilities such as CATCH.

Summary of skills priorities

14. Engaging with wider society and school children in particular to promote the industry through programmes such as Children Challenging Industry and the Catalyst Science Discovery Centre. Research has shown that we need to engage with young people by Year 9 if we are to inspire them to seek careers in our sector.
15. Working with Government and other organisations, including Science Industry Partnership / Life Sciences and Industrial Sciences Trailblazer, to ensure the apprenticeship levy delivers for our sector.
16. Addressing the specific need for more professionally accredited technicians and apprentices through an employer-owned, demand-led system facilitated by the Science Industry Partnership.
17. Promoting training and qualifications that meet robust and professionally verified standards including the 'Cogent gold standard' as a brand for excellence in chemical industry skills
18. Reinforcing and strengthening improvements in higher level graduate, masters and post-graduate level training by working closely with the Institute of Chemical Engineers and the Royal Society of Chemistry to deliver this and accredit qualifications.
19. Continuing to lobby for freedom of movement and hence access to the specialist skills the sector needs to deliver its strategy and remain globally competitive.
20. Encouraging take-up of SCI's Bright SCIdea Entrepreneurs Challenge Programme.
21. Defining our Emotional Intelligence requirements.
22. Accelerating the Apprenticeship Programmes.
23. Utilising the CATCH facilities in Yorkshire and Humber to ensure new process operators are industry ready.
24. Linking to the existing innovation infrastructure to support regional innovation.

The chemical and chemistry–using industries are highly regulated and rightly so – helping to give confidence to employees, local communities and consumers. Focusing on the long-term success of the industry, the Chemistry Council will address key regulatory levers that either help or hinder that long-term growth, working in particular with relevant trade associations to create a regulatory climate and culture that strengthens international competitiveness and growth and drives social and environmental progress.

Brexit and regulation

The most immediate and significant challenge is to determine the future of regulation for chemical and chemistry-using industries as the UK leaves the European Union (EU). The Council believes it will be essential to secure the correct balance between future regulatory alignment and flexibility, to not only ensure future EU market access with limited additional cost but also the opportunity to drive the same, if not more effective, economic, social and environmental outcomes through a more pragmatic and proportionate approach.

In many regulatory areas – for example, the safety regimes governing our plants and factories and the REACH regulation addressing our substances and products – the focus should be on retaining alignment with the EU regulatory framework and retaining an influencing role for UK expertise in the future development of those regulations.

The 'Innovation Principle

In other areas we believe there is an opportunity to build on the UK's well-earned reputation for a proportionate and pragmatic risk-based approach to regulation. The UK is one of the more receptive European environments for the "new" and the "innovative" – be it nanotechnology and related materials; hydrogen economy or shale gas. But more can be done. So as we look ahead to linking the challenges and opportunities presented by the Government's Industrial Strategy, its 25 Year Environment Plan and its Clean Growth Strategy, we believe there is an opportunity to embed an "Innovation Principle" in UK Law. First proposed by the European Risk Forum in 2013, this principle would mean that whenever policy or regulatory decisions are under consideration, the impact on innovation as a driver for jobs and growth would be assessed and addressed. The Innovation Principle should therefore be complementary to the Precautionary Principle, balancing precaution and innovation – protecting society, the environment and the ability to innovate.

Summary of Regulation priorities

The Chemistry Council will work with Government and through relevant trade associations and other key stakeholders to:

25. create a regulatory climate and culture that strengthens international competitiveness and growth and drives social and environmental progress
26. secure the appropriate balance between retaining future regulatory alignment as we exit the European Union and pursuing a more flexible regulatory approach beyond exit, to drive more effective economic, social and environmental outcomes.
27. encourage the adoption of an "Innovation Principle" in UK law, ensuring that the impact on innovation as a driver of jobs and growth is addressed and assessed when considering policy or regulatory decisions

Fiscal environment for manufacturing

Boosting investment in UK advanced manufacturing – from pilot plant to full commercial scale-up – requires a conducive and internationally-competitive fiscal environment.

The UK's current Corporation Tax rate is the lowest in the G20 and the Chemistry Council is supportive of the Government's intent to reduce this further, to 17% by 2020. However, the UK has been the least uncompetitive environment within the G7 countries in terms of Capital Allowances (CA) for investment in plant and equipment, with an annual allowance of 100% up to a maximum £200,000, making the country relatively less attractive as an investment location for pilot and full-scale manufacturing facilities. In relation to industrial buildings too – including manufacturing facilities – the UK removed its investment allowance entirely in 2011. Competitor G20 countries typically offer capital allowances for investment in buildings of between 2-10%. Finally, on capital equipment, France and Canada offer allowance rates of 28 and 50% respectively, in comparison to an annual rate of 18% on a reducing balance basis in the UK.

Against this uncompetitive backdrop, the Chemistry Council very much supports the Government's 2018 Budget announcement that will see the annual investment allowance threshold for plant and machinery rise from £200,000 to £1 million for two years with effect from January 2019.

Research and Development Tax Environment – Comparative Analysis

Country	Corporation Tax Rate	R&D Tax Incentives [i]	Patent Box [ii]
United Kingdom	19%	• Under RDTC, SMEs are entitled to an enhanced deduction of 230% of qualifying expenditure, or a cash payment of up to 33.35% of qualifying expenditure if in loss position. • Under RDEC, large companies are entitled to a taxable cash payment equal to 11% of qualifying expenditure. • Companies are entitled to a capital allowance of 100% of eligible R&D capital expenditure in the year of expenditure.	10%
United States	15%-35% + local rate between 4.6%-12%	• The 'Traditional Research Tax Credit' equals 20% of qualifying expenses, exceeding a 'base amount'. • The 'Alternative Simplified Credit' is equal to 14% of qualifying expenses over 50% of the average qualifying expenses over the previous three years.	No Patent Box
Germany	15% + local rate between 14 %-17%	• No R&D Tax Credits available.	No Patent Box
France	33.33%-35%	• Companies benefit from an R&D credit equal to 30% of the first EUR100m of qualified R&D expenditure (50% in overseas territories) and 5% after that. • SMEs are entitled to an ' Innovation Tax Credit' amounting to 20% of qualifying expenses for certain projects.	17%
Ireland	12.5%	• All R&D expenses are deductible in the year the expenses are incurred. • All qualifying research expenses (including capital expenditure) benefit from a 25% volume-based credit. • A 25% credit is also available for expenditure incurred in the construction or refurbishment of facilities used for R&D purposes.	6 .25%
Belgium	33.99%	• Companies can choose between a one-time 13.5% additional deduction 6.8% of all R&D investments or a 20.5% additional depreciation deduction. These can be converted into refundable tax credits (significantly lower than the deduction). • Other tax incentives are available for employing research staff.	6.8%

i This information refers to R&D Tax Credits relating to resources as opposed to capital costs.

ii Patent box regimes came under scrutiny in the OECD's Base Erosion and Profit Shifting (BIEPS) Action Plan published in 2013. Since 2016, countries including the UK signed up to the new OECD rules and have implemented the 'nexus approach' whereby the portion of intellectual property income eligible for a reduced corporation tax rate is linked to the company's R&D spend. For more information visit the HMRC and the OECD websites.

Source: Deloitte, 2017 Survey of Global Investment and Innovation Incentives, March 2017.

Access to Finance

The UK is operating in an internationally-competitive environment to attract inward investment and to capture and retain domestic investment in manufacturing.

Building commercial-scale manufacturing capacity is highly capital-intensive and requires significant upfront investment, often several years ahead of commercialisation. Companies need to invest in land and shell buildings, high-quality and competitive utilities and significant capital equipment kit-out costs, in addition to the skills of the workforce to operate the plant.

Key international competitors – from Belgium to Ireland to Singapore – have developed a much more focused and integrated approach to attracting inward investment. They have targeted multinational companies and deployed highly effective account management with a strong 'offer' including fiscal incentives, financial incentives and flexible support to help companies get the skills required. Such countries have also focused on ease of access to major markets, with Belgium positioning itself as a continental European hub; Ireland as a gateway to the EU and the US, while Singapore has been seen as a gateway to Asia.

In competitor countries, financial incentives in the form of grants, loans or 'in kind' support are available to support capital and revenue investment at a rate of between 10% and 15% of the total commitment. These countries make these incentives available to attract and anchor manufacturing and hence exports in the host location. This is well-established behaviour and the scale of the recurring economic benefit for the host location means that both SMEs and multinational organisations expect to be able to access incentives wherever they look to invest.

The Chemistry Council supports the proposals below made by the Life Sciences Council in their strategy.

The UK should set a target of attracting ten large (£50-250m) and ten smaller (£10-50m) commercial-scale chemical manufacturing facilities in the next five years. At an intervention rate of 10-15%, the low-impact scenarios (10-£10m and 10-£50m investments) would need £60-90m public sector finance and the high-impact scenario (10-£250m and 10-£50m investments) would need £300-450m. The larger financial incentives are more likely to be made available through loans rather than grants. For SMEs, access to market rate loans may be more attractive whereas for larger companies who are better equipped to raise private sector money, loans may only be attractive if offered at below-market rates. Although this might appear costly, it has the potential to capture high-value jobs across the country and generate new business for supply chain companies. It also has a long tail of benefit for the UK trade balance and will substantially influence the ability to close the export gap.

As an energy intensive industry, support is also needed for investment in mature energy efficient technologies with longer payback and for the development, demonstration and deployment of new low carbon technologies. This starts with an effective Industrial Energy Efficiency Scheme for mature technologies. We welcome the potential support for low carbon technology innovation related bids under the Industrial Strategy Challenge Fund and would encourage the Government to build on this with further support for development of low carbon technologies.

Co-ordinated and Expert Support

In addition to offering fiscal and financial incentives, both domestic and international companies should be supported to make the decision to invest in manufacturing in the UK. Competitor countries offer a 'one stop shop', and the UK should seek to emulate this support. The incentives and support that are currently on offer remain highly varied in scope and may be available from a variety of national and local sources. Both domestic and global potential investors have reported that this is a highly challenging landscape to navigate, understand and access.

The Department for International Trade offers free and confidential support for inward investors to make the case to invest in the UK. Once a company has shortlisted the UK, DIT also brokers access to subnational partners and support levers. This could include site selection, skills, supply chain, or regulatory and export support. This same level of support should be made available to scale-up domestic companies.

Offering UK support through the perspective of the company (customer) journey is important. To be internationally competitive, companies need a senior national-level account manager fully accountable for delivery. The majority of support and incentives need to be available "on demand", and sufficiently mobile within the UK even if the offer needs to be drawn from multiple sources. Reviewing the incentives landscape and simplifying the customer journey could boost the UK's chances to win high-value, internationally-mobile investment in advanced manufacturing.

Summary of Finance Priorities

28. Fiscal environment – UK Government should optimise the fiscal environment for manufacturing investment to drive investment in industrial buildings, plant and equipment for manufacturing and late-stage R&D. The Council also recommends that Government:

a. Maintains the commitment to reduce corporation tax to 17% by 2020 and for that level to be regularly reviewed over the next decade as the impact of the country exiting the European Union becomes clearer.

b. Maintains the international competitiveness of allowances and wider support such as the Patent Box in terms of rate and extending the scope to a wider range of IP.

c. Aims to extend its more supportive capital allowance regime for plant and machinery beyond the end of 2020.

d. Extends the current R&D capital allowance to offer a payable credit.

29. Access to finance

a. The UK should set a target of attracting ten large (£50-250m) and ten smaller (£10-50m) commercial-scale chemical manufacturing facilities in the next five years. At an intervention rate of 10-15%.

b. Support is also needed for investment in mature energy efficient technologies with longer payback and for the development, demonstration and deployment of new low carbon technologies. This starts with an effective Industrial Energy Efficiency Scheme for mature technologies.

30. Co-ordinated and Expert Support

a. To be internationally competitive, companies need a senior national-level account manager fully accountable for delivery. The majority of support and incentives need to be available "on demand", and sufficiently mobile within the UK even if the offer needs to be drawn from multiple sources.

Make support and incentives for manufacturing investment and exporting available to business through a single front door, provide a senior national account manager accountable for delivery and simplify the customer journey.

Appendix 1: Acknowledgements

In delivering this strategy we should like to thank members of the Chemistry Council and all members and contributors to the supporting working groups and related themes for their invaluable leadership and commitment to the task. Chemistry Council members are:

Steve Foots, Industry co-Chair, Chief Executive, Croda International plc

Richard Harrington MP, Government co-Chair, Minister for Business and Industry

Paul Booth OBE, Chair of Tees Valley Local Enterprise Partnership

Richard Carter, Managing Director UK and Ireland, BASF

Tom Crotty, Director, INEOS Group

Tony Devlin, National Officer, Unite the Union

Alan Jope, President, Unilever Beauty & Personal Care

Calum MacLean, Chief Executive, Synthomer plc

Robert MacLeod, Chief Executive, Johnson Matthey, plc

Jennifer Peake, Leader of the Chemical Industry Future Forum, Technical Manager, William Blythe

Jakob Sigurdsson, Chief Executive Officer, Victrex plc

Dr Phil Souter, Associate Director, P&G

Harry Swan, Managing Director, Thomas Swan & Co Ltd

Dave Tudor, Pharma Supply Chain, GlaxoSmithKline

Dr Tony Bastock OBE, Chairman, Contract Chemicals Limited

Mark Williams, Vice President Europe, SABIC

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Alliance of Chemical Associations (ACA)

CATCH/Your Connected Future

CEFIC

Centre for Process Innovation (CPI)

Chemical Sciences Scotland (CSS)

Chemicals Northwest (CNW)

Cogent Skills

Department for International Trade

Innovate UK

Institution of Chemical Engineers (IChemE)

Knowledge Transfer Network (KTN)

North East of England Process Industry Cluster (NEPIC)

Royal Society of Chemistry (RSC)

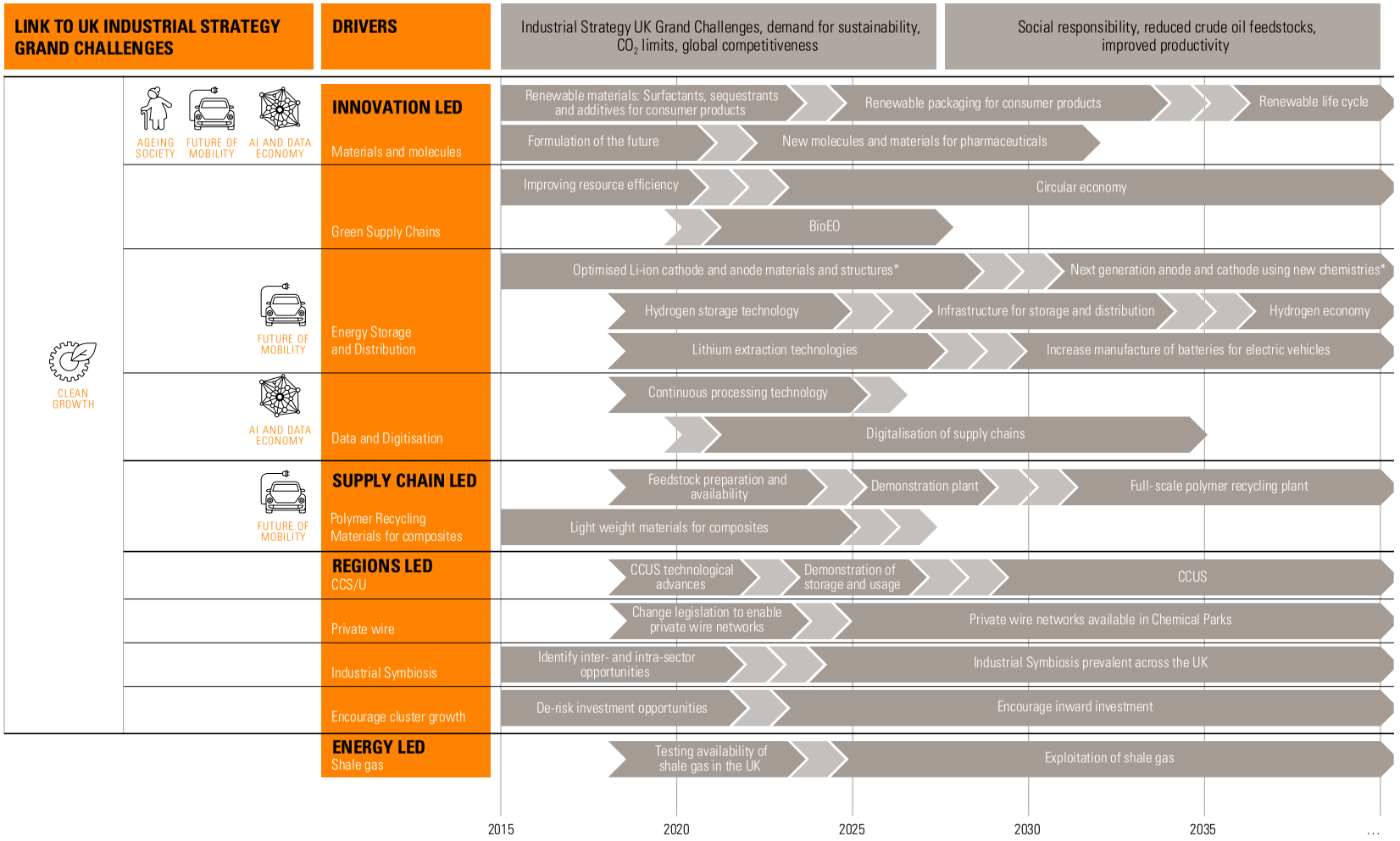
Scottish Enterprise

Tees Valley Unlimited

UK Research and Innovation (UKRI)

Appendix 2: The Chemistry Council Roadmap – Delivering Solutions to the country's grand challenges

CGP Roadmap: Core Projects



* https://www.automotivecouncil.co.uk/wp-content/uploads/sites/13/2017/09/Electrical-Energy-Storage-Roadmap.jpg
** CGP Strategy Document 2018
*** Developing a low carbon future for the chemical industry

1 chevron = some uncertainty around mass market
2 chevron = considerable uncertainty around mass market

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