Life and Chemical Sciences

Manufacturing Strategy for Scotland

Life Sciences in SCOTLAND

Chemical Sciences SCOTLAND

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FOREWORD

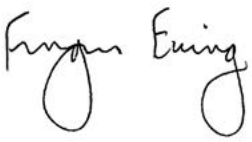
Scotland's Economic Strategy sets out a framework for sustainable economic growth and in doing so, clearly states our ambition to rebalance the economy through a focus on increasing our manufacturing base, internationalisation and inclusive growth.

In Scotland we are fortunate to have dynamic life and chemical sciences sectors, both of which have the capacity, potential and opportunity to strengthen their global base and manufacturing position from our shores. This *Life and Chemical Sciences Manufacturing Strategy* is an industry led strategy supplementing both sectors' existing industry strategies: *Scottish Life Sciences Strategy 2011* and *Platform for Growth – A strategic plan for the Chemical Sciences in Scotland 2012*, respectively.

Life Sciences seeks to double its turnover to £6.3bn by 2020, while Chemical Sciences already has its target to increase exports by 50% by 2020 within its sights. The ambition of this combined sector-specific strategy is to substantially increase Scotland's manufacturing base over the period, and set out the steps as to how this might be achieved. In terms of scale, this means an additional turnover of £5.6bn per annum across the two sectors, which is equivalent to replicating the economic output of Grangemouth, Scotland's largest industrial complex. It is a remit that stretches the industries and is one which the Scottish Government supports the sectors to pursue.

We already have world-scale chemical and life sciences businesses which continue to drive globally competitive positions from Scotland. However, despite recent progress, a commercialisation gap does exist between our manufacturing and world-renowned research base and this must be addressed along with other key areas of challenge: technology scale-up facilities, strengthening supply chains and re-shoring, and, attracting new investment if we are to succeed.

It is essential that we clearly state our manufacturing ambitions if we are to grasp these opportunities to increase sustainable manufacturing in the life and chemical sciences sectors in Scotland. Where challenge exists, so does innovation and I believe Scotland has what it takes to meet these goals.



Fergus Ewing MSP Minister for Business, Energy and Tourism

September 2015

UK MANUFACTURING

Manufacturing in Scotland has great economic potential. It pays around 30% more than service sector jobs[1] whilst also generating 45% more in export revenue[2]. Recognising this, the Scottish Government recently published a paper on reindustrialising Scotland[1], arguing that a stronger manufacturing sector can increase innovation, tackle inequality, support internationalisation and create high-value, well-paid jobs. The UK Government has also argued that a stronger manufacturing sector is essential for a more robust economy, publishing a comprehensive foresight report on the *Future of Manufacturing*[3]. Similarly, the EU is pursuing a strategy for a *European Industrial Renaissance*[4], with manufacturing targeted to grow from 16% to 20% of GDP by 2020.

In developed, high-wage nations, future manufacturing businesses must produce highly differentiated products and related services that can sustain healthy margins. This may be achieved through marketing excellence, product provenance, outstanding quality, innovative design, leading-edge technology, automation or superior business models, combined with optimised manufacturing and business processes.

In 1990 UK manufacturing output contributed around 20% Gross Domestic product (GDP). By 2010 this had fallen to 11% of GDP, where it remains. Other countries, such as Germany and Japan, have retained their contributions whilst others, like China for example, have increased their contribution. Scotland has followed a similar pattern to the UK.

If we are to meet the objectives of both the chemical sciences and life sciences sector strategies, this trend needs to be reversed.

"We have all the necessary attributes and capabilities to deliver strong and competitive high-value manufacturing within the life and chemical sciences sector. Scotland is one of the top five countries in the world for IP generation with access to excellent fiscal measures like the UK Patent Box legislation; there is a competitive and supportive regulatory environment and it is also a great place to live. In addition, we have brilliant young scientists and engineers studying at world-class universities. Pull all these elements together with a large injection of self-confidence and there is no reason why we should not continue to compete successfully on a global level for an increasing number of high value chemical and life sciences projects. This will require Scotland to attract more inward investment, re-shore key elements of the existing supply chains and push hard on skills investment plans."

Dave Tudor, Vice-President of global primary manufacturing GSK

1. www.scotland.gov.uk/Resource/0045/00453082.pdf
2. Scottish Government, 2013, Scotland's Global Connections Survey
3. www.gov.uk/government/collections/future-of-manufacturing
4. ec.europa.eu/enterprise/initiatives/mission-growth/index_en.htm

LIFE & CHEMICAL SCIENCES MANUFACTURING

Scotland's chemical sciences sector has some 200+ core businesses, excluding supply chain, and it punches well above its weight, particularly in global markets. This sector remains one of the highest performing sectors in terms of GVA per employee and export earnings. (At £3.8bn the second highest figure after whisky[5]). Direct employment currently stands at 12,300, GVA at £1.9 billion and the sector has a business turnover of £8.7bn per annum[6]. Companies in the sector have ambitions to grow; from local SMEs and subsidiaries of international companies to global brands such as GSK, BASFPharma, Johnson Matthey, Exxonmobil and Ineos.

Scotland is home to one of the most sizeable life sciences clusters in Europe, with a significant international presence such as Charles River Laboratories, Thermo Fisher Scientific, GSK, Johnson & Johnson, and Optos. With over 600 organisations, ranging from higher education institutions to companies, the total sector employs more than 30,000 people[7]. The latest Scottish Government figures shows turnover in excess of £3.2bn and GVA of £1.6bn for the sector.

"Sustainable manufacturing is hugely important to the Scottish economy if we are to be competitive in global markets. In order to boost Scotland's manufacturing contribution to the life and chemical sciences sectors we need to find smarter and cleverer ways of doing things more quickly across all areas of the sector to ensure companies have the support to develop and grow scalable, sustainable businesses."

Neil Partlett, Managing Director CalaChem

The current size and value of the manufacturing elements of the life and chemical sciences sectors can be readily subdivided as follows: (Scottish Government[5,7])

Area	*Business Units (no)*	*Turnover (£M)*	*Employees (no)*
Medical Technologies	**240**	**1053**	**8500**
Pharma/Fine Chemicals (part of both life & chemical sciences)	**30**	**656**	**3300**
Basic/ speciality chemicals	**200**	**8700**	**9000**
Industrial Biotech	**40**	**189**	**1100**

5. http://www.gov.scot/Resource/0046/00469028.pdf

6. Turnover and GVA: ONS data for SIC codes 19,20 ,21 for 2011 reported by Scottish Government http://www.scotland.gov.uk/Resource/0043/00439641.pdf). Turnover and GVA figures for 2012 are being reassessed as a result of large company reclassifications/restructures, which follows a trend amongst multinational companies towards restructuring on an international basis.

   Direct employment: 9,700 from ONS figures for 2012 http://www.scotland.gov.uk/Resource/0045/00458058.pdf plus employees and on-site contractors at Ineos/PetroIneos Grangemouth complex and ExxonMobil Mossmorran.

7. http://www.scotland.gov.uk/Topics/Statistics/Browse/Business/Publications/GrowthSectors/LifeSciencesSourcebook

MANUFACTURING CHARACTERISTICS OF THE SECTORS

Scotland's chemical sciences sector is dominated by large global players, which in some cases are distanced from their headquarters with many operating as manufacturing facilities with limited research and technology development taking place. The sector has a growing group of technology based SMEs which are developing into smaller scale manufacturing businesses with great potential to develop and grow internationally from a Scottish base.

The academic sector is strong, and despite recent progress, increased interactions with the business base, especially the manufacturing base, are still needed.

The life science sector in Scotland, while including a number of large companies, is dominated by small and even micro businesses. Many of these are pre-revenue and those which are revenue-generating, by virtue of the venture capital-funded nature of the sector, do not seek to manufacture in-house or with our service base in Scotland. Whilst the sector is R & D rich, commercialisation of this knowledge and international knowledge into the manufacture of end (or intermediary) products is an opportunity to be exploited.

"The opening of Scotland's first bio-refinery at our Glenrothes plant is a significant step towards establishing Scotland as a world leader in this sector. To maximise this opportunity and to enable sustainable manufacturing in Scotland to flourish on a global stage, it is vital that we create a supportive and collaborative environment where more businesses are able to scale to manufacture more quickly."

Christian Kemp-Griffin, Chief Executive CelluComp

MANUFACTURING CHALLENGES

Many of the generic issues in manufacturing relate to ensuring the manufacturing base in Scotland is globally competitive and remains at the forefront of technological development. Input costs such as energy, utilities, raw materials and availability of cross-functional skills are all issues consistently cited by the business base.

To remain globally competitive, businesses also need: efficiencies in resources, processes, security and surety of supply, access and availability of funding, innovative supply chains and skills availability.

The sectors need to be able to access new concepts in manufacturing best practice and new technologies to keep them at the forefront of thinking and manufacturing development into the future, and be able to influence global company decision makers, that Scotland is a location for future new product/process development.

"For manufacturing to succeed in Scotland, companies in the life and chemical sciences sectors need to be thinking about this at the outset on day one. Manufacturing should be seen as an integral part of the product development process, not just an add-on."

Sarah Jardine, Director of Manufacturing Optos and Chair of Scottish Manufacturing Advisory Service (SMAS)

UNCONVENTIONAL GAS(ES)

Any manufacturing strategy involving the chemical sciences sector, should consider the question of using unconventional gas(es) in order to reduce energy costs and generate a secure supply of energy and chemical feedstocks. It is well recognised that this is a contentious and emotive issue. The chemical sciences sector has suggested that Scotland should learn from the experiences in the USA, and the transformational change which has occurred as a result of their energy and feedstock self-sufficiency, by accessing previously untapped unconventional gas sources.

The Scottish Government has recently announced a moratorium on all planning consents for unconventional oil and gas extraction to allow time for further research and a full public consultation to take place[8].

At the time of publication, the timeline for the public consultation has not been set out. The chemical sciences sector welcomes being included in the debate and must position itself to manage the outcome once it has been determined.

"Grangemouth is fast becoming a significant hub for the chemical sciences sector in Scotland. It is a great location for manufacturing companies and we are keen to build on this expertise to create a cluster of world-class companies that range across the sector spectrum. We are especially keen to work with other businesses and assets in the area to attract overseas companies to locate or re-shore in Grangemouth."

John McNally, CEO INEOS O&P

8. http://news.scotland.gov.uk/News/Moratorium-called-on-fracking-1555.aspx

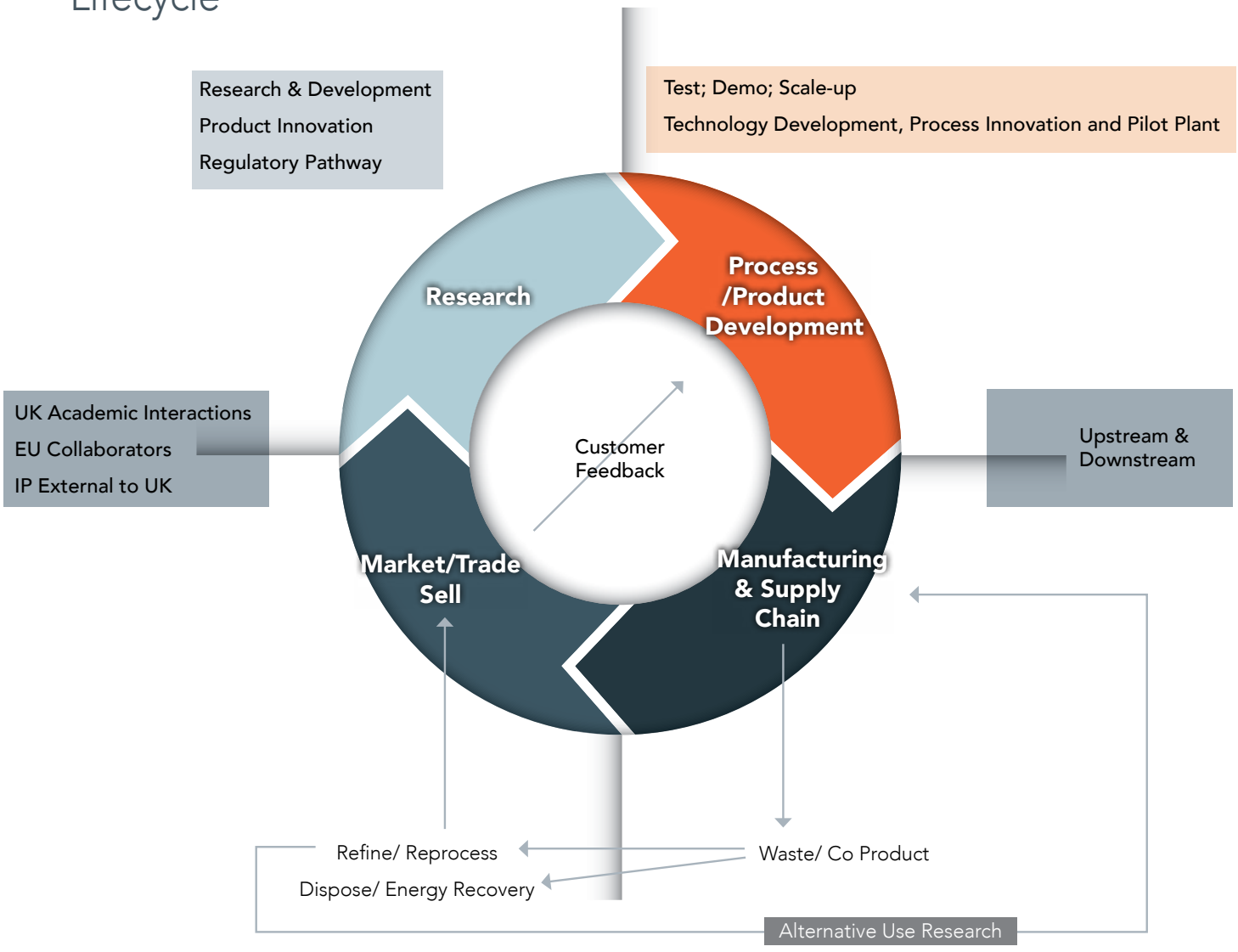

INEOS
INEOS

GROWTH OPPORTUNITIES & MANUFACTURING FOCUS

The potential for growth on a global scale over the next 20 years is huge, particularly in fast-growing sectors. Sustainable manufacturing has a major part to play in developing innovative products, processes and solutions to drive export opportunities, strategic partnerships and long-term growth.

The approach has been developed across the whole manufacturing lifecycle:

Lifecycle



The areas of focus which offer the greatest manufacturing growth potential are based on a number of criteria: those which contribute most to the chemical science and life science sectors in manufacturing terms; those which are growing globally; those with which the sectors themselves believe Scotland has a competitive and compelling offering, and through which we can win business to Scotland.

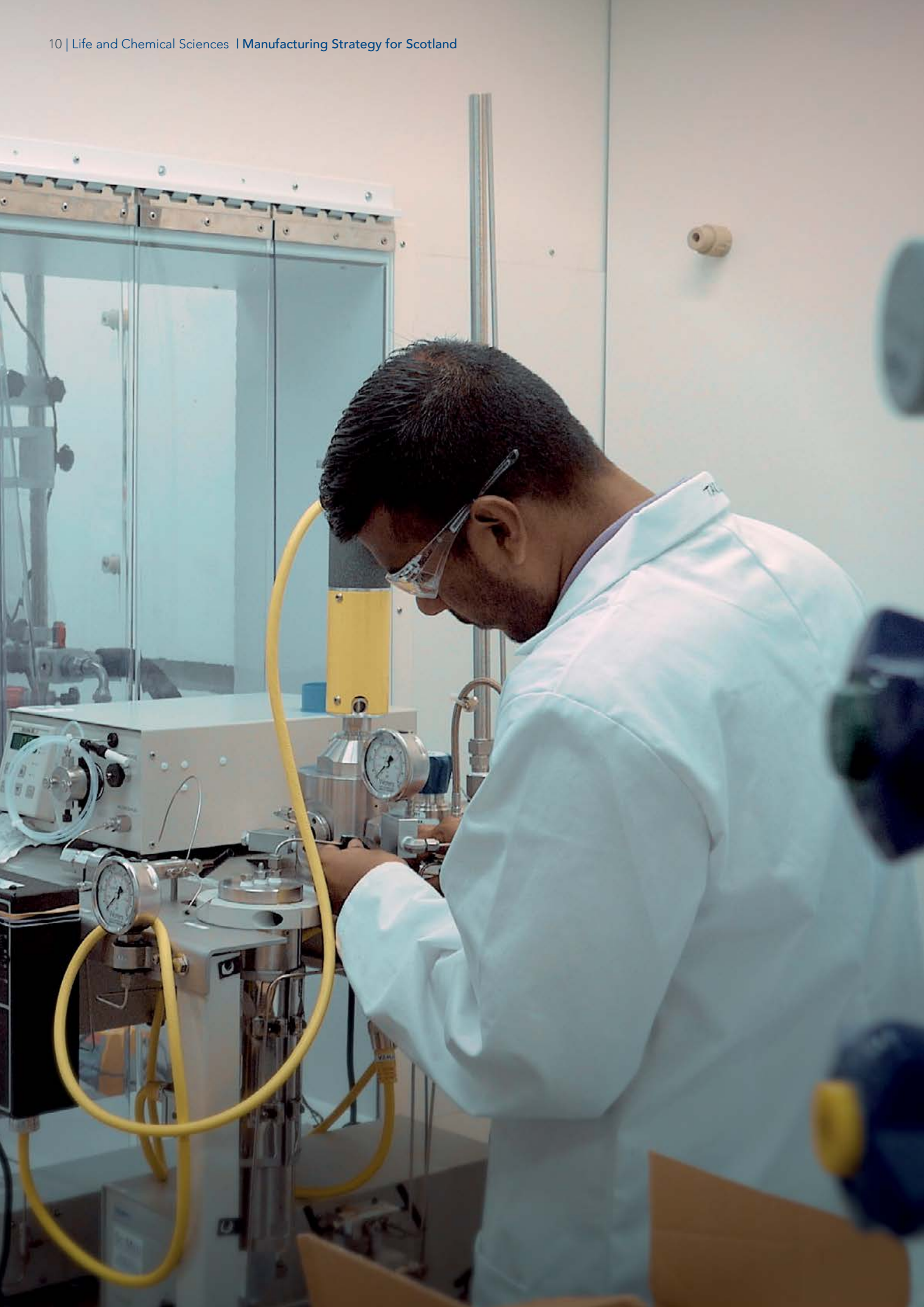
These currently include:

- Fine Chemicals/ Pharmaceuticals
- Speciality Chemicals (including agrochemicals)
- Industrial Biotechnology
- Medical Technologies
- Pharma Services
- Commodity Chemicals (through supply chain)

These are the main opportunity areas and are therefore the priorities for the sectors in which increased manufacturing activity is likely to be generated.

"Having successfully produced the first samples of bio-butanol from the by-products of whisky fermentation, we are arranging the investment to scale-up to industrial production and prove that this works at scale. Encouraging more investment and collaboration in the sustainable manufacturing sector will help accelerate the rate of growth of companies like ourselves as we work towards a first demonstration facility at Grangemouth."

Martin Tangney, President Celtic Renewables



STRATEGIC PLAN

The aim of this plan is to achieve the objectives of the strategies for both chemical sciences and life sciences through increasing the contribution manufacturing makes in both of these sectors.

There is no doubt that the scope of ambition for these two sectors to substantially increase manufacturing turnover from the current annual level of £9.5bn to £15.2bn over the next five years is a challenge[9,10].

However, the similar vision shared by life and chemical sciences offers great potential to harness these synergies to maximise cross-sector opportunities. A strong platform for manufacturing growth might be established through the development of stronger, more facilitated, engaged and collaborative industry groups, and with strong communication between both the life and chemical sciences sectors, it should be possible to deliver these objectives.

The action plan going forward has been developed around five key areas:

Leadership confidence and promoting manufacturing

Research Commercialisation

Technology Development and Scaling

Supply Chains and Re-shoring

Investing in Scotland

9. http://www.scottish-enterprise.com/knowledge-hub/articles/insight/life-sciences-scotland-2020-vision
10. http://www.scottish-enterprise.com/~/media/se/resources/documents/sectors/chemical%20sciences/platform%20for%20growth.pdf

The principal actions to deliver the strategic plan in these key areas are as follows:

Leadership confidence and promoting manufacturing

Scotland has a strong industrial and engineering heritage and many of the innovations we use today were developed and made first in Scotland. Manufacturing suffers from the perception of being a low value, low skill, manual plant syndrome. In fact, manufacturing in Scotland today is high value, in a hi-tech clean environment which covers the whole spectrum from R & TD through to final product. Scotland's leaders need to be confident about saying we are a manufacturing nation, that our knowledge is good, AND we make things - well!

Priorities:

- Empower companies and business leaders to become ambassadors to attract new investment into Scotland
- Maximise our networks to ensure Scotland is recognised as a leading location for sustainable high-value manufacturing in both chemical and life sciences both domestically and internationally
- Seek to develop a 'product design to manufacture' mindset
- Ensure that we develop a comprehensive skills pipeline across all disciplines and roles

Research Commercialisation

When it comes to research in the life and chemical sciences, Scotland currently punches well above its weight. Researcher for researcher, Scotland produced more publications and citations respectively than the rest of the world and is consistently ranked in the top three European countries, out-performing Germany, France and the UK.[11,12]

Similarly, the UK-wide ranking of university research (REF 2014) showed that Scotland has two of the top three institutions in the UK for biological sciences research and three of the top ten institutions in the UK for chemical sciences research.[13]

However, despite recent progress, a gap exists in the translation of research into application as little of this makes its way into the Scottish manufacturing base. In addition, we need the flexibility to import Intellectual Property (IP) when required to enable our business base to access global expertise which can assist their manufacturing operations in Scotland.

Priorities:

- Work in partnership with key stakeholders to improve Scotland's innovation performance, and ensure manufacturing is recognised as part of this agenda
- Ensure we have mechanisms in place which support cross-border transfer of IP including participation in Vanguard[14], Bio Based Industries Joint Undertaking (BBI)[15] and Sustainable Process Industries through Resource and Energy efficiency (SPIRE)[16] along with other EU delivery mechanisms that support manufacturing in Scotland
- Review funding packages in Scotland to ensure they are competitive with other competitor locations and influence government where new initiatives, or changes to existing practises, might be needed

11. www.sdi.co.uk/knowledge-hub/articles/publication/scottish-chemical-sciences-research-base
12. http://www.sdi.co.uk/knowledge%20hub/articles/insight/scottish%20life%20sciences%20research%20among%20worlds%20best?anchor=q=elsevier
13. http://results.ref.ac.uk/Results/SelectUoa
14. http://www.s3vanguardinitiative.eu/
15. http://bbi-europe.eu/
16. http://www.spire2030.eu/

Technology Development and Scaling

Few small and new-start companies have scale and manufacturing as key objectives. Many have a short-term view to sell and let others manufacture in other locations, or subcontract their manufacturing needs. Indeed, many manufacturing businesses have limited knowledge of facilities which might assist them to scale. Additionally, some larger businesses are 'branch plants' with limited access to, or influence on, the key decision makers when it comes to investing in research and technology development for tomorrow's products and processes.

Priorities:

- Ensure that the Scottish industry has access to key Scottish academic and other technological expertise to enable industry issues to be resolved and collaborations among industry and academia around maufacturing to be strengthened
- Consult with industry to understand the needs and opportunity gap; and work with partners to develop a comprehensive provision of facilities, both in Scotland and at a UK level, where Scotland plays a key role
- Undertake primary research to determine other areas of expertise which might offer Scotland a global competitive advantage e.g. formulation and synthetic biology
- Actively promote the benefits of the circular economy and green chemistry techniques by using biotechnology in processes, process and resource efficiency, continuous manufacturing, process innovation and de-risking as well as waste minimisation and sustainable product design

Supply Chains and Re-shoring

Many existing manufacturing businesses are re-visiting the UK as a location of choice due to the high quality of our manufacturing base, highly skilled workforce, our health and safety and regulatory regimes and our quality standards. In addition, many companies are seeking opportunities to use our supply chain base as investment levers to bring consistency and quality to their supply chains which will de-risk their manufacturing facilities if supply chain businesses can demonstrate capability in, and understanding of, regulatory requirements.

Priorities:

- Develop a comprehensive action plan on supply chains which brings innovation, regulatory compliance and efficiency into the supply chain and articulates clear action for delivery
- Develop innovative and effective supply chains which can add value to the Scottish offering and also be used to attract new investment due to their strength and depth
- Highlight best practice, sharing knowledge and expertise with other businesses; for instance companies like Toshiba and GlaxoSmithKline whose supply chains are driving investment
- Build up Scotland's services offering, for instance the Grangemouth Cluster and Irvine Bay, to attract other manufacturing companies

Investing in Scotland

Many of Scotland's global manufacturing players have historically been located here to service the EU market. Whilst this remains true to some extent, there is huge potential for these and other businesses to be global organisations operating from a Scottish base. Scotland needs to develop and share its success stories much more widely and be confident about its global offering.

Priorities:

- Work across the sectors to promote manufacturing as an important part of the business base aligned with other important areas such as R & TD and sales and marketing
- Develop more ambitious plans to attract new investment, particularly from outwith Scotland
- Develop innovative new models for attracting new investment, including investment in capital assets
- Pro-actively target key businesses which can enable more business to be placed in Scotland
- Review our current investment offering and ensure it is 'world class' to attract the type of high-calibre manufacturing projects we seek

CALL TO ACTION

We hope you will have taken on board the strong proposition outlined in this strategy for Scotland's life and chemical sciences sectors to increase significantly their manufacturing activity, and in turn, their contribution to the economy. This will not happen on its own. Therefore we believe it is imperative that industry works closely together with government and agencies in a concerted effort to exploit the many opportunities that are at hand.

To make a difference, all elements of the strategic plan must come into play. We, as industry leaders, must get actively involved and ensure that our businesses and people:

- Collaborate across sectors to ensure we have a skills pipeline which will enable our sectors to flourish
- Work with government and agencies to support a reliable, cost effective, and sustainable energy policy
- Be willing exemplars to promote manufacturing and also Foreign Direct Investment (FDI)
- Have a collective input to the broad regulatory and business environment
- Work together to develop innovative, collaborative, and competitive supply chains that link our natural assets, manufacturing strengths and export potential
- Collaborate with our outstanding science base to invent, exploit and commercialise new manufacturing technologies for domestic and international use

The single action that will have the biggest impact is for business leaders to be willing to work collectively and collaboratively to help deliver this vision.

There are undoubtedly challenges, but in Scotland we are fortunate that we have competitive advantages to help position the country as a world-leader in these sectors. We currently have one of the best tax regimes for R&D in the world through Patent Box[17], access to grants, enterprise areas and a highly skilled stable workforce alongside a committed and accessible government. We need to harness these key elements to produce maximum benefits for companies from across our sectors and thus for Scotland as a whole.

The importance of the chemical science and life science sectors to the Scottish economy was emphasised by Deputy First Minister, John Swinney, when he announced that the Scottish Government's revised economic strategy will be based around innovation, investment, international activity and inclusive growth. This is further reflected by having a minister dedicated to working with these sectors - Mr Ewing MSP, Minister for Business, Energy & Enterprise - who has endorsed this strategic plan.

If everyone plays their part, Scottish companies in life and chemical sciences can look forward to a productive, rewarding and inclusive future. All it takes is the self-confidence to take the first step on this journey to success. You will be encouraged to join task groups delivering on specific topics and we look forward to working with you.

Bob Tooze
Chemical Sciences Scotland

John Brown
Life Sciences Advisory Board

17. http://www.hmrc.gov.uk/manuals/cirdmanual/CIRD200110.htm

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Scottish Enterprise
Atrium Court
50 Waterloo Street
Glasgow
G2 6HQ

Helpline:
0845 607 8787

Email:
Enquiries@scotent.co.uk
www.scottish-enterprise.com

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