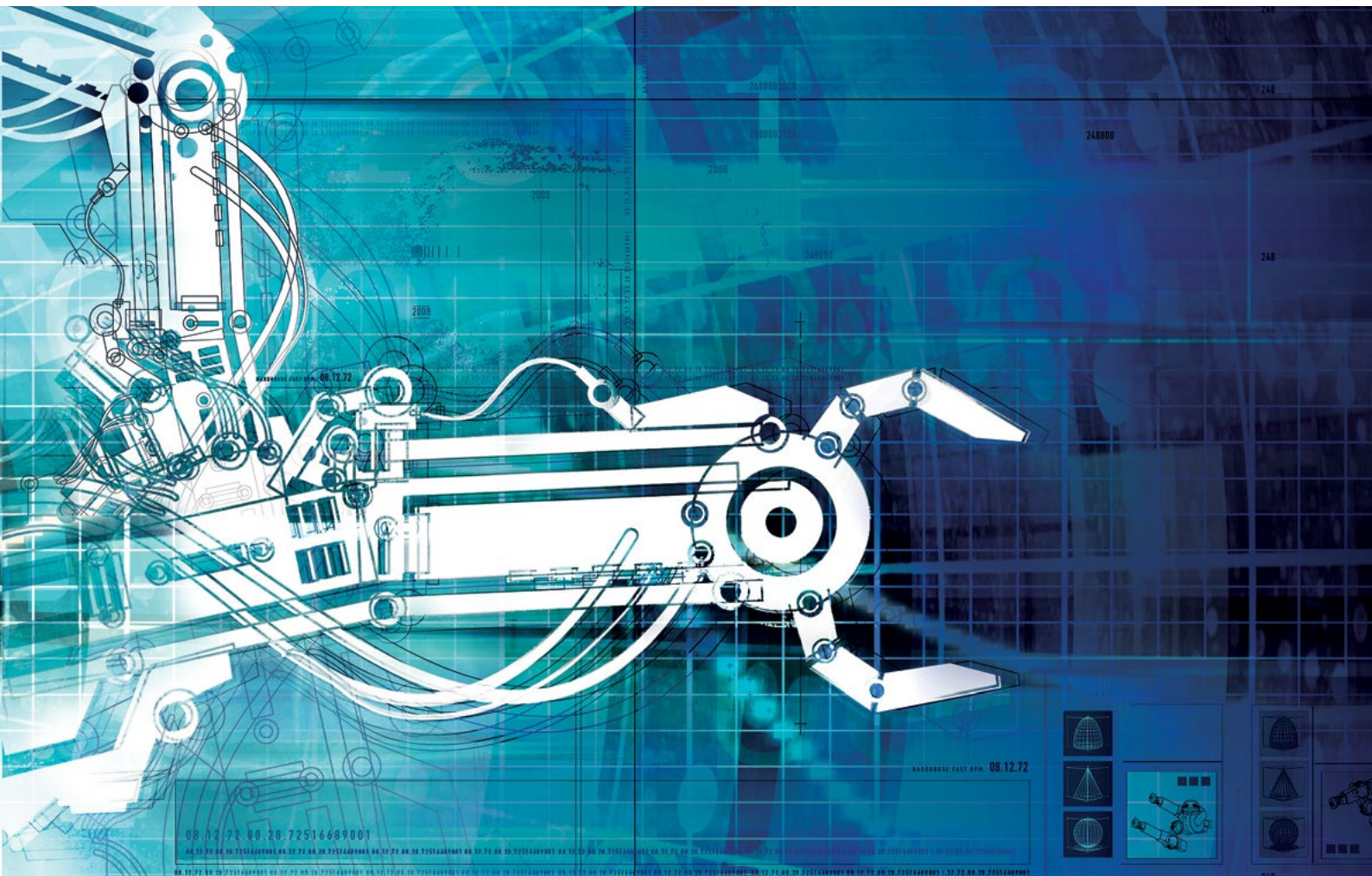


A Manufacturing Future for Scotland



Scottish Funding Council
Promoting further and higher education

Innovate UK

Skills
Development
Scotland



SMAS
Scottish Manufacturing
Advisory Service


Highlands and Islands Enterprise
Iomairt na Gàidhealtachd 's nan Eilean


The Scottish Government
Riaghaltas na h-Alba


Scottish Enterprise

MINISTERIAL FOREWORD

DEPUTY FIRST MINISTER AND CABINET SECRETARY FOR FINANCE, CONSTITUTION AND ECONOMY



Scotland has a proud manufacturing heritage. We have an innovative and diverse manufacturing sector, boasting world-class dynamic companies competing in international markets.

These firms have the capacity, potential and opportunity to grow through the adoption and development of innovative products and services. Some sectors, such as the steel industry, have faced particular pressures but remain vital strategic assets in the Scottish economy.

Scotland's Economic Strategy sets out an overarching framework for delivering a more productive, cohesive, and fairer Scotland through a greater focus on investment, innovation, and internationalisation with more export orientated growth.

Manufacturing can play a crucial role in boosting Scotland's productivity performance through contributing to improvements against all of these priorities. The sector can also support inclusive growth, a central part of our economic strategy, by helping to address regional imbalances through local spillovers and supply chain linkages, whilst providing jobs that are typically high-skilled and well-paid.

Manufacturing is continually evolving, increasingly IT driven, and encompasses a wide variety of activities across a range of industrial and service sectors. Our support for the future of manufacturing in Scotland is framed from this starting point.

The Action Plan is based on a commitment to raising productivity through increased investment and innovation and a long-term partnership between government, industry, our Enterprise Agencies and other key stakeholders.

We are committed to supporting manufacturing businesses to grow and to invest in product, process and service innovation and will establish a new joint Manufacturing Centre of Excellence and Skills Academy. We will help firms exploit significant opportunities to improve productivity and business

performance through workplace innovation, including through the launch of a new Workplace Innovation Service which will align with this Action Plan. We will also be looking at how best to support innovation in the manufacturing sector as part of our innovation reform work.

The circular economy provides new opportunities for manufacturing firms to innovate and rethink how their business operates in order to find new ways to reduce waste, become more efficient and improve design and manufacturing processes to extend the product life-cycle. We will launch an enhanced programme of support for firms to realise these opportunities backed by new resources from the European Regional Development Fund as part of our forthcoming circular economy strategy.

We must develop a manufacturing proposition that embraces new digital technology, products and services (such as re-manufacture or repair) and makes use of the skills available in Scotland, particularly the talent in our Universities and Colleges. *A Manufacturing Future for Scotland*, seeks to re-imagine and re-position manufacturing here in Scotland as an essential sector in our approach to inclusive growth.

The more businesses we have making innovative products, providing ancillary services and expertise, and competing successfully on the world stage, the more prosperous our country will become.

Scotland has the skills, resources and capabilities to grow these businesses. We will assist that through the actions set out in this Plan.

My challenge to you is to adapt to new opportunities, seek out the support available to you, and build on the incredible human talent and physical resources we already possess.

John Swinney MSP

February 2016

INDUSTRY ENDORSEMENT FROM SARAH JARDINE

CHAIR OF SCOTTISH MANUFACTURING ADVISORY BOARD



Scotland's wide-ranging manufacturing industry plays a central role in sustaining and growing our economy. The products we create, from world renowned food and drink to textiles and pharmaceuticals, represent over 50 per cent of our international exports and 54 per cent of our expenditure on research and development.

The 189,000 people¹ employed by our manufacturing companies are at the heart of our high skills – high wage economy with average earnings in the manufacturing sector above the Scottish average.

I am privileged to serve our manufacturing industry as Chair of the Scottish Manufacturing Advisory Board. This position offers a unique perspective of the companies that see Scotland take centre-stage among global manufacturers. I see an amazing heritage, world-class new product development and a talented and committed workforce with an invaluable level of expertise.

However, if the manufacturing industry is to really strengthen Scotland's economy and pave the way for the future prosperity that will see our society and communities thrive, then implementing this action plan is vitally important.

Although our foundations are strong, to really compete on the world stage and maximise the economic return from our efforts and capabilities, there needs to be a determined and intense focus on further improving our productivity. It can only be achieved by clear investment in people, resources, assets and capability.

We must nurture our existing leaders and attract and retain the very best talent if we are to create visionary leadership. We need the most talented individuals who will inspire industry to integrate new technology and innovation, adopt new methods and processes and truly internationalise their businesses. A focus on leadership development is critical to ensuring that our plans become a genuine success.

I believe that, used to their full potential, the resources offered as part of the Action Plan will help your business play its part in transforming Scotland's economic capability. The Scottish Government's significant investment to improve resource efficiencies and our commitment to complete 600 enhanced asset reviews over the next three years is a serious commitment to strengthening our manufacturing base and ensuring it plays a central role in Scotland's economic performance over the next decade.

I really encourage you to take advantage of this commitment and to work with your organisation, your peers and with the resources and expertise available to you within the agencies and organisations supporting this plan to take forward the eight action areas identified.

Although it's a really exciting time to work in the manufacturing sector, we do face significant challenges ahead. Only by working together will we achieve meaningful change and secure our position as a leading net exporter and to establish a world-class 21st century manufacturing economy. Scotland deserves

1. Source: Business Register and Employment Survey 2014, Office for National Statistics

HOW THIS PLAN COMPLEMENTS INDUSTRY AMBITION FOR GROWTH

This Action Plan sets out a course of action that is complementary to the growth strategies established by the various manufacturing intensive sectors. These supporting plans set out the specific opportunities and challenges for each industry in addressing the manufacturing agenda. It is expected that by collaboration and cross-sector co-operation greater impact can be realised than may otherwise be achieved.

The various sectors have recognised Industry Leadership Groups (ILGs). These groups, led by representatives from industry and supported by public sector bodies, continue to develop sector specific growth strategies and action plans which highlight specific opportunities for development and growth.

The first of these, the *Life and Chemical Sciences Manufacturing Strategy 2015-20²⁰*, was published in September 2015. It focuses on narrowing the commercialisation gap between manufacturing and the research base; increasing technology scale-up facilities; strengthening supply chains and re-shoring; and, attracting new investment, all within the particular context of the life and chemical sciences sector in Scotland.

It is planned that other key manufacturing sectors including Aerospace, Defence and Marine, Food and Drink, and Textiles, will also bring forward refreshed strategies that set out their plans for their respective industries over the next 18 months.

Close co-operation between those bodies involved in the delivery of the Manufacturing Action Plan and the various sector leadership groups will ensure alignment between this overarching plan and each industry strategy. This will deliver a more integrated and coherent approach to support for manufacturing industries.

SUMMARY OF KEY ACTIONS

A Manufacturing Future for Scotland sets out an Action Plan to work with industry to:

- Deliver concrete initiatives to boost productivity including leadership, employee engagement and skills, energy efficiency and the adoption of circular economy approaches across the manufacturing sector.
- Stimulate innovation and investment in Scottish manufacturing sectors to better compete globally.

To deliver these ambitions, the Scottish Government, the Enterprise Agencies and other public agencies will:

- Launch an enhanced programme of support to enable companies to capture new opportunities presented by the circular economy - and its impact on product design, manufacturing process and supply chains - through Zero Waste Scotland's new European Regional Development Fund Circular Economy Programme.
- Establish a new joint Centre for Manufacturing Excellence and Skills Academy to act as a hub for continuous innovation in manufacturing that can sustain globally competitive businesses in Scotland.
- Assist companies to assess the benefits of investing in advanced manufacturing technologies and equipment and provide investment case support through an enhanced Scottish Manufacturing Advisory capital asset review service.
- Address anticipated skill demands by promoting STEM subjects throughout the school curriculum and improving engagement between industry and education.
- Create momentum behind national ambitions for more, industry-led innovation including providing support for firms to increase workplace innovation through the new Workplace Innovation service which will be launched in 2016.
- Support manufacturing SMEs to keep pace with technology and process developments by working in partnership with industry to develop and deliver a Smart Manufacturing Excellence Programme.
- Support more Scottish companies to achieve supply chain excellence by reviewing sector and cross-sector supply chain capabilities; and launching two re-shoring pilot projects.
- Develop a performance management framework to monitor progress.



INTRODUCTION

No one should be in any doubt about the importance of Scotland's manufacturing industry to our future success. Overall, manufacturers employ around 190,000 people in Scotland³, produce over 50 per cent of Scotland's international exports⁴ and are Scotland's biggest investors in business research and development (R&D)⁵. Together these businesses are creating jobs, driving growth and boosting productivity across the country.

Manufacturing is not only a proud part of Scotland's rich heritage but also has the potential to be a key driver of our future prosperity through global exports. That's why the Scottish Government and its agencies have made it a priority to work with Scottish manufacturers to support increased levels of trade and investment, increase apprenticeships, and promote innovation.

Manufacturing industries have undergone a significant transformation in recent decades. The challenges brought by the increasingly global nature of the modern economy have profound implications for the sector.

Since the 1970s the economies of both Scotland and the UK have seen a marked change in structure, with the contribution of manufacturing in the economy declining a share of GDP⁶. The emergence of new economic centres in the East, a reduction of trade barriers, lower transportation and communication costs as well as the development of new labour saving technologies have all acted to intensify competition.

Some of the decline in the relative importance of the sector can also be explained by the shift towards an economy that is increasingly underpinned by service-related industries. This pattern can be observed across all advanced economies. However, many comparable international economies continue to outperform both Scotland and the UK in terms of manufacturing, with associated implications for important drivers of productivity including trade and investment in R&D.

Recent macroeconomic trends have compounded this already challenging global environment for manufacturers. In particular, the historically high value of Sterling, low commodity prices and the muted global economic outlook have all impacted on profitability and export activity.

These trends mean that any analysis of the sector must acknowledge the importance of high value, advanced manufacturing. Modern manufacturing companies operate in an environment of rapid technological change and increased competition. They also operate across producer networks and industrial sectors.

In developed, high-wage nations, manufacturing businesses must therefore produce highly differentiated products and related services that can sustain healthy margins. To achieve this, Scottish manufacturing is increasingly adopting advances in technology - becoming highly-automated and IT-driven. These advances in modern manufacturing technologies make factories smarter, safer, more efficient and environmentally sustainable. However to remain competitive, Scotland needs to do more.

This will require co-ordinated and sustained action by industry, government, and other key stakeholders. It can be achieved through the adoption of the most productive and energy efficient technologies, continued investment in skills, improving access to patient, committed finance and developing the capabilities of industry.

The action plan acknowledges the critical role that our key sectors and industry leadership play in driving sustainable and inclusive growth in manufacturing. It is the result of a One Scotland approach involving the public and private sectors in Scotland and beyond, including Scottish Government, Scottish Enterprise, Highlands and Islands Enterprise, Skills Development Scotland, the Scottish Funding Council, Zero Waste Scotland, Innovate UK and representatives of the manufacturing industry and trade unions.

3. Source: Business Register and Employment Survey 2014, Office for National Statistics

4. Source: Export Statistics Scotland 2014, Scottish Government

5. Source: Business Enterprise Research and Development Scotland 2014, Scottish Government

6. *Reindustrialising Scotland* (<http://www.gov.scot/Publications/2014/06/5184>) provides a detailed analysis of trends in manufacturing in Scotland, the UK and international competitors.





A PRIORITY FOR SCOTLAND

An enhanced role for manufacturing has the potential to drive investment, innovation, productivity and internationalisation, as well as supporting inclusive growth by providing well paid and highly skilled employment opportunities across the country.

In Scotland manufacturing represents just 10 per cent of total Gross Value Added⁷ but accounts for 52 per cent of international exports⁸ and 54 per cent of all Scottish business R&D spending⁹. Manufacturing jobs also help drive the prosperity of many regional communities around Scotland with average wages in the sector above the Scottish average¹⁰.

Boosting productivity will be key to driving long-term growth in the manufacturing sector. In order to improve performance, industry must be ready to embrace and implement technological innovations, new methods and processes and resource efficient business models into the manufacturing base. This investment will also help to secure a balanced and resilient economy.

This plan addresses the Scottish Government's desire, as expressed in *A Stronger Scotland: The Government's Programme for Scotland 2015-16*¹¹, to work with industry to:

- Deliver concrete initiatives to boost productivity including leadership, employee engagement and skills, energy efficiency and the adoption of the circular economy across the manufacturing sector.

- Stimulate innovation and investment in Scottish manufacturing sectors to better compete globally.

Over the next three years the *One Scotland* partners will work together to deliver a series of actions to increase levels of investment in Scottish manufacturing and strengthen resilience in the face of fierce global competition and volatile commodity prices. These actions will reflect the importance of manufacturing to the delivery of *Scotland's Economic Strategy*¹² and the four drivers of a fair and prosperous economy: Inclusive Growth; Investment; Innovation; and Internationalisation.

Inclusive Growth

Manufacturing is present in all areas of Scotland but tends to constitute a larger proportion of employment outside the major cities¹³. Manufacturing can play a key role in local economies, bringing in investment, creating trade links, and supporting the local economy. As such, it can make an important contribution towards regional equity.

It is people, whose skills will define the success of manufacturing, from industry leaders to new entrants to the workforce. It will be vital to future competitiveness to engage the entire workforce in supporting innovation and the adoption of new processes and technology. The new Workplace Innovation Service offers additional support and measures to support Scottish manufacturers maximising the return from existing and future investments.

7. Source: Quarterly Nation accounts 2015 Q2, Scottish Government – based on year 2014 data.

8. Source: Export Statistics Scotland 2014, Scottish Government

9. Source: Business Enterprise Research and Development Scotland 2014, Scottish Government

10. For example, median annual gross earnings, for full-time employees in Scotland, in the manufacturing sector (£28,685 in 2015) are above the Scottish median (£27,710). Earnings are particularly high in a number of subsectors including pharmaceuticals (£40,436) and repair and installation of machinery and equipment (£39,195). Source: Annual Survey of Hours and Earnings 2015

11. <http://www.gov.scot/Resource/0048/00484439.pdf>

12. <http://www.gov.scot/Publications/2015/03/5984>

13. <http://www.gov.scot/Publications/2014/06/5184>

Manufacturing offers a wide range of career opportunities from unskilled work to highly skilled technical and managerial positions. However, compared to the general economy, it is notable that over a quarter of employment is in the skilled trades occupations¹⁴ – work that typically requires vocational qualifications. Through this plan we will develop and implement a new collaborative approach to addressing future manufacturing skills needs.

One of the challenges in manufacturing is a marked under-representation of women in the workforce. For example, only 27 per cent of manufacturing sector workers are women¹⁵. A major factor is qualification choices, with fewer women taking STEM (Science, Technology, Engineering Maths)-oriented degrees and modern apprenticeships. Through this plan we will ensure that future investment in STEM education and training includes consideration around how to shift the gender balance.

This aligns with the aims of the *Developing the Young Workforce Strategy*¹⁶ which encourages diversity in the workforce, including ensuring in the senior phase of school young people should not be gender stereotyped when considering career choices. School and employer partnerships, work placements and the career education standards will be important in tackling this inequality and helping young people improve their understanding and readiness for employment.

Investment

There is considerable scope to strengthen Scottish manufacturing performance through investment.

Accelerating adoption of best practice and leading-edge technologies will be crucial to the future success of Scottish manufacturing. Investing in energy-efficient plant and resource efficiency measures will offer long-term financial paybacks

as well as accelerating the de-carbonisation of manufacturing.

Through the Scottish Manufacturing Advisory Service (SMAS) we will introduce a new enhanced asset review service to manufacturing companies focused on the optimal deployment of technology solutions to achieve maximum impact. The aim is to complete over 600 reviews during the next three years.

Analysis also highlights that many SMEs need support and encouragement to prepare and submit investment cases to capital asset finance providers. To support this and as part of the commitment to the Scottish Business Development Bank through SIB we are expanding and developing financial readiness support with a major focus on increasing support for manufacturing businesses.

Public sector partners in Scotland are working together in a Decarbonisation of Industry Steering Group. This promotes and co-ordinates action to support energy intensive industries in making the transition to lower carbon forms of production. It specifically helps to them to deliver their emissions reductions under the EU Emissions Trading System and to meet legal obligations such as the UK Climate Change Levy and Energy Savings Opportunity Scheme (ESOS). Beyond this they can consider what further support will be needed to deliver emissions reduction and energy efficiency improvements in future.

Innovation

This action plan aligns with and creates momentum behind national ambitions for more industry-led innovation. There are opportunities to encourage and support more manufacturing businesses to invest in product, process, service and workplace innovation.

A new joint Manufacturing Centre of Excellence and Skills Academy will be established as a hub for

14. Source: Annual Population Survey 2014, January to December

15. Source: Annual Population Survey 2014, January to December

16. https://www.educationscotland.gov.uk/Images/DYWResponseYouthEmpl%20Strategy_tcm4-853595.pdf

continuous innovation in manufacturing that can sustain globally competitive businesses in Scotland. Manufacturers and suppliers will have access to a range of expert services, advanced demonstrator facilities and training programmes all focused on innovative manufacturing.

Workplace innovation, the improved deployment of staff to enhance employee engagement, productivity and business performance, offers significant scope to support the growth of manufacturing businesses. Scottish Enterprise and Highlands and Islands Enterprise will introduce a new Workplace Innovation service in 2016 which will align with this Action Plan. This new approach will help companies embed a holistic approach to work organisation, staff development and workplace partnership. It will offer a range of support including awareness raising, company engagement, master classes, learning journeys and best practice visits.

In the next decade, digital manufacturing technologies will allow companies to connect physical assets by a “digital thread”—unleashing a seamless flow of data across the value chain that will link every phase of the product life cycle, from design, sourcing, testing, and production to distribution, point of sale, use, servicing and potentially reuse.

Building on Scotland’s Digital Future¹⁷ this action plan will support and implement additional measures to encourage and support our manufacturing businesses to put investment in the best available technologies at the core of their business going forward.

The circular economy provides a compelling framework for re-thinking how businesses operate in the 21st century. It aims to eradicate waste, not just from manufacturing processes, but also systematically throughout a product’s life-cycle. *Making Things Last*, the Scottish Government’s forthcoming circular economy strategy, will include a strong innovation agenda – in product specification and design, product manufacturing and remanufacturing, supply chains and product stewardship, business models and customer relationships. The actions outlined in this plan form a key part of the overall circular economy strategy, and will seek to maximise circular economy opportunities across manufacturing, closely aligned with the other action themes within this plan.

We have already established the Scottish Institute for Remanufacture¹⁸ to provide a centre of expertise, increasing innovation by co-funding collaborative projects between industry and higher education institutions, and developing a remanufacturing community involving businesses and academics. We want to ensure the Institute stays at the cutting edge, helping remanufacturing businesses to grow and innovate.

In addition, to assist manufacturing companies in trialling and adopting new circular economy practices, such as product or design innovation and new circular business models, a key early action will be the implementation of a new Circular Economy Programme of advice and support backed by European Regional Development Funding (ERDF).

17. Scotland’s Digital Future outlines the steps that are required to ensure Scotland is well placed to take full advantage of all the economic, social and environmental opportunities offered by the digital age. Further information on key actions can be found at: <http://www.gov.scot/Topics/Economy/digital>.

18. <http://www.scot-reman.ac.uk/>

Internationalisation

Manufacturing accounts for 52 per cent of Scotland's international exports¹⁹ and our ability to strengthen Scottish manufacturing's position within global supply and value chains is crucial to future success in both trade and attracting inward investment.

The actions in this Plan support the implementation of the forthcoming Trade and Investment Strategy for Scotland and will support more Scottish businesses to achieve supply chain excellence and enhance how they manage and optimise their supply chains. To do this we will implement a programme of measures to develop key supply chain capabilities and build resilience in areas key to the long term future of manufacturing. Actions planned include pilot projects

in Life Sciences and Chemicals, Oil and Gas, and the Aerospace, Defence and Marine sectors to support more Scottish based SMEs to become suppliers to these sectors. Furthermore, building the innovation and research capacity of Scottish manufacturing will add strength to Scotland's inward investment offer.

We will also take action to encourage more international investment in Scotland's industrial infrastructure and build resilience in areas important to the long term future of manufacturing. An example of this being the HVM catapult²⁰ led innovation support programme aimed specifically at small and medium sized businesses operating across the UK Metals processing supply chain.

19. Source: Export Statistics Scotland 2014, Scottish Government

20. <https://hvm.catapult.org.uk/>



SHAPING THE MANUFACTURING ACTION PLAN

Strengthening the role of manufacturing in Scotland's economy will not be easy or quick. The impact of globalisation and transparency of costs means that an inherently complex set of inter-related factors must be carefully managed over the long-term to achieve global competitive advantage that sustain well-paid jobs.

While it is clear that Scottish manufacturing in general needs to raise its level of investment and productivity, there is good reason to believe this can be achieved: in every sector of manufacturing, there are many

examples of ambitious companies investing in their future and succeeding in competitive global markets. With an ambitious mindset and the right support, many more companies can get on the path to higher investment and growth.

In the preparation of this plan we have consulted with industry and other key stakeholders and undertaken further research. This analysis has led to eight action plan themes (described below) each with an associated activity workstream. Collectively these form the Manufacturing Action Plan.



ACTION PLAN THEMES

Each of the themes described below have an initial workstream plan based on analysis to date. It is fully expected that these workstreams will develop and evolve in greater detail as the plan moves through the early stages of implementation. It also follows that in developing and delivering outcomes associated with the plan, a wide range of agencies and supporting organisations will be encouraged to participate.

Leadership

Leadership is critical for the development of our manufacturing companies. In an environment where technology is changing so rapidly, companies and their leaders need to be adaptable and agile to take advantage of the opportunities available to innovate, grow and trade internationally.

There needs to be increased ambition and a desire to be world-class, competing on quality and efficiency rather than cost. Manufacturing leaders must invest in developing the new skills needed by the workforce, encourage innovation and pick the right technologies that are required by customers, products and processes.

They must have the vision to instigate transformational change where necessary and foster the environment where employees at all levels are encouraged to contribute to success and sustainable growth. Empowering workplace practices at every level leads to sustainable high performance and a high quality of working life. Evidence suggests that the mutually-reinforcing impact of workplace partnership, shared learning, high involvement innovation, enabling organisational structures and systems, and self-organised teams creates tangible and sustainable change in the day-to-day culture

of manufacturing workplaces driving increased competitiveness and productivity and fostering resilience. This can be supported by the recognition that fair wages, job security and fulfilling, well designed jobs can contribute to better productivity, while also improving the health and well-being of the workforce.

Our research and consultations with over 100 manufacturing companies highlight the demand and need to support manufacturers to keep pace with developments and progress their future strategy based on a sound understanding of Smart Manufacturing practice.

To support this we will work in partnership with industry to develop and deliver a Smart Manufacturing Excellence Programme including workshops, web-based advice and learning and targeted learning journeys to clusters of manufacturing excellence in Europe and beyond.

There are benefits from greater diversity in business ownership models, and through Co-operative Development Scotland²¹, the Scottish Government is committed to supporting the continuing growth of the employee ownership model. Not only does this model root and sustain businesses and headquarters in Scotland, but also contributes to higher levels of productivity and innovation within enterprises. With employee interests clearly aligned to those of the business; the resulting higher levels of employee engagement can result in increased innovation, productivity and growth.

21. <http://www.scottish-enterprise.com/services/develop-your-organisation/co-operative-development-scotland/overview>

| Leadership Workstream Lead Organisation: Scottish Enterprise/Highlands and Islands Enterprise | Timescale |
|---|--|
| Deliver Smart Manufacturing Excellence Programme via SMAS Building awareness and interest <ul style="list-style-type: none"> • A series of masterclasses based on the theme of smart manufacturing • Establish of special interest group on digital/smart manufacturing Influencing and networking <ul style="list-style-type: none"> • A series of manufacturing leaders influencers events Learning from others <ul style="list-style-type: none"> • Deliver a series of world-class exemplar learning journeys for manufacturing leaders | From Q2 2016 From Q2 2016 From Q3 2016 From Q3 2016 |



CASE STUDY

MACPHIE OF GLENBERVIE

A RECIPE FOR SUCCESS

Macphie of Glenbervie is the UK's leading, independent food ingredients manufacturer. From humble roots dating back to 1928 and a team of just six people, the business has grown into a profitable and high performing manufacturing organisation that's known for its innovation, creativity and excellence. To help maintain its market position, support future growth and enhance manufacturing performance, the business called on the Scottish Manufacturing Advisory Service (SMAS) for expert guidance.

Today Macphie employs over 250 people across two premises - its headquarters in Aberdeenshire and another manufacturing facility in Tannochside, South Lanarkshire, producing a wide variety of convenient culinary products including sauces, bakery mixes and desserts for major retailers and manufacturers globally, including Marks & Spencer and other well-known household brands.

Despite strong results and financial success, the leadership team recognised the need to take proactive steps to future-proof the business and improve its manufacturing performance. The company maintains its global competitive edge by constantly challenging itself to improve efficiency and reduce costs in a number of ways. To-date they have delivered this through the investment in and adoption of renewable technology, increased automation and the implementation of quality management systems.

Neil Freckingham, Operations Director at Macphie, said: "At Macphie we live and breathe innovation, creativity and excellence. We are constantly challenging ourselves to deliver imaginative and innovative business solutions for our customers.

"Our team of expert bakers, chefs and food scientists have a wealth of food industry experience allowing them to understand customers' needs, as well as their day to day technical and operational challenges. This insight supports our hands-on approach to sharing knowledge and developing solutions, whether in the form of product demonstrations, a new recipe idea or a new packaging format to drive greater production efficiency.

Put simply, we work in partnership with our customers for mutual business success."

Working with advisors at SMAS to implement quality management systems, Six Sigma and Lean, the senior team adopted these proven methodologies designed to improve the quality of processes by removing the causes of variation. In doing so, they are enhancing customer value and strengthening output and performance.

The adoption of renewable technologies at their Aberdeenshire headquarters made them the first food

"At Macphie we live and breathe innovation, creativity and excellence. We are constantly challenging ourselves to deliver imaginative and innovative business solutions for our customers."

Neil Freckingham, Operations Director at Macphie

manufacturer in Scotland to be fueled by renewable energy. Through the installation of a biomass boiler, which runs on locally sourced woodchips, and two wind turbines, this multi-million pound investment reduces the business' carbon emissions by 2100 tonnes a year – underlining their commitment to environmental sustainability.

Tracking the very latest innovations in automation, and learning from similar manufacturing plants in the US, the business has adopted both robots and automated machinery at its Glenbervie plant. This investment in advanced manufacturing technology has allowed the company to reduce manual handling risk as well as up-skilling by providing value-added jobs for the workforce.



Skills and Jobs

Investment in new equipment and technologies will only generate a return if there is a skilled workforce capable of getting the most out of new manufacturing technologies. It means placing equal emphasis on both enhancing the skills of the current workforce and attracting new talent with the correct basic skill set. Industry consensus is that significantly more investment will be required in Science, Technology, Engineering and Maths, the so called 'STEM' subjects, both in schools and manufacturing-oriented degrees, apprenticeships and vocational courses. In future we will require more experienced professionals in areas of digital manufacturing with knowledge of the principles of a circular economy (refurbishment, design repair and re-manufacture).

We are also committed to addressing the under-representation of females in STEM subject courses and careers. In implementing the recommendations of the Developing the Young Workforce Commission through its youth employment strategy, the Scottish Government has invested £1.5 million over two years to enable the Scottish Funding Council to pursue a range of enhanced opportunities for young people, including a programme of equality projects across Scotland's colleges and universities. As part of the

Developing the Young Workforce approach, Skills Development Scotland (SDS) published an Equalities Action Plan for Modern Apprenticeships (MA) in Scotland²² to improve the participation of under-represented groups within the MA programme.

In future we will require more experienced professionals in areas of digital manufacturing with knowledge of the principles of a circular economy (refurbishment, design for re-manufacture). To attract and retain the brightest young people into manufacturing means promoting the reality of 21st century manufacturing opportunities which offer highly technical and well paid careers often in modern progressive working environments. With a highly respected academic infrastructure serving manufacturing businesses, Scotland is ideally placed to build on this capability.

Skills Investment Plans articulating the future skill requirements are in place for many of the key sectors. Where required these will be enhanced to fully reflect the ambitions of the Manufacturing Action Plan. The development of Skills Investment Plans will be undertaken in close cooperation with industry partners.

22. <https://www.skillsdevelopmentscotland.co.uk/news-events/2015/december/plan-to-tackle-inequality-in-apprenticeships/>

| Skills and Jobs Workstream Lead Organisation: Skills Development Scotland | Timescale |
|--|--|
| <p>Skills investment plans</p> <ul style="list-style-type: none"> • Review existing Skills Investment Plans (SIPs) for each sector with a significant manufacturing component to ensure alignment with overall objectives of the MAP and identify any gaps • Determine process for ensuring that individual SIPs remain aligned to the skills required to support the move to 'smart manufacturing' <p>Workforce development</p> <ul style="list-style-type: none"> • Review cross-sector requirements for development of STEM oriented workforce • Working with industry and the education sector to develop an action plan to promote STEM as a potential area of study and work for girls and young women. • We will facilitate engagement between employer led programmes which we support to inform and inspire young people on careers in manufacturing with the emerging network of industry led DYW Regional Groups. • Working with industry, establish major programme of activities to promote manufacturing and improve perceptions amongst potential entrants and influencers. • Review current provision and approach to enhance links between education and manufacturing organisations (Schools, Colleges, Universities). • Develop case studies demonstrating career paths and where STEM can lead to. | <p>From Q1 2016</p> <p>Proposal by end Q2 2016</p> <p>From Q2 2016</p> <p>From Q1 2016 to Q1 2017</p> <p>From Q1 2016 to Q1 2017</p> <p>From Q1 2016 to Q1 2017</p> <p>Q1 2016 to Q3 2016</p> <p>Q2 2016</p> |

CASE STUDY

CHANGING PERCEPTIONS OF FUTURE SKILLS

PRIMARY ENGINEER INSPIRES YOUNG MINDS

Industry is undergoing transformational change fuelled by new technologies in the digital age. Skills Development Scotland, through its Skills Investment Plans, is working with a range of partners to deliver education programmes that encourage future skills in Science, Technology, Engineering and Mathematics (STEM) from an early age.

Primary Engineer²³ is an initiative supporting the STEM agenda that delivers practical maths and science through “design and make” activities for young people. It aims to inspire and motivate children while offering teaching staff a wide range of capacity-building CPD opportunities.

East Ayrshire Council uses the programme for Interdisciplinary Learning mapped to the Curriculum for Excellence, allowing pupils the opportunity to apply their learning to design and technology projects. Pupils also take part in the Scottish Engineering Special Leaders Award ensuring that greater numbers aspire to work in engineering.

John Wilson, Senior Education Manager, East Ayrshire Council points out that: “Significant numbers of teachers have undertaken Primary Engineer CPD training empowering them to implement what they have learned in a classroom context.”

Parental involvement has been improved through encouraging them to bring their own expertise to school and also attend special events. In addition, each school now has a dedicated engineering partner from the business community.

The University of Strathclyde is the principal academic partner for Primary Engineer and its associated programmes. Professor Sir Jim McDonald, Principal and Vice-Chancellor says that there has been a “step change” in interest and awareness of engineering and technology from primary school teachers, pupils and their families.

The University hosts the annual Scottish Engineering Leaders Awards with entries rising from 1600 to over 6000 in just three years. Significantly over 50 percent of the finalists are now girls.

Encouraging and developing interest in STEM subjects from an early age is having a profound effect on the level of interest in engineering and technology while also improving gender balance within the sector.

Digital technology enables this to become an opportunity for young people throughout the country to aspire towards rewarding careers in a modern and vibrant digital manufacturing environment that requires a range of new skills in design, visualisation, robotics, automation and programming as well as more traditional roles.

East Ayrshire Council has established a flagship programme that equips staff and pupils with a wide portfolio of skills. Their success has meant that the local authority now attends national events to disseminate good practice.

Graham Short, former Executive Director of Educational and Social Services says that their success is wide-ranging: “The benefits go far beyond engineering and technology in developing problem solving and enterprising approaches to learning which are motivating in their own right. Importantly, it has also helped address a skills gap for primary teachers who often are not confident in the area of the STEM subjects.”

23. <http://www.primaryengineer.com/>



Circular Economy

The circular economy provides a compelling framework for re-thinking how businesses operate in the 21st century. It aims to eradicate waste, not just from manufacturing processes, but also systematically throughout a product's life-cycle. The circular economy includes a major focus on innovation: in product specification and design, product manufacturing and re-manufacturing, supply chains and product stewardship, business models and customer relationships. It is an alternative to the predominant linear approach in which products are used and then discarded, moving towards an economy focused on maintaining tight component and product cycles of use and re-use. Manufacturing systems, therefore, lie at the heart of achieving a more circular and resilient economy.

As such there are substantial opportunities and benefits for manufacturing companies in leading this transition, for example:

- Increased productivity: eliminating wasted materials and maximising the value of products and materials they use.
- Efficient production: an effective way to compete against lower-cost products in key growth markets.
- Stimulating product and supply-chain innovation: working across supply chains to re-design products for a longer lifetime and for disassembly and re-use.
- Strong and loyal customer relationships: developing processes to enable product maintenance/refurbishment and return rather than disposal, and leasing of products rather than ownership.
- Greater resilience: to supply constraints and price spikes in relation to finite raw materials e.g. copper and indium.
- Job creation: by offering a wider range of customer services from product manufacture to maintenance, repair and remanufacturing.

The Scottish Government is providing strong leadership, positioning Scotland as a global leader in developing and applying circular economy practices.

The actions outlined in this plan form a key part of the Scottish Government's forthcoming circular economy strategy, *Making Things Last*, and will seek to maximise circular economy opportunities in manufacturing, working closely with the other action themes within this plan. To assist manufacturing companies in trialling and adopting new circular economy practices, such as product or design innovation and new circular business models, a key early action will be the provision of circular economy focussed advice and support through Zero Waste Scotland's new European Regional Development Fund (ERDF) Circular Economy programme.

| Circular Economy Workstream Lead Organisation: Zero Waste Scotland (ZWS) | Timescale |
|--|--|
| Circular Economy <ul style="list-style-type: none"> • Launch of enhanced programme of company support for CE delivered by SE and by ZWS's new ERDF funded Programme. • Identify existing exemplars and 'early adopter' candidates to promote CE learning journeys in manufacturing. • Identify workforce skill requirements to increase organisational CE manufacturing capabilities & support their development (in conjunction with Skills Action Theme). • Develop sector-specific interventions to drive demand for circular manufacturing products and services. • Identify opportunities afforded by the development of a National Strategy for Through-life Engineering Services. | <p>Q2 2016</p> <p>From Q2 2016</p> <p>From Q2 2016</p> <p>From Q3 2016</p> <p>From Q4 2016</p> |

Energy Efficiency and Decarbonisation

Investment in modern capital equipment to improve energy efficiency makes a significant contribution to reducing costs and improving the competitiveness of manufacturing industry. It also increases resilience and reduces risk arising from volatile energy prices. The case for investment is particularly strong for Scotland's energy intensive sectors such as chemicals, food and drink, glass, paper and pulp, and refining.

Energy efficiency will also make a significant and immediate contribution to decarbonising Scotland's industry, although in the longer-term this may need to be augmented by other actions including carbon capture and storage to reach the Scottish Government's 2050 decarbonisation target. The challenge is that the pay-back on such investments is often long-term; requiring strong leadership, technical expertise and access to appropriate finance.

Public sector partners in Scotland are working together in a Decarbonisation of Industry Steering Group, to promote and co-ordinate action to support energy intensive industries. This aims to support them to deliver their emissions reductions under the EU Emissions Trading System and to meet legal obligations such as the UK Climate Change Levy and Energy Savings Opportunity Scheme (ESOS), and to consider what further support will be needed to deliver emissions reduction and energy efficiency improvements in future.

The Steering Group has commissioned a report to provide a Scottish summary of the UK Government's 2015 industrial decarbonisation roadmaps. It will include recommendations that will inform the development of a national programme of activity to support industrial decarbonisation, energy efficiency and heat recovery. This programme will build upon current support offered by Resource Efficient Scotland, the Heat Network Partnership, and the Enterprise Agencies including SMAS and the Low Carbon Infrastructure Transition Programme.

The Scottish Government has announced in the 2015 *Infrastructure Investment Plan*²⁴ that energy efficiency is to become a national infrastructure priority and will take this forward through the proposed Scotland's Energy Efficiency Programme (SEEP) from 2018. The new national infrastructure priority is currently in its development phase, which includes the piloting of new approaches to integrating domestic, non-domestic and industrial energy efficiency and heat demand reduction.

24. <http://www.gov.scot/Publications/2015/12/5962>

| Energy Efficiency and Decarbonisation Workstream | Timescale |
|--|--------------|
| Lead Organisations: Scottish Government/Scottish Enterprise | |
| <ul style="list-style-type: none"> • Advice and support: Develop expert advice for Scotland’s energy intensive companies to develop feasible and cost effective business plans to implement ESOS (Energy Savings Opportunities Scheme) audit recommendations. This may include support to achieve ISO 50001. | From Q2 2016 |
| <ul style="list-style-type: none"> • Energy efficiency and heat recovery: As part of the new energy efficiency national infrastructure priority, consider how to best incentivise additional energy efficiency and heat recovery opportunities within businesses. Work with the UK Government to develop new incentive or regulatory mechanisms to deliver this. | From Q1 2017 |
| <ul style="list-style-type: none"> • Benchmarking performance: Establish a more detailed baseline of Scottish industrial energy, heat and emissions performance, to benchmark against EU standards. | From Q1 2017 |
| <ul style="list-style-type: none"> • Low carbon technology demonstration: Explore the scope for supporting and accessing finance for cross-sector technology demonstrator projects identified in UK roadmaps (CCS, heat electrification, industrial biomass etc), including EU ETS Innovation Fund. | From Q1 2018 |

Competitive Infrastructure

Property market intelligence²⁵ highlights that some of Scotland’s industrial property stock is becoming increasingly aged and obsolete. There is a need to plan now to ensure Scotland’s long-term future as a competitive location for advanced manufacturing with attractive options for both indigenous companies to expand and for continuing to attract international investment into Scotland. Precisely how continuing advances in technology will impact on production facilities is still emerging. However,

modern manufacturing facilities should be flexible, energy efficient, digitally connected and close to appropriate transport infrastructure.

To address this, co-ordination is required between public and private investments in industrial property development. The new Trade and Investment Strategy will support this by outlining a strategic approach and actions to attract international investment to large scale capital projects.

| Competitive Infrastructure Workstream Lead Organisation: Scottish Government | Timescale |
|---|--|
| <p>Industrial property review</p> <ul style="list-style-type: none"> • Take forward a review of Scotland’s stock of industrial property. • Review research and determine approach to planning for current and future requirements. <p>Transport and access to markets</p> <ul style="list-style-type: none"> • Establish what is required to encourage and support investment in physical infrastructure and routes to international markets that support the activities of manufacturing firms. | <p>Q2 2016</p> <p>Q2 2016</p> <p>Initial scoping by Q2 2016 Complete option appraisal by Q3 2016</p> |

25. Source: Ryden, 77th Scottish Property Review October 2015

Investment in SMART Manufacturing

The retooling of manufacturing operations will require considerable investment, much more than in any of the other themes. To achieve this, we need to do more to encourage and support businesses to develop compelling investment plans to scale up their operations and maximise their competitiveness.

The banking sector in Scotland has developed specialist manufacturing investment capabilities and in some cases have specific targets to increase their investment in manufacturers. We want to do all we can to maximise the flow of investment carefully – to check there are no unforeseen impediments and to improve the competitiveness of manufacturing in Scotland.

To accelerate development of investment related to the deployment of best available technologies and

processes we plan to introduce an enhanced asset review service operated by Scottish Manufacturing Advisory Service (SMAS). The focus of this enhanced service will be capital intensive businesses and will include a comprehensive review of current technology deployed and detailed assessment of the investment required to drive businesses capability to level of best available technology.

Through the Scottish Investment Bank (SIB) we plan to develop and provide focused financial readiness support to target manufacturing companies who have the ambition to grow, to help them understand available growth funding options, funder requirements and also address identified barriers preventing viable business cases from accessing finance on acceptable terms.

| Investment in SMART Manufacturing Workstream | Timescale |
|--|--|
| Lead Organisation: Scottish Enterprise/ Highlands and Islands Enterprise | |
| Industrial property review <ul style="list-style-type: none"> • Launch new SMAS Capital Asset Review service. • Complete first 100 Capital Asset Reviews and undertake review to inform future activity. • Target completion of 600 Capital Asset Reviews. | Q2 2016 Q2 2017 By end of 2019 |

CASE STUDY

JERBA SHARES ROADMAP TO SUCCESS

AMBITIOUS SME ENCOURAGES SMALL BUSINESSES TO THINK BIG

Jerba Campervans is punching above its weight – a small business that thinks and behaves like a much larger company. In ten years they have become a leading specialist in the luxury conversion market. Their growth is a consummate model of how Scottish companies can “think big” and achieve ambitious targets.

While their competitors import pre-cut furniture, Jerba differentiate themselves by offering bespoke conversions and undertaking the machining in Scotland.

Ambitious growth targets, combined with a commitment to the highest standards, has led to £300,000 investment in a new 7,500 sq. ft. manufacturing facility in East Lothian increasing production by a third.

Established in 2005 in North Berwick, Jerba’s continuous drive to improve productivity focused on strategic planning, innovative IT management tools and investment in manufacturing equipment.

Jerba Campervans engaged with SMAS for guidance on achieving their growth targets. SMAS helped implement lean principles to maximise value and enhance quality.

Practitioner Gerry Borge identified ways in which processes could be enhanced: “We built a two day workshop for all their staff introducing the concept of lean thinking to create a deep understanding of how this approach could benefit and transform the business.

“The principles were then applied to designing processes in the new premises. These included simulations to assist in the positioning of equipment and work stations, as well as assessing storage arrangements to ensure materials were readily

accessible at the correct stage of the manufacturing process.

“The entire team were able to demonstrate a sound understanding of both value-adding and wasteful activities and put this into practice by designing a layout for their new premises.”

Growth has been recognised by official affiliations with the equipment manufacturer, Volkswagen, and the award of a European Union licence allowing Jerba Campervans to manufacture in any member country.

“Working with SMAS has been an extremely positive. Having access to the expertise of SMAS practitioners brought a fresh perspective to our processes making meaningful changes to the way we operate.”

Simon Poole, managing director of Jerba Campervans

Owners Simon Poole and Cath Brookes set out to create something that complements every adventure and spent countless nights away with their family perfecting the designs.

Simon said: “Working with SMAS has been an extremely positive. Having access to the expertise of SMAS practitioners brought a fresh perspective to our processes making meaningful changes to the way we operate.

“The way in which we have adapted our systems has had a significant impact on our productivity, work culture and, ultimately, profitability.”

To find out more about Jerba Campervans just visit their website at: www.jerbacampervans.co.uk



Supply Chain Capability

The vertically integrated company of the past has been replaced by complex supply chains connecting large and small companies around the globe. As a result, supply chain management has become a key competitive differentiator. We want to support more Scottish businesses to achieve supply chain excellence and enhance how they manage and optimise their supply chains. We need to strengthen the supply chain capability of manufacturing SMEs to adopt new materials and processes that improve their ability to compete in global value chains.

There are significant opportunities to increase Scottish content in both domestic and international supply chains including through re-shoring. It is perceived that large businesses are looking to

improve their supply chain resilience and reduce cost by engaging with local and competitive suppliers. Some wish to re-shore operations which they had contracted-out overseas, for reasons of quality and control.

Scotland has many international relationships, such as the Vanguard Initiative²⁶, an EU policy to help regions, including Scotland, unlock their growth potential. These relationships can provide further scope for collaboration across borders, building supply chain capability and access. As digital technology is increasingly used to integrate global supply chains across all operations, from product design to field servicing, it is important that Scottish companies keep up with the latest developments.

| Supply Chain Capability Workstream | Timescale |
|--|----------------------------|
| Lead Organisation: Scottish Enterprise | |
| <ul style="list-style-type: none"> • Complete a review of sector and cross-sector supply chain capabilities and develop strategies to close critical gaps including FDI | Q2 2016 |
| <ul style="list-style-type: none"> • Launch two re-shoring pilot projects from sectors including Life Science, Chemicals, Oil and Gas, and Aerospace, Defence and Marine | Initial Scoping Q2 2016 |
| <ul style="list-style-type: none"> • Review outcomes from re-shoring pilot projects and use to develop a re-shoring programme across all the main sectors of the economy | Q4 2016 |
| <ul style="list-style-type: none"> • As part of the new Trade and Investment Strategy, develop an international marketing and communications programme to promote Scottish manufacturing and associated innovation capabilities. This will include using the new Innovation and Investment Hubs in Brussels, London and Dublin to increase profile and support collaboration. | Q3 2016 |

26. <http://www.s3vanguardinitiative.eu/>

CASE STUDY

SCOTLAND AT THE FOREFRONT OF SUPPLY CHAIN EXCELLENCE

Achieving supply chain improvement is critical to the continued global competitiveness of Scottish industry. Supply chain spend is often the largest single part of a company's cost base and with increasing business complexity, excellence in managing within supply chains is becoming more critical. Industry research shows that companies who focus on and tailor their supply chains to customer needs achieve 70% higher performance than their competitors.

The next generation of supply chains will be:

- Even more efficient.
- faster and responsive.
- tailored to customer needs.

We are punching above our weight in Scotland with the aerospace, defence and security supply chain the most advanced. The programme, supply chains for the 21st century (SC21), is proving to be an essential tool.

SC21 is designed to increase the performance of suppliers and their supply chains within the UK aerospace, security, space and defence industries. Established in 2006 there were 19 founding members, 16 of the UK's largest primes and three key small and medium sized enterprises (SMEs). A decade later, the programme has more than 700 global subscribers.

SC21 has created a single improvement template that helps to create consistency (www.sc21.org.uk). This continuous sustainable improvement plan (CSIP) encourages supply chain companies to work with their customers and establish clear performance metrics.

An awards scheme allows those who have undertaken diagnostics to attain bronze, silver and gold awards.

These awards are based on strict quality and delivery performance levels that have to be achieved and demonstrated over a sustained period, and verified by customers.

The Scottish Manufacturing Advisory Service (SMAS) has five trained assessors supporting companies through the awards process. There are 47 Scottish companies on the SC21 programme, ten of which have bronze level accreditation and one silver:

Scottish SC21 Success

Silver

WB Alloys, Glasgow / Aberdeen

Bronze

Bovill and Boyd, East Kilbride

Axon Cable, Dunfermline

RD Taylor, Glasgow

Fasteq, Linlithgow

ZOT, Musselburgh

Plexus, Kelso

Castle Precision Engineering, Glasgow

Hydro Bond Engineering, Aberdeen

WB Alloy Welding Products Ltd has been supplying welding related equipment and expertise to industry – nationally and internationally – since 1974.

Engaging with this project has supported the company's ongoing commitment to service and operational excellence, by providing the management team with a range of tools which facilitate ownership, responsibility and continuous improvement. To date, the company has enjoyed:

- **Delivery performance improved to >95% OTIF**
- **Quality performance risen to >98%**
- **Productivity improved by 20%**



" We will continue to use SC21 as a basis for all our continuous improvement activity even if we no longer sold products into the aerospace, defence and marine markets. It provides a fantastic framework for improvement in any business."

Paul Houston, Managing Director, WB Alloy Welding Products Ltd.

Bovill & Boyd produce and maintain precision components. Established in 1983, the company has an annual turnover of £3million and employs 14 people.

The senior management team is using the SC21 programme to develop the East Kilbride site and raise its profile within the UK Aerospace, Defence and Security industry: upgrading the infrastructure, introducing best practice and training and developing the staff. They are now working towards becoming Scotland's second silver award businesses.



"We've seen tangible benefits for staff and customers far beyond the financial gains. Better communication and more balanced responsibilities have improved morale and productivity. The improvements enabled us to reduce project delivery lead-times and improve our service."

Tracy Brown, Commercial Director, Bovill & Boyd

Technology and Innovation

This action plan aligns to and creates momentum behind national ambitions for more widespread, deeper, sector led and open innovation. It recognises that innovative manufacturing and the utilisation of leading edge technologies are drivers of competitive advantage.

Opportunities exist to encourage and support more manufacturing businesses to invest in product, process, service and workplace innovation. There is much to be learned and gained from developing technologies in the fields of sensors, automation, additive manufacturing and the 'Internet of Things'.

Many Scottish manufacturing firms compete internationally with collaborations involving multiple supply-chain companies building company level and national capabilities. We will encourage and support organisations adopt a more open and collaborative relationship with customers and suppliers to innovate.

Workplace innovation, the improved deployment of staff to enhance employee engagement, productivity and business performance, offers significant scope to support the growth of manufacturing businesses and to drive this forward we will introduce a service that seeks to maximise engagement across the workforce.

National capability is also strengthened by aligning company challenges to world leading insights of University departments and those contained within Catapult²⁷ and Innovation Centres²⁸. Opportunities exist to broaden and deepen national networks, including extending them into Europe through the Enterprise Europe Network²⁹ and the Vanguard Initiative. This will be particularly important in smart digital manufacturing where we can learn from European leaders.

To secure buy-in from industry we need to demonstrate the value gained from a long-term commitment to innovation and technology adoption, particularly within SMEs where day-to-day pressures can focus attention on the here and now.

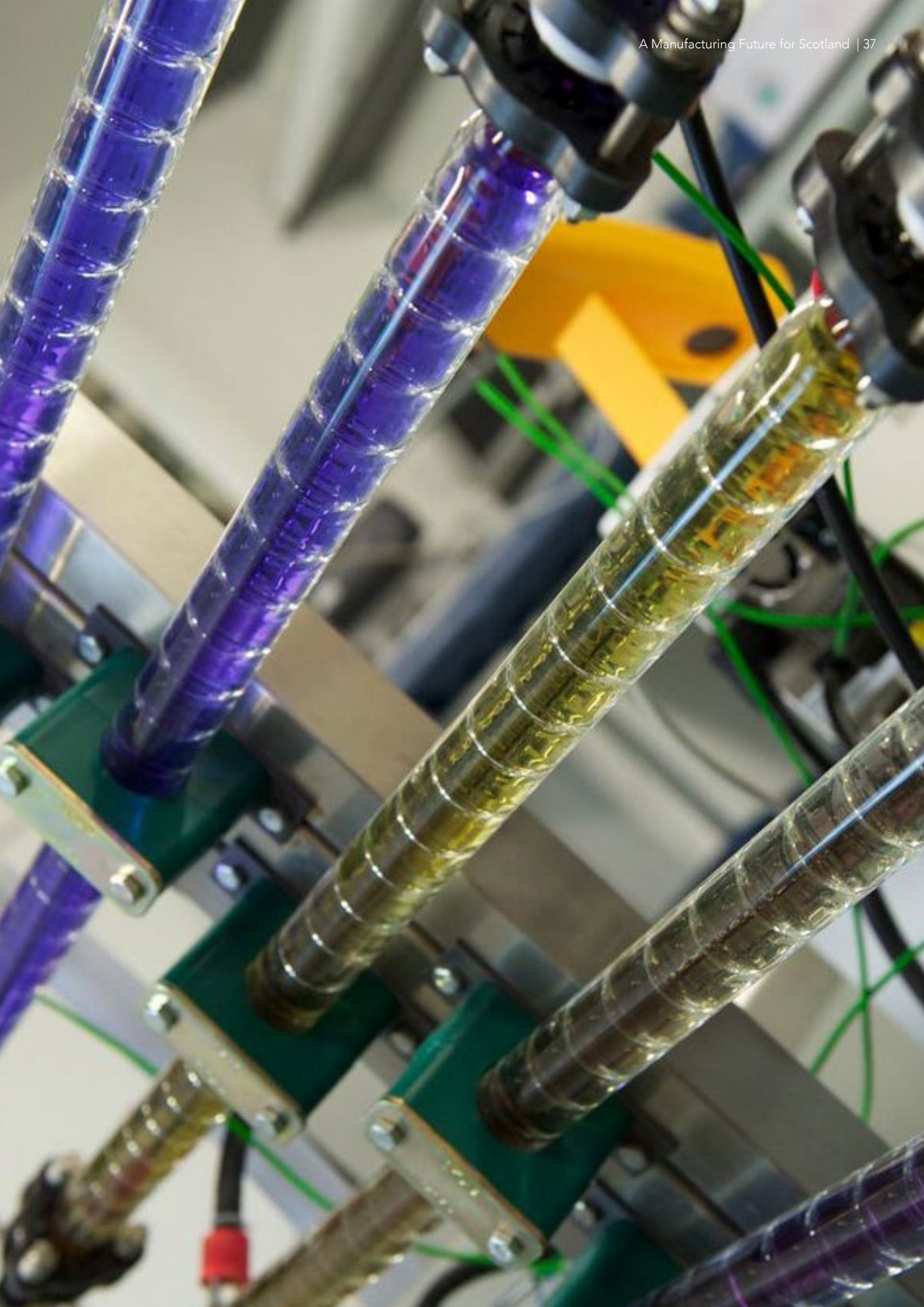
Co-ordinating national innovation resources and assets to be appropriate for the manufacturing base is key. In particular, interaction with both new and existing centres of excellence will provide an environment where innovation and demonstration opportunities can be developed. A shared objective is to create an environment within which businesses of all sizes and in all manufacturing sectors can innovate and adopt new novel technologies.

27. <https://www.catapult.org.uk/>

28. <http://www.sfc.ac.uk/funding/FundingOutcomes/KnowledgeExchange/InnovationCentres/InnovationCentres.aspx>

29. <http://een.ec.europa.eu/>

| Technology and Innovation Workstream Lead Organisation: Scottish Government/Scottish Enterprise | Timescale |
|---|---|
| <ul style="list-style-type: none"> • Scottish Government to establish a multi-partner approach to take forward the development of a joint Manufacturing Centre of Excellence and Skills Academy. The first stage will be development of detailed business plan in consultation with industry. • Develop action plan to increase SME engagement with network of Innovation Centres. • Utilising new or existing mechanisms, support manufacturing firms develop innovative products, processes, services and the adoption of new technologies. • Work with partners and industry to introduce a new Workplace Innovation service. • Work with Innovate UK to align interventions and promote opportunities around digital for manufacturing, driving manufacturing readiness and stimulating innovation to uncover new sources of revenue from manufacturing. | <p>Q2 2016</p> <p>Initial action plan by Q2 2016</p> <p>Progress report Q3 2016</p> <p>From Q3 2016</p> <p>Report on alignment by Q2 2016</p> |



CASE STUDY

MANUFACTURING BREAKTHROUGH DRIVEN BY INDUSTRY AND ACADEMIA

SCOTTISH STUDY LEADS TO STEP CHANGE IN CRYSTALLISATION MANUFACTURING

Established in 2011, CMAC (Continuous Manufacturing and Crystallisation) is a world-leading research centre and network of experts from across seven academic institutions, employing 120 people across the network. Headquartered in the landmark, Technology and Innovation Centre, (TIC) building at the University of Strathclyde their goal is to accelerate the adoption of continuous manufacturing processes, systems and plants, to achieve higher quality, lower cost and more sustainable production of high-value chemical products.

CMAC participated in a collaborative development project with Swiss Agriscience multinational, Syngenta, and its manufacturing site in Grangemouth. The project evaluated the crystallisation of a major agrochemical active ingredient manufactured here in Scotland with funding from the Engineering and Physical Sciences Research Council (EPSRC).

David Ritchie, lead scientist at Syngenta said: "Overall it was a very valuable collaborative experience. I was really impressed that every experiment, in all equipment scenarios, yielded meaningful results. The project has led to insights which have changed the way we think about crystallisation."

The collaborative project resulted in a step change in the fundamental understanding of the crystallisation process and Syngenta has used this within its own development programme to model and further develop its own industrial process. This improved both the productivity and consistency of the production process and has been incorporated into the continuous site manufacturing improvement programme.

CMAC's Industrial Director Craig Johnston noted: "Although we are better known for our work with large pharma, including GSK in Scotland, we do work across sectors with a broad range of user and technology companies. We now have over

60 PhD students and Syngenta host them during their training year to provide industrial context for developing continuous processes and hybrid solutions. This project was an excellent example of learning through continuous techniques being applied to improve productivity of batch processes."

Overall it was a very valuable collaborative experience.

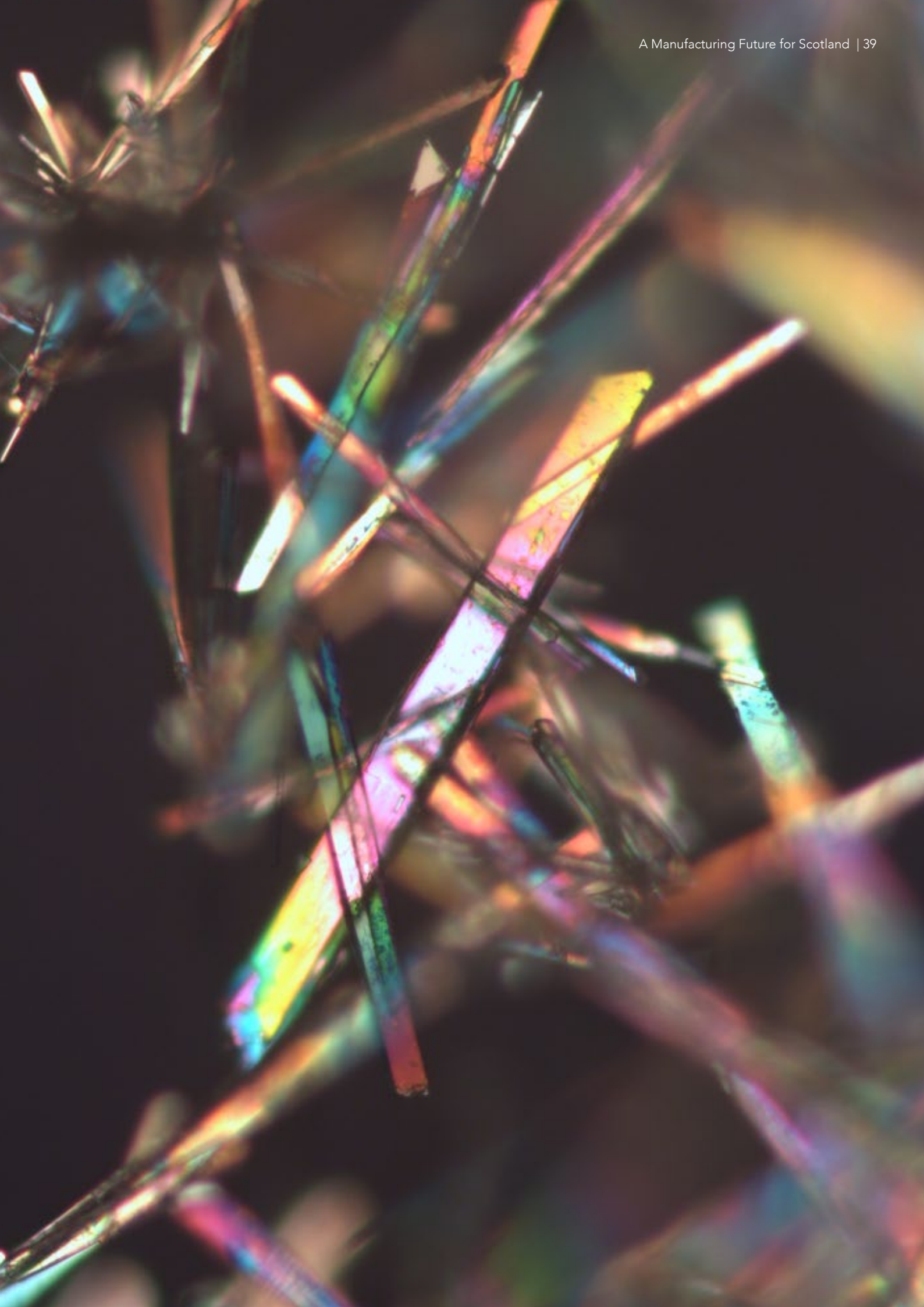
I was really impressed that every experiment, in all equipment scenarios, yielded meaningful results.

The project has led to insights which have changed the way we think about crystallisation."

David Ritchie, lead scientist at Syngenta

Crystallisation is a key part of the production of chemically complex products and has a significant impact on both the capacity and quality of production. Crystallisation processes are traditionally operated in batch production mode. The development project studied a number of operating modes including some not previously considered. The study led to the process of crystallisation in the CMAC laboratory's continuous unit. The analytical protocols applied in the experiment led to very well characterised results enabling subsequent system modelling and process development.

These findings have led to the development of disruptive manufacturing technology that rethinks the way a whole sector can develop and highlights the importance of innovation in Scotland.



MEASURING PROGRESS

The aim of this plan is to enhance the global competitiveness of the Scottish manufacturing sector. We need to monitor our progress towards this objective and look for evidence that we are achieving it.

We will develop a performance management framework to monitor progress, building on the initial thinking set out in the summary diagram below. If the Action Plan is successful, then we would expect to see the following outputs:

1. An increase in the number of manufacturing companies applying for funding to support investment in the business (visible through banks, Regional Selected Assistance etc).
 2. A corresponding increase in the number and value of loan and grant applications agreed with manufacturing companies.
 3. An increase in innovation activity across manufacturing.
 4. A more diverse workforce and greater levels of engagement in workplace innovation and support of young workforce initiatives.
- Once these outputs are evident we would expect to, in due course, see the following outcomes for the Scottish manufacturing sector:
1. **Increased Investment:** Boosting the rate of capital investment (Gross Fixed Capital Formation) in the Scottish manufacturing sector could help to close the gap in overall rates of investment compared with the stronger manufacturing economies of the developed world³⁰.
 2. **Higher Productivity:** Higher levels of investment by manufacturing firms can help strengthen the competitiveness of Scottish industry, and contribute to improvements in overall productivity growth.
 3. **Export Growth:** Higher levels of productivity will enable more Scottish manufacturers to compete globally, growing their share of international markets and boosting export growth. This will support the aims of the new Trade and Investment Strategy.
 4. **CO₂ and Waste Reduction:** Productivity improvements and the adoption of circular economy business models will help improve the long-term sustainability of the manufacturing sector.

30. See chapter 2 of Reindustrialising Scotland (<http://www.gov.scot/Publications/2014/06/5184>).

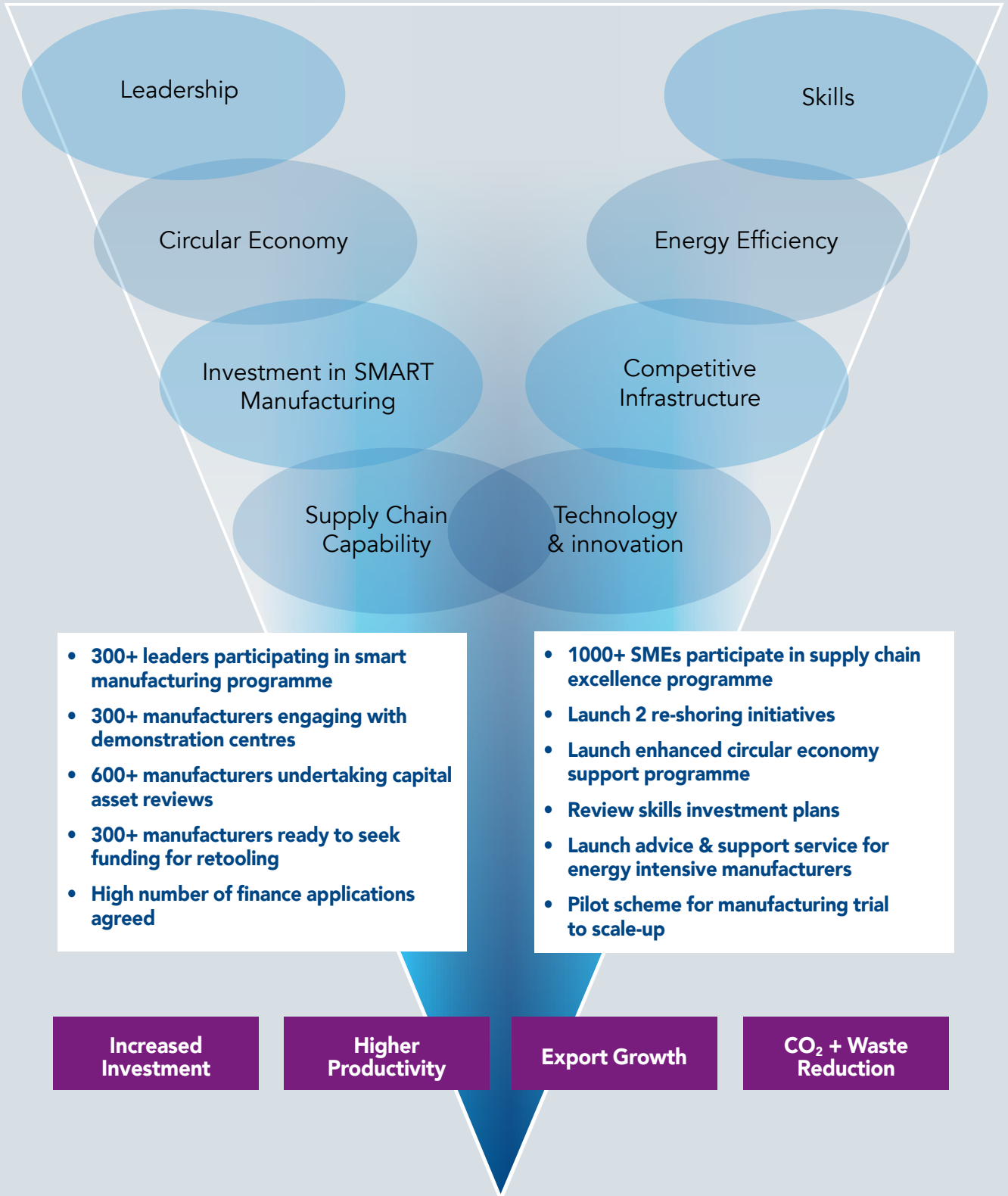
Increasing the competitiveness of Scotland's manufacturing sector

Ambition

Action Themes

Outputs within 3 years

Outcomes



If you require further information please contact the following organisations

Scottish Government:

Email: manufacturing@gov.scot

Website www.gov.scot

Tel: 0300 244 4000

Scottish Enterprise:

Email: Enquiries@scotent.co.uk

www.scottish-enterprise.com

Tel: 0845 607 8787

Highlands and Islands Enterprise:

Email: info@hient.co.uk

www.hie.co.uk

Zero Waste Scotland

Email: reception@zerowastescotland.org.uk

Web: www.zerowastescotland.org.uk

Tel: 01786 433930

Skills Development Scotland:

www.skillsdevelopmentscotland.co.uk

Tel: 0141 284 6000

Scottish Funding Council:

info@sfc.ac.uk

www.sfc.ac.uk

Tel: 0131 3131 6500

Innovate UK

www.innovateuk.gov.uk

