Materials Processing Institute

WHITE PAPER
INNOVATION SERIES
PAPER 01 JULY 2016

GOODBYE EU; HELLO WORLD - A VISION FOR AN INNOVATION CENTRED, INDUSTRIAL GROWTH STRATEGY FOR THE UNITED KINGDOM

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EXECUTIVE SUMMARY

In leaving the European Union, the United Kingdom faces many challenges but has an opportunity to build on its strengths in product design, engineering, materials and manufacturing, to create trade led, manufacturing growth. The rebalancing to an **international trade based economy**, will require new investment in infrastructure and more complex supply chains, which together reveal that the **Materials and Foundation Industries are a crucial aspect of Sovereign Capability**.

To ensure that the UK can capitalise on these opportunities and protect its global interests, an **innovation centred industrial growth strategy** is needed, to deliver innovations in energy, processing, metals and materials. This will require the UK to **take back responsibility for innovation in the Materials and Foundation Industries**, support industry led initiatives such as the proposed new innovation **'Catapult' for the metals and materials sector**, and free up the small businesses in **these supply chains to innovate, invest and grow.**

Creating this solid industrial foundation, through innovation and infrastructure, will give the confidence required to reliably invest in British manufacturing, creating much needed **jobs and growth in communities** and regions, throughout the United Kingdom.

New Trading Opportunity

In the immediate aftermath of the UK's decision to leave the EU the conversation has been dominated by what will be lost, rather than recognising that this step change in the geo-politics of Britain and Europe will now become a reality and there will be opportunity for the UK to create the strong manufacturing led growth that has long been the ambition of the nation. For the UK to thrive in the post-EU world the emphasis must be on policies which support trade and it is the trade in manufactured goods which has the greatest potential to create jobs, grow the economy and attract inward investment. It follows that the only strategy that could achieve this success is one with innovation at its core. It is innovation that will drive the improvements in productivity, new products and customer services, that will give Britain the edge in this international trading environment.

Innovation Strategy

Fundamentally, innovation is about the commercialisation of research within industry. Britain is recognised as being strong at research and has made great improvements in innovation in the last decade, but to realise the opportunities of this new environment, the status quo is not acceptable. Britain must move rapidly to adopt an industrial strategy founded on innovation and the following actions are required:

Continued Access

Secure continued access to the network of innovation partners in Europe. Continued access to funding is not as important as continued access to facilities, capabilities and expertise. The real value in collaboration lies in the knowledge that others bring to a project and the work that the project partners undertake, which is effectively 'free' to the other participants. Norway and Switzerland are examples of countries that have achieved a settlement of this nature with the EU and it is to be expected that the UK could negotiate a similar arrangement.

New Innovation Strategy

A fundamental review of UK innovation strategy is required. The purpose of a nation's innovation strategy is to support industrial strategy. In the UK the basic formation of the industrial strategy was set some years ago and is based around a set of narrowly defined sectors. This does not include key areas of the manufacturing economy, such as the Foundation Industries, for example. Such omissions were less of a concern with Britain in the EU, when the European innovation strategy could be relied upon to fill some of these gaps. Now the UK must take back responsibility for these important areas of its own economy and provide the innovation support that it needs, in addition to the currently defined automotive and aerospace sector strategies.

Achieve Potential

Realise the opportunities presented around international trade and Sovereign Capability. Recognise that different trading partners, in different trading regions, will mean that to be successful the UK will need to make different choices about: managing risk, making investments and dealing with the flow of goods, finance, human resources and crucially, information.

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WHAT DOES BRITAIN DO WELL?

Britain is Good at Research

UK universities are rightly recognised as world leading, but this does not necessarily lead to improvements in industrial output. The UK's public research budget is heavily weighted towards fundamental university research, with ten times as much funding targeted at this part of the innovation supply chain, as compared with the industrialisation of the research. This model runs counter to actual experience of commercialising research, where funding needs to be weighted towards the riskier and more expensive final stages. Without this support, the investment in early stage research is entirely wasted, as the results are either never commercialised, or are published and used by competing overseas nations. Exporting research results is of little economic value when compared with the benefits from exporting the goods and services that are the product of implementing the research in industry.

For this to happen the research must be scaled up and commercialised. A number of key UK sectors, including metals and materials, highlight a lack of upscaling facilities. The steel sector is quite well served with the piloting facilities at the Materials Processing Institute and these could quite readily be augmented to create a national multi-metals, multi-materials pilot and upscaling facility.

What is proposed is a fundamental shift in innovation policy, with a clear recognition that the driver for innovation is to serve the needs of industry and with greater cultural value attached to commercialisation rather than knowledge development.

Britain is Good at Design

The British brand stands for design and quality throughout the world. British designers, architects and engineers are rightly recognised for their creativity and inventiveness. This design expertise reaches across media and marketing, into fashion and product design. By recognising and including this design expertise in industrial innovation strategy, the UK can embed a competitive advantage in its manufacturing companies. Bringing together designers and engineers can yield new approaches to product design for instance, that combine aesthetics with functionality. It should also be recognised that successful and innovative design relies on, and is enabled by, innovative materials. The link between form, function and the properties of materials of construction is intrinsic and essential, and so it is clear that for the UK to fully exploit its global leadership in design and to integrate this into successful manufacturing, metals and materials must form part of the nation's industrial innovation strategy.

SOVEREIGN CAPABILITY: THE CASE FOR COPPER

As an International Trade Based Economy, the UK will experience a fundamental change in the way that goods are physically landed on these shores. Export growth will drive infrastructure requirements in air freight, container shipping and bulk carrier, with associated national rail infrastructure. Trading in this way will increase the length and complexity of supply chains. Inventory and logistics management will increase in importance, along with working capital financing and insurance.

Copper sits at the intersection of these factors. Essential for infrastructure investment, its importation requires long supply chains that could be disrupted.

The impact of the loss of a cargo of copper billet could be a major disruption to key infrastructure projects. The UK has ample onshore copper resources, from secondary materials, but these cannot be exploited as the UK has no copper smelting capability due to high energy prices. Innovation is the key to re-establishing this vital aspect of Sovereign Capability.

WHERE DOES BRITAIN NEED TO DO MORE?

The UK needs to undertake a review of its innovation strategy and build in those essential items that are currently missing and would previously have been dealt with at a European level. A good example of this is in the area of raw materials where the British Geological Survey has defined a list of critical raw materials. (Table 1).

Managing the long term availability of these raw materials was previously considered throughout the EU, but the territorial bounds on which this now needs to be applied have been reduced to the level of the nation state. This creates a requirement for the UK to unleash the forces of innovation and creativity to understand how these precious materials can be conserved, tracked, separated, reused and recycled, within the geography of the UK.

Such an initiative can be part of a much larger drive for a circular economy, with a 'cradle-to-cradle' approach to manufacturing that is not only more environmentally sustainable, but which yields highly efficient and profitable manufacturing. To achieve these breakthroughs, the UK needs, quite specifically, to create a clear focus on innovation across the metals and materials sectors. This is a cause that has long been championed by the materials sector in the UK, but has not yet received the full backing of the relevant innovation agencies. In a world with Britain outside the EU, the country can no longer rely on the beneficence of others to undertake its much needed research in materials, processing and energy and so it is more essential that the much supported and well publicised proposal for a Materials Catapult, is swiftly implemented.

THE CHANGING NATURE OF TRADE

Part of the rationale for Britain leaving the EU is to increase the capability of the country to trade with non-EU nations. It is to be expected that UK Government policy will be designed to support and promote such trade. It is worth considering how this shift in trade from Britain's near neighbours to a more globalised approach will change the nature of trade itself. In a physical sense, we would expect an increase in the proportion of goods leaving the UK, or being landed in the UK through bulk carriers, container ports, or air freight. A reduced portion will arrive by rail, or road transport via continental ferry. Such a shift will require Britain to invest in its infrastructure in airport and port capacity, but also in rail to support the collection and distribution of goods between factories, ports and airports.

1. Investment in the infrastructure to facilitate global trade will have an immediate impact on demand for engineered materials. This will affect all materials classes including ferrous, non-ferrous, light metals and rare metals; partly used for construction, but also for electronic equipment. Concrete, glass, ceramics and brick, will also feature strongly.

2. A lengthening of global supply chains for materials and manufactured goods will increase inventories, working capital and vulnerability to supply chain interruption associated with climatic, commercial, or financial interventions.

Despite these clear arising needs, the UK has significant gaps in processing capability for many of these important materials classes. These include copper melting, significant parts of aluminium processing and some steel processing capabilities.

The most significant driver in the offshoring of these industries is the relatively high energy costs in the UK, with 5% of world electricity used for mineral processing an example of the energy intensiveness of this sector.

It will be important to UK Sovereign Capability, in a post-EU situation, that the issue of energy be addressed, to enable the economic reshoring of parts of the metals supply chain. Innovation has an important role to play in designing new and improved processing technologies, improving productivity and yield, reducing energy consumption, designing new integrated energy systems, delivering industrial integration and creating the materials of the future.

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SOVEREIGN CAPABILITY

The combination of:

- Effects of more internationalisation in trade on UK infrastructure and supply chains
- Recognition that greater attention must be given to security of supply of critical raw materials
- A desire to exploit the UK's competitive advantage in product design
- An understanding of the UK's leading position in materials research

demonstrates that outside the EU, the Materials and Foundation Industries, form a crucial part of Britain's Sovereign Capability.

This recognition creates an imperative for Britain to take back responsibility for innovation strategy in materials and fully integrate this with the other sector strategies. The Materials and Foundation Industries should be supported in the way that the industry has requested, by establishing a Materials Catapult, to help build on existing capabilities in the UK innovation sector.

Creating this solid industrial foundation, through innovation and infrastructure, will give the confidence required to reliably invest in British manufacturing, creating much needed jobs and growth in communities and regions, throughout the United Kingdom.

Chris McDonald
Chief Executive Officer
Materials Processing Institute

RAW MATERIALS CONSIDERED CRITICAL BY BRITISH GEOLOGICAL SURVEY

ANTIMONY
Antimony Tin Oxide, flame retardant, micro capacitors

COBALT
Li-ion batteries, synthetic fuels

GALLIUM
Thin layer photovoltaics, IC, LED

GERMANIUM
Fibre Optic Cable, IR optical technology

INDIUM
Displays, thin layer photovoltaics

PLATINUM
Fuel cells, catalysts

PALLADIUM
Catalysts, seawater desalination

NIOBIUM
Micro capacitors, ferroalloys, high strength low alloy steel

NEODYMIUM
Permanent magnets, laser technology

Table 1

Materials Processing Institute

Chris McDonald is the Chief Executive Officer of the Materials Processing Institute, a not-for-profit industrial research institute, which has been supporting the materials, processing and energy sectors for over 70 years. Chris led the divestment of the Institute from its then parent company, Tata Steel, returning the organisation to independent ownership in 2014.

Chris's background is in industrial research and manufacturing, where he has worked internationally. A graduate of Cambridge University, Chris is a Fellow the Institute of Chemical Engineers and of the Institute of Materials, Minerals and Mining. He sits on industrial advisory boards at a number of universities, including Oxford and Sheffield and is an associate faculty member at the University of Warwick.

Chris has an interest in innovation management and industry dynamics. He provides expert opinion and support to companies, institutes and government organisations on innovation strategy & management to support growth and inward investment. He is a member of the CBI Regional Council for North East Engalnd and has recently been appointed as the Innovation Lead for the UK Metals Council.

Chris is often called to commentate in the media on innovation leadership and the steel industry.

> “A member of the CBI Regional Council and the Innovation Lead for the UK Metals Council”

Chris McDonald
Chief Executive Officer
Materials Processing Institute

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The Materials Processing Institute is an independent, open access and not-for-profit technology and innovation centre working with industry, government and academia worldwide. Support ranges from small scale, site based investigations, through to long term collaborative research programmes.

The Materials Processing Institute has expertise in materials, materials processing and energy, specialising in challenging processes, particularly those involving high specification materials, high temperatures and difficult operating conditions.

The Institute has over 70 years' experience as a leading UK technology provider. Extensive materials processing knowledge is supported by state-of-the-art facilities with a broad range of equipment, from laboratories through to demonstration, scale-up and production plant.

Scientists and engineers work with industry and apply their expertise to develop and implement robust solutions to research and development and improvements for products and processes.

Expertise is spread across a wide range of disciplines, including:

- Materials Characterisation, Research and Development
- Simulation and Design
- Monitoring, Measurement and Control in Hostile Environments
- Process Development and Upscaling
- Specialist Melting and Steel / Alloy Production
- Engineering / Asset Management
- Materials Handling
- Minerals and Ores

Research and project management teams deliver support across a wide range of industrial and manufacturing sectors including:

- Metals and Metals Manufacture
- Chemicals and Process
- Nuclear
- Oil & Gas
- Energy
- Aerospace and Defence
- Mining and Quarrying

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70
YEARS OF INNOVATION