

# NATIONAL MATERIALS INNOVATION STRATEGY

ECONOMIC EVIDENCE BASE

ROYCE

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## Acknowledgments

**This report was commissioned by the Henry Royce Institute for advanced materials as part of its role around convening and supporting the UK materials community to help promote and develop new research, development and innovation activity.**

**This important new evidence-base is supporting the production of a National Materials Innovation Strategy which is pivotal to delivering a coherent approach to materials across Government, industry and the wider materials technology community, and to the long term development of a vibrant, innovative and high-value Materials Sector.**

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# 1. Introduction

Throughout 2023 and 2024 The Henry Royce Institute (Royce) is seeking to support the development of a National Strategy for Materials Innovation (NMIS). Together with ScotChem, Perspective Economics was appointed in late 2023 to develop an economic evidence base that could be used to inform subsequent development of the NMIS.

This short summary report presents findings from an in-depth search for UK companies involved in materials innovation, in order to better understand how any future materials innovation policies or supports may relate to the economic profile of materials innovation activity.

## Methodology & Sources

The evidence base is derived from multiple open and proprietary data sources, including web intelligence provided by glass.ai, company data platform Bureau van Dijk, investment data platform Beauhust, and UKRI's Gateway to Research API. Several other bespoke sources including, for example, trade body membership lists were also used as inputs for company identification.

## Sector Expertise

The study has benefitted from input from sector experts, via both the Materials Innovation Leadership Group (MILG) who provided valuable feedback on early iterations of the evidence base, and from a panel of advisors with materials industry expertise, sub-contracted to the Perspective Economics team.

## GVA Estimation

Estimates of Gross Value Added (GVA) are calculated by applying ONS derived GVA per employee figures to estimates of UK employment within the set of companies identified. There is a risk that this approach may underestimate materials-related GVA because the figures used reflect GVA generated by all employees, rather than just employees with skills and expertise required to undertake materials innovation activity (who could be expected to contribute GVA above sector averages). This approach has nevertheless been adopted in the interests of prudence. Subsequent iterations of the analysis may seek to isolate materials-specific employment within the companies identified and adjust GVA estimates accordingly.

## UK Employment Estimates

Considerable care has been taken to identify UK-specific employment within larger UK headquartered multi-nationals so as not to overestimate employment or GVA. This has included desk-based review of Annual Reports, Gender Pay Gap reports, UK specific web pages and independent economic impact reports for ~80 companies.

## Segmentation & Classification

The analyses use industry-leading large language models as part of a semi-automated process for classifying each company into a 'best-fit' sector, and into a 'best-fit' value chain segment. The parameters used to define value chain and sector classifications are provided in the report appendices.

## Limitations

The approach to identifying companies with materials innovation activity, and subsequent measurement of employment and GVA is experimental. It is intended to provide a more granular understanding of UK materials innovation activity but does not purport to offer definitive metrics. The analysis is subject to several limitations including, in particular, the requirement to assign 'best-fit' supply chain categories and sector classifications. In reality many of the materials innovation companies identified operate across multiple sectors, and may be involved in more than one part of the materials supply chain. While forcing 'best-fit' classifications supports analytical clarity and ease of interpretation, it also underplays the complexity of economic activity. As previously mentioned, employment and GVA estimates relate to aggregate economic activity of the companies identified. Further analysis is required to isolate only materials related economic activity.

## 2. Materials Innovation Sector Profile

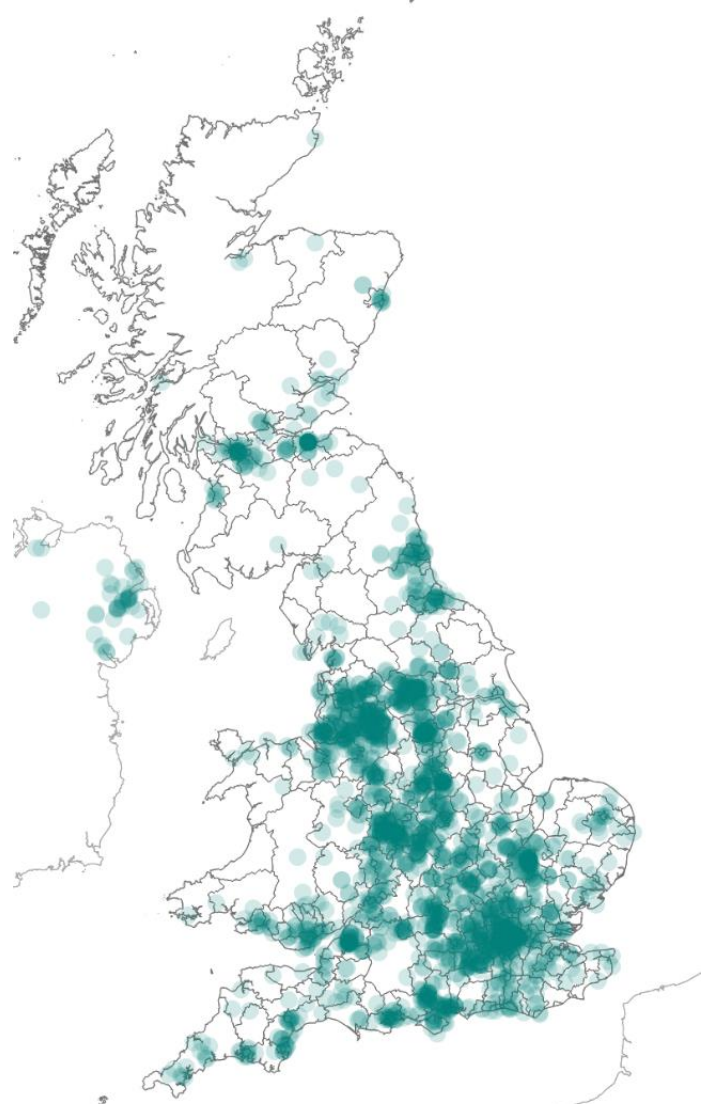
An initial search for companies involved in materials innovation activity in the UK identified 2,224 companies. This initial search drew primarily on web-intelligence, driven by a list of key terms produced in consultation with the wider NMIS strategy development team.

Subsequent strategy development activity engaged industry representatives in a series of workshops across the UK. These workshops identified additional companies which were incorporated into the materials innovation company dataset.

The study team also worked with a panel of expert advisors and conducted additional searches using proprietary data platforms to further test and augment the original company dataset.

This multi-source identification process identified an additional 350 companies, resulting in a set of 2,574 companies. Registered Office postcodes were available for a total of 2,551 companies (98.7%, Figure 1). Seventy percent of the companies identified have Registered Offices outside of London and the South East.

Figure 1 – Map of Registered Office Locations

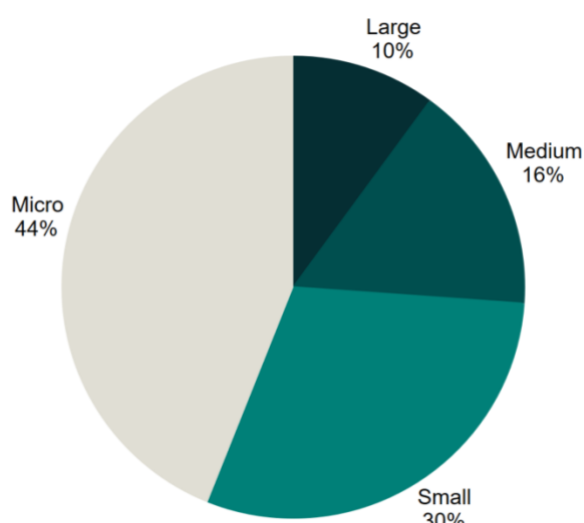


Source: Glass.ai, Bureau van Dijk, Tussell, Beauhurst, Sector Experts

Approximately three quarters of the companies identified are micro or small sized companies (between 1 and 49 employees). Sixteen percent are medium sized companies (between 50 and 249 employees) and ten percent are large companies (250 employees or more).

Materials innovation companies are registered under a total of 217 unique Standard Industrial Classification (SIC) codes<sup>1</sup>. The ten most common SIC codes against which materials innovation companies are registered are presented in Table 1.

Figure 2 – Initial Size Estimate



Source: Various (based on UK employment figures)

Table 1 – Top 10 Materials Innovation SIC Codes

Primary UK SIC (2007) description	Rank of Most Common SIC	% of Total Companies
Other research and experimental development on natural sciences and engineering	1	8%
Other manufacturing n.e.c.	2	7%
Manufacture of other plastic products	3	5%
Other professional, scientific and technical activities (not including environmental consultancy or quantity surveying) n.e.c.	4	4%
Other business support service activities n.e.c.	5	4%
Research and experimental development on biotechnology	6	3%
Manufacture of other chemical products n.e.c.	7	2%
Manufacture of other rubber products	8	2%
Engineering related scientific and technical consulting activities	8	2%
Manufacture of other special purpose machinery n.e.c.	10	2%

Source: Glass.ai, Bureau van Dijk

<sup>1</sup> Just over 1/3 of all UK SIC codes

## Global Economic Headlines

In the last available year for which data is available (typically 2021 or 2022), the companies identified generated turnovers of just under £1 trillion globally and employed just under 1.9 million people and have secured a total of more than £6.1bn in external grants and fundraisings.

Table 2 – Global Economic Headlines

<b>Turnover (£m, Last avail. Yr)</b>	<b>£984,759</b>
<b>Employees (Million, Last avail. Yr)</b>	<b>1.88</b>
<b>Total Grants Fundraising (£m, All Years)</b>	<b>£6,100</b>

Source: Bureau van Dijk, Beauhurst

## UK Economic Headlines

The study team used several sources to estimate the number of people employed within the UK, including company accounts, annual reports, gender pay reports, economic impact reports, UK specific web-content and LinkedIn<sup>2</sup>.

Based on UK specific employment data, in the latest year for which data was available, UK materials innovation companies employed 635,000 people.

Using Gross Value Added (GVA) per employee reference data derived from ONS sources suggests that the companies identified contribute just under £45bn in GVA to the UK economy<sup>3</sup>.

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<sup>2</sup> Used to estimate UK employment within large companies. Stated in order of priority i.e., LinkedIn data was only used where other sources did not provide specific UK employment figures. All employment within micro, small and medium sized companies is assumed to be UK specific.

<sup>3</sup> GVA per employee based on ONS GVA reference tables (Regional Gross Value Added by Industry) and Employment by Industry, calculated at the level of SIC Sections. As noted in the methodology, this approach may result in an underestimate.



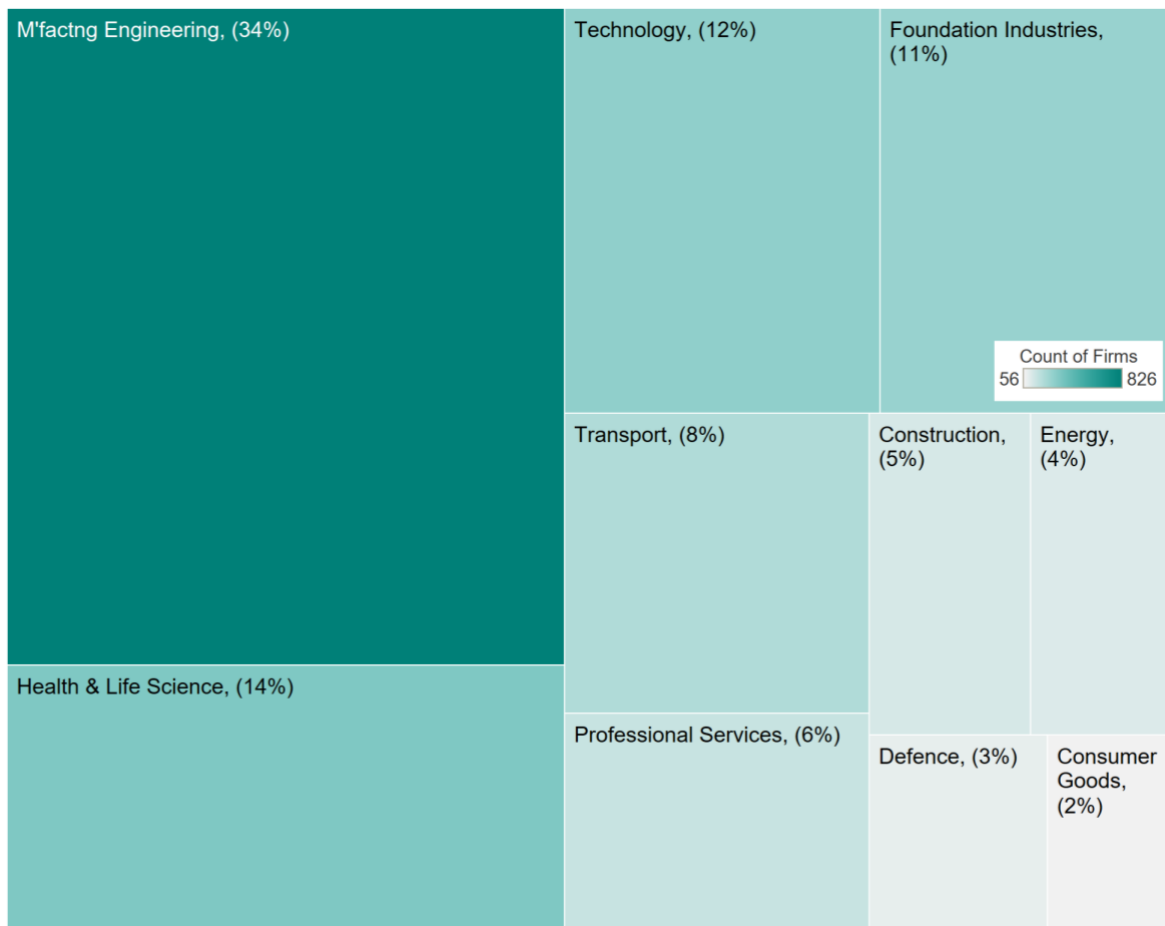
## Sectoral Classification

The analysis used industry-leading large language models and machine learning techniques to categorise companies into sectors that align with feedback received from the programme of NMIS workshops. Descriptions used to produce the classification are provided in the appendices. The sectors were:

- |                          |                              |
|--------------------------|------------------------------|
| 1. Foundation Industries | 7. Technology                |
| 2. Construction          | 8. Manufacturing Engineering |
| 3. Consumer Goods        | 9. Energy                    |
| 4. Transport             | 10. Professional Services    |
| 5. Defence               | 11. Other                    |
| 6. Health                |                              |

A majority of companies identified are categorised as manufacturing engineering companies. This definition is broad and includes but is not limited to mechanical, chemical, electrical, and industrial engineering and equipment manufacturers.

Figure 3 – Sectoral Breakdown of Firms



Source: Glass.ai, Perspective Economics

While manufacturing engineering firms account for one third of the materials innovation companies identified, other sectors also contribute substantively to employment and GVA. Table 4 provides a breakdown of key economic metrics by sector. Defence, technology and transport companies each also account for between 13% and 20% of estimated employment and GVA.

Table 4 – Economic Metrics by Sector

	% Firms	% Estimated Employment	% Estimated GVA	Median Turnover
Construction	5%	6%	5%	£4.3M
Consumer Goods	2%	3%	3%	£4.3M
Defence	3%	19%	18%	£11.0M
Energy	4%	6%	8%	£1.2M
Foundation Industries	11%	7%	8%	£10.4M
Health & Life Science	14%	9%	10%	£2.2M
M'factng Engineering	34%	13%	13%	£4.1M
Professional Services	6%	8%	7%	£1.7M
Technology	12%	15%	17%	£2.2M
Transport	8%	14%	13%	£8.0M

Source: Glass.ai, Perspective Economics

Median turnovers are reflective of the composition of each sector, for example the Defence sector includes a small number of companies, many of which are comparatively large. Figure 4 provides a breakdown of the size of companies across sectors.

Figure 4 – Size of Firms by Sector

	Construction	Consumer Goods	Defence	Energy	Foundation Industries	Health & Life Science	M'factng Engineering	Professional Services	Technology	Transport
Large	15%	21%	30%	15%	13%	8%	7%	10%	6%	19%
Medium	19%	5%	20%	9%	26%	12%	18%	4%	13%	27%
Small	27%	34%	19%	17%	31%	28%	34%	32%	31%	23%
Micro	38%	39%	31%	60%	31%	52%	41%	54%	50%	32%

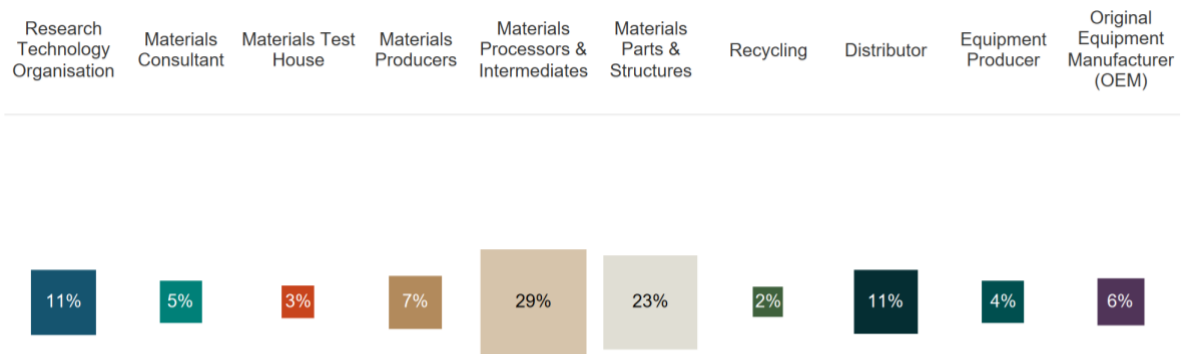
Source: Glass.ai, Perspective Economics

### Value Chain Segmentation

Analysis of descriptive information suggests that over half of the companies identified are involved in materials processing / production of intermediates or in the production of materials parts and structures (Figure 5). Comparatively few companies have been classified as either materials producers or original equipment manufacturers – pointing to potential value chain vulnerabilities at critical start and end points.

OEMs account for 41% of UK employment, and together, materials processors and parts producers account for 35% of employment. Value added by OEMs is estimated to be 43% of total GVA (~£20bn). Value added by parts producers is lower relative to employment associated with that value chain segment (18% of GVA compared to 21% of employment).

Figure 5 – Value Chain Analysis



Source: Perspective Economics

Analysis of company size by value chain segment shows (unsurprisingly) that the largest materials innovation companies are OEMs, and that the materials producer and parts producer value chain segments also have notable shares of larger companies.

Figure 6 – Company Size by Value Chain Segment

	RTO	Materials Consultant	Materials Test House	Materials Producers	Processors & Intermediate.	Materials Parts & Structures	Recycling	Distributor	Equipment Producer	OEM
Large	4%	11%	6%	17%	7%	12%		5%	5%	41%
Medium	6%	6%	9%	18%	18%	22%	16%	11%	16%	20%
Small	26%	19%	32%	23%	34%	28%	28%	36%	39%	22%
Micro	64%	64%	54%	42%	41%	37%	57%	48%	40%	17%

Source: Perspective Economics

Analysis of company numbers by both sector and value chain segment suggests that, for example:

- 68% of defence companies are either OEMs or producers of parts and structures;
- 59% of foundation industries companies are either materials producers or processors / intermediates;
- more than one third of health and life sciences companies are RTOs and just under two thirds of professional services companies are either RTOs, consultants or test houses.

Figure 7 – Company Count by Sector and Value Chain Classification

	RTO	Materials Consultant	Materials Test House	Materials Producers	Materials Processors & Intermediat.	Materials Parts & Structures	Distributor	Recycling	Equipment Producer	OEM
Construction	3%	2%	1%	3%	33%	43%	11%	3%		1%
Consumer Goods	4%			5%	48%	13%	25%	5%		
Defence	3%	4%	3%	1%	15%	38%	5%		1%	30%
Energy	16%	4%	3%	5%	26%	27%	3%	8%		9%
Foundation Industries	5%	0%		28%	31%	8%	22%	5%	1%	1%
Health & Life Science	35%	3%	2%	12%	20%	14%	7%		4%	4%
Manufacturing Engineering	4%	1%	3%	4%	39%	24%	11%	0%	8%	5%
Other Sector	13%	1%	5%	6%	28%	13%	14%	14%	5%	1%
Professional Services	11%	47%	7%	3%	12%	10%	6%	3%		1%
Technology	18%	4%	2%	5%	25%	17%	11%	1%	10%	7%
Transport	5%	1%	2%	1%	16%	57%	3%	0%	1%	13%

Source: Perspective Economics

## Next Steps

This evidence base forms the first phase of an endeavour to estimate the critical role that materials play in the UK's prosperity.

The next phase will see us produce a more granular analysis to better understand the materials-specific employment landscape – estimating how many people are currently in materials-related roles and what materials job roles are in most demand amongst the large and strategically significant companies we have already identified.

This crucial evidence base will ensure that the National Materials Innovation Strategy and Action Plan is focused on priority areas that align into national and regional policy drivers – from economic growth and clean energy, to job creation and healthier lives.

## Appendix 1: Sectoral Definitions

Sector Group	Description
Foundation Industries	Companies that are critical to the manufacturing supply chain, providing essential materials and components used across various aspects of the economy. Including companies involved in the production of metals, ceramics, chemicals, cement/concrete and paper. They are called "foundation" because their outputs are fundamental to the construction, manufacturing, and production processes in many other industries, acting as the building blocks for a wide range of products and infrastructure projects.
Construction	Companies involved in the construction of new buildings and repairs or alterations to existing properties in Great Britain measured by the amount charged for the work, including work by civil engineering companies.
Consumer Goods	Companies involved in the manufacture of consumer products including but not limited to cosmetics, cleaning products and textiles.
Transport	Companies involved in the manufacture of aerospace products and components
Defence	Companies involved in the manufacture of products primarily for military use including fighter aircraft, helicopters, large aircraft wings, missiles, jet engines, submarines, warships, amphibious vehicles, armoured vehicles, armour, weapons and munitions, surveillance and communications equipment.
Health & Life Sciences	Companies involved in the application of biology and technology to health improvement, including biopharmaceuticals, medical technology, genomics, diagnostics and digital health.
Technology	Companies involved in telecommunications and data, computing (including quantum and neuromorphic), semiconductors and chips, other electronic components and products, and scientific equipment.
Manufacturing Engineering	Companies involved in mechanical, chemical, electrical, and industrial engineering as applied to manufacturing of goods and intermediates that are not included in the foundation industries. Including equipment manufacturers.

Energy	Companies involved in the production, storage and distribution of energy including traditional energies (oil and gas), renewable energy and nuclear energy.
Professional Services	Companies involved in providing materials innovation related consultancy services

## Appendix 2: Value Chain Definitions

Group	Description	Example Companies
Research Organisation	Any organisation involved in materials research and development	CPI, AMRC, TWI, Lucideon, NCC, BDC, WMG / IfM
Consultant	Any organisation involved in offering materials-related consultancy or advisory services	Avalon CSL, Frazer-Nash, ScotChem
Test House	Any organisation involved in materials testing or monitoring	NPL, Element Materials Technology, NDT Consultants, Sonomatic, Westmoorland Mechanical Testing, Resonate Circuits
Producers	Any organisation involved in the development and/or production of chemicals and/or virgin materials	Huntsman, Solvay (Syensqo), NSG, Outokumpu, Tata Steel, GSK, Croda, Timet, Scott Bader
Materials Processors & Intermediates	Any organisation involved in a process that adds value to an existing material	Hexcel, Bodycote, Chemring, M. Wright, James Dewhurst, Technical Fibre Products
Parts & Structures	Any organisation using materials to produce parts, structures or components	Teledyne, Spirit Aerosystems, GKN, NIFCO, Fluid Power Equipment, Plessey Semiconductors, IQE, ZF Automotive, Safran, Thales



OEM	Any organisation assembling parts and structures to produce end products and systems	Airbus, Boeing, JRL, Nissan, Siemens, Vestas, Weir Group, Hitachi, Toshiba, Seagate, Smiths, Sunseeker
Equipment Producer	Any organisation providing manufacturing and processing equipment and tools	Cygnets Group, Renishaw, Surface Measurement Systems, RHI Magnesta, Oxford Instruments
Distributor	Any organisation involved primarily in the wholesale or distribution of materials products	Plastribution, Sheet Materials Wholesale, Vulcan Materials Company, Neonickel
Recycling	Any organisation involved in recycling and reprocessing materials	Veolia, Gen 2 Carbon, EMR

Source: NMIS Study Team

This National Materials Innovation Strategy Economic Evidence base is a comprehensive and updated Econometrics Report on materials innovation in the UK. It presents the findings from an in-depth search for UK companies involved in materials innovation, in order to better understand how any future policies may support to the economic profile of materials innovation activity. This evidence is supporting a strategy process which is surfacing the promising cross-sector opportunities that if exploited, will ensure the UK maintains a world-leading position in the rapidly expanding materials markets in which the UK has a major foothold, and which currently generate turnover of £1 trillion and employ 1.9 million skilled workers.

The report was authored by Perspective Economics, with expert input from Dr Faye Smith OBE, Dr Rob Hardeman MBE, ScotCHEM and Members of the Materials Innovation Leadership Group (MILG).

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