

Semiconductors 'New Economy' cluster snapshot

The global semiconductor market is valued at over \$600 billion and is forecast to reach \$1 trillion by 2030, reflecting the importance of these materials now and in the future. The building blocks of microchips, semiconductors form the basis of all modern electronic systems. There's a global race to develop, build and maintain end-to-end supply chains in this market underpinned by economic growth potential and firming up national security. This is demonstrated by the wide-ranging impacts of the ongoing global chip shortage.

Published by government in May 2023, the UK's **National Semiconductor Strategy** provides a 20-year vision for building on the nation's industry and securing its place on the global stage. The strategy focuses on the UK's strategic advantages: semiconductor design, cutting edge compound semiconductors, and a world-leading R&D ecosystem. There's a commitment of £1 billion of investment in the next decade to improve access to infrastructure, power more research and development and facilitate greater international cooperation.

A key objective for the UK is safeguarding the supply of semiconductors through periods of global disruption, including by building a more resilient end-to-end supply chain. This is especially important because the UK has a comparatively small semiconductor industry, particularly in the manufacturing aspect (there are around 25 "fabrication" plants across the UK, but most are small in size and capacity)¹. This represents a growth opportunity for the Midlands given the region's industrial excellence and technical expertise. This is supplemented by an academic base working within semiconductor research and linked technologies.

1. Business, Energy and Industrial Strategy Committee Report (2022) – 'The semiconductor industry in the UK'.

Cluster in context

4,000+ jobs -
9% of the UK total

19 high growth
companies
(18% of the UK)

200+ businesses
- 16% of the UK total. 51%
growth since 2013

4 companies with
£100m+ turnover

7% of Midlands
university graduates
(over 9,000 total) in 2021
studied subjects relevant
to semiconductors³,
including from 4 of the
top 25 UK universities
for Engineering and
Technology

For example the University of Warwick specialises in power semiconductor technology, and there is semiconductor development expertise at the University of Nottingham.

There is currently limited data available for accurately quantifying semiconductor activity in the UK and its regions. However, this document attempts to pull together available information about semiconductors in the Midlands², produced by the Midlands Engine Observatory. Due to the rudimentary data in this sector, the findings should be taken with some caution and be viewed as a foundational publication.

Semiconductors are one of the five critical technologies identified in the **UK Science and Technology Framework (2023)** and the International Technology Strategy.

These define semiconductors as:

"A class of electronic materials with unique properties that sit at the heart of the devices and technology we use every day".

Semiconductors play a significant role in modern electronics and information technology, enabling the processing and control of electrical signals in devices like computers, smartphones, automotive vehicles and various advanced systems in many industries.

Semiconductor technology is also used to process electrical energy, underpinning major markets in transport, renewable energy controls and grid management – putting the opportunity at the heart of the net zero transition across the Midlands' strongest industries and supply chains.

As identified by the **UK government** and **TechUK**, semiconductors are significant across many sectors and essential to maximising the potential of net zero, artificial intelligence, 5G / 6G, space and quantum computing.

As well as providing obvious technological and economic growth opportunities, the development and strength of semiconductor supply chains has wider implications for national security. Beyond design, the UK has particular strengths in power device technology, reinforced by the recent acquisition of the UK's largest semiconductor plant by US company Vishay, in which the University of Warwick played a pivotal role. This was done through the ESCAPE (End-to-end Supply Chain development for Automotive Power Electronics) project.

Methodology

This document's evidence collection has followed a similar process to the recent Midlands Engine "**Exploring the Investment Potential of Midlands Clusters**" report and its individual cluster snapshots.

It has been supported by the expertise of The Data City, especially its Real-Time Industrial Classifications (RTIC) methodology. The principal data source is **Computer Hardware: Semiconductor electronics RTIC**, utilising The Data City's AI-driven tool to identify companies operating in new economy clusters.

This tool allows us to investigate cluster features at the local level, helping us understand economic value and the firms driving it. The Data City identifies companies in the semiconductors RTIC as those that have a specific focus and/or product offer related to the semiconductor supply chain.

The Midlands Engine Observatory has collated further relevant evidence from other sources to supplement the insight provided by The Data City.

2. For the purposes of this document, the "Midlands" is defined as the 65 Local Authorities that form the Midlands Engine Partnership geography; slightly different to the traditional West Midlands and East Midlands regional (ITL1) geographies.

3. Mechanical engineering; Physics; Engineering (non-specific); Production and manufacturing engineering; Electrical and electronic engineering; Chemical, process and energy engineering; Materials technology; Polymers and textiles; Materials science

Business ecosystem⁴

217 total businesses active in the Midlands

- 16% of the UK semiconductor business population with 51% growth between 2013 and 2022
- 4 strategic (£100m+ turnover) companies
- 27% of the strategic semiconductors companies in the UK have a Midlands location

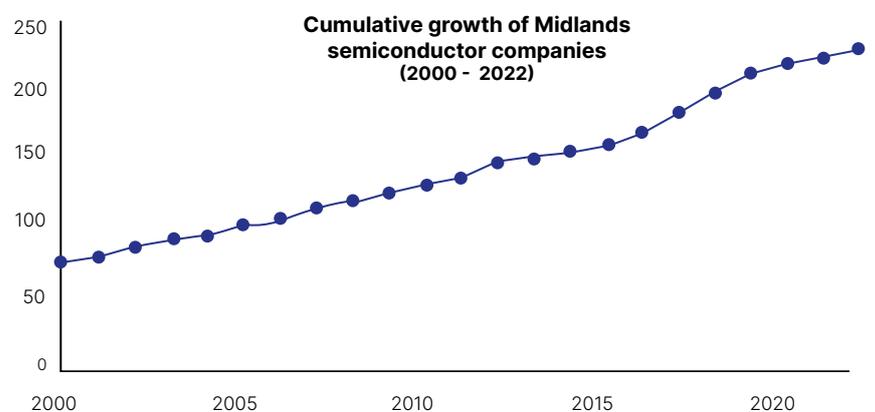
19 high growth companies⁵

- 18% of the high growth semiconductor companies in the UK have a Midlands location

56 incorporations between 2017 and 2022

- 18% of UK semiconductor incorporations between 2017 and 2022 have a Midlands location
- 24 semiconductor companies in the Midlands are identified as “scale-ups” and a further 10 as “large scale-ups”

Semiconductor companies by company stage (UK and Midlands)			
Company stage	UK companies	Midlands companies	Midlands % of UK
Seed	0	0	N/A
Start-up	204	32	15.7%
Scale-up	130	24	18.5%
Large scale-up	69	10	14.5%
Unicorn	0	0	N/A
Established	505	88	17.4%
Other SME	418	63	15.1%
Total	1,326	217	16.4%
Linked to university spinout	21	0	N/A



Midlands firms in the semiconductor supply chain include:

Teledyne Lincoln Microwave (Lincoln)

A world leader in the development and supply of microwave products, including microwave semiconductors such as Gunn and Schottky Diodes. Also produces other electrical products such as amplifiers, circulators and converters.

Dynex Semiconductor (Lincoln)

Manufacturers of high-power bipolar capsule devices, IGBT modules and power assemblies. These semiconductor devices are currently in service across 60 different companies.

Advanced Epi Materials and Devices Ltd (Leamington Spa)

Offering a range of tailored services focusing on group IV semiconductor materials including silicon, germanium, silicon carbide and various alloys. In addition to supplying epitaxial materials, Advanced Epi specialises in in-depth material characterisation, device fabrication and process development.

Morgan Technical Ceramics (Rugby)

Global market leader and specialising in supplying materials and components for manufacturing processes of semiconductors and other high-quality demanding markets, such as LED displays, for more than 20 years.

Torex Semiconductors Europe (Leicestershire)

Leading provider of CMOS power management ICs aimed at battery-powered and energy-efficient applications. Specialising in cutting edge CMOS analogue technology.

4. The Data City 2023

5. Estimated 20%+ company growth per year

Innovation ecosystem

Project funding

Midlands universities have received £4.6m (3.3% of the UK total) UKRI funding for semiconductor projects since 2017, according to **Gateway to Research**⁶. Universities to receive funding from these active awards were:

- University of Nottingham: £3.3m+
- Warwick University: £1.2m+

Universities with relevant high performing HEI research⁷

- Loughborough University
- Keele University
- Nottingham Trent University
- University of Birmingham
- University of Nottingham
- University of Leicester
- University of Warwick

Since 2018/2019, the Midlands has received over £13.2m (6.2% of UK) innovation funding with an average award of £390k⁸.

Semiconductor projects funded by UKRI funding include:

ESCAPE: End-to-end Supply Chain development for Automotive Power Electronics

(University of Warwick as a key project partner; £20m)

ESCAPE is a £20m consortium project which aims to establish globally unique and cohesive end-to-end supply chain capability for innovative Silicon Carbide (SiC) power electronics. Partially funded by the Collaborative Research and Development (CR&D) programme delivered by the Advanced Propulsion Centre (APC), it is designed to service UK and global end user demand.

EPI2SEM Facility (University of Nottingham; £2.9m)

The facility aims to revolutionise semiconductor technology by making it smaller and more versatile, with applications in quantum materials, manufacturing processes, quantum technologies, nanotechnology, surface physics and various scientific disciplines, ultimately contributing to research advancements and societal prosperity.

Boron-based semiconductors - the next generation of high thermal conductivity materials (University of Nottingham; £400k)

The project addresses the pressing challenges of thermal management in electronic and photonic devices by developing scalable technologies for boron-based semiconductors. These materials have the potential to significantly improve heat dissipation, offer a wide optical range, and enhance the performance of power electronics and photonics.

Electric fields by 4D scanning transmission electron microscopy (University of Warwick; £1m)

The future of technological advancement relies on the ability to control electronic properties of functional materials, however measuring internal electric fields has been challenging. New advanced detectors in electron microscopes can help us measure things like internal fields in materials, including semiconductors. This can be useful for making better semiconductors and understanding how these materials behave.



Investment ecosystem

Only 6% The Midlands has received a relatively low level of public innovation funding compared to its proportion of UK industry, receiving only 6% of Innovate UK funding.

However £4.6m worth of investment funding has been identified within semiconductor companies registered or active in the Midlands since 2009.⁹ Companies that received investment include:

- **P.W. Circuits Limited** (Leicestershire)
- **Dynex Semiconductor Limited** (Leicester)
- **Express Circuits Limited** (Warwickshire)

6. Projects reported to reference 'semiconductors' – this is unlikely to be exhaustive.

7. REF 2021 GPA >3.0 in any of Physics and Engineering, Polymers and textiles; Materials science

8. Innovate UK Award Data

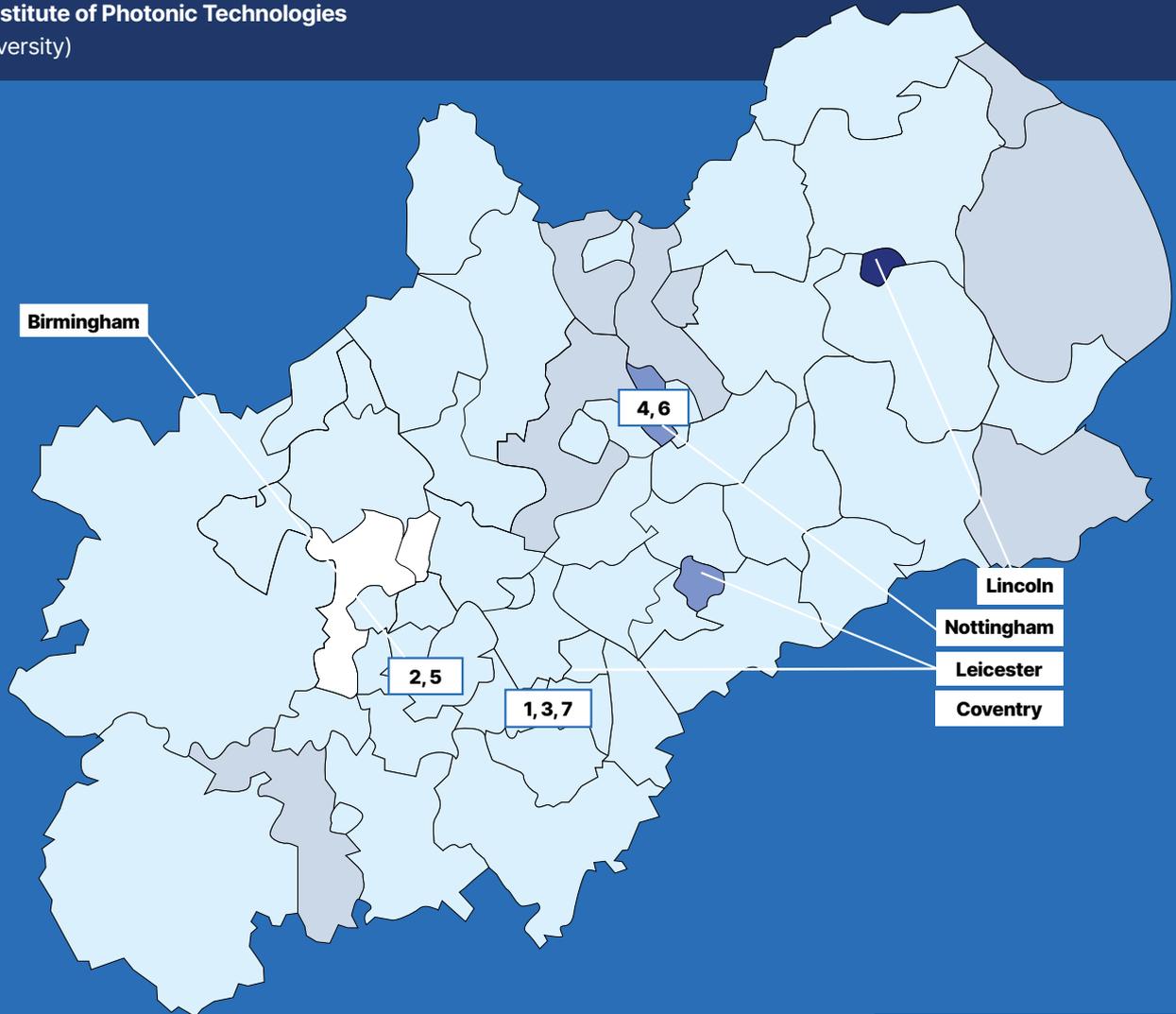
9. Dealroom and The Data City, 2023

Innovation assets

- 1. **Advanced Propulsion Centre** (University of Warwick)
- 2. **Birmingham Centre for Strategic Elements & Critical Materials** (University of Birmingham)
- 3. **Manufacturing Technology Centre** (Coventry)
- 4. **EPI2SEM** (EPitaxial growth and In situ analysis of 2D semiconductors) (University of Nottingham)
- 5. **Aston Institute of Photonic Technologies** (Aston University)

6. **Institute for Advanced Manufacturing** (University of Nottingham)

7. **Semiconductors Research Group** (University of Warwick)
 There are wider national opportunities for Midlands organisations to tap into, for example the **Compound Semiconductor Applications Catapult (South Wales)** and the **'ChipStart'** incubator for semiconductor start-ups.



Talent ecosystem

4,287 employees across identified semiconductor companies¹⁰ (estimated) - 9.5% of all UK semiconductor employees.

9,035 graduates in relevant subjects¹¹ - 7% of Midlands graduates studied relevant subject to semiconductors.

As highlighted in the map above, spatial concentrations of talent in the private sector include Lincoln (albeit skewed by one large employer), Leicester and Nottinghamshire, in addition to the university talent and academic expertise of Warwick.

10. The Data City 2023

11. Graduates from relevant subjects 2021 (HESA): Mechanical engineering; Physics; Engineering (non-specific); Production and manufacturing engineering; Electrical and electronic engineering; Chemical, process and energy engineering; Materials technology



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