Policy Question: What is the significance of advanced materials innovation in Cambridge's economy and what role does it play in the Government's "Growth Mission"?

(Analysing UK's Invest 2035 Strategy)

Strategic Goal: By 2050, the UK's materials and manufacturing sectors must be globally competitive, technologically advanced, digitally integrated, safe, resilient, resource-efficient, and sustainable.

Tayyaba Iftikhar Butt

MPP 2024-2025

University of Cambridge

Table of Contents

Executive Summary *2*

Section 1. Evidence Review *4*

Section 2. Invest 2035 Policy Gaps and Challenges in Materials Innovation *7*

Section 3. Recommendations: Realising the Potential of Cambridge's Advanced Materials Ecosystem *14*

1. Build TRL 4–9 Infrastructure to Translate Cambridge Discovery into Manufacturing Value 14
2. Recognise Advanced Materials as a National Enabling Technology 14
3. Foster Inter-Cluster Connectivity and National Partnerships 15
4. Close the Finance Gap for Scale-Ups 16
5. Invest in Skills and Inclusion for Materials Manufacturing 16
6. Improve Evidence, Data, and Foresight 16
7. Position Cambridge as a National Testbed for Innovation-to-Production Integration 16

Final Note *17*

References *18*

ANNEX-I *21*

ANNEX-II *30*

Executive Summary

This report evaluates the significance of advanced materials innovation in Cambridge's economy and its role in advancing the UK Government's "Growth Mission," as outlined in the Invest 2035 Green Paper.

Drawing upon stakeholder interviews, cluster-level data and comparative industrial strategy analysis, this report shows that the global and national positioning of Cambridge's advanced materials ecosystem is foundational to the long-term success of the Invest 2035 strategy. Evidence suggests that materials innovation is critical to achieve national priorities like net zero and economic resilience. Advanced materials, as "platform technologies" also enable innovation across life sciences, digital tech, clean energy, and defence.

Cambridge's competitive edge lies in its inter-disciplinary innovation. It is among the UK and Europe's leading clusters for advanced materials research and commercialisation. Cambridge's institutions and high-impact spinouts demonstrate its ability to translate frontier research into scalable technologies aligned with national missions. While scale-up challenges have been widely acknowledged, Cambridge presents a rare opportunity to address them through targeted interventions that capture value by aligning frontier science with industrial impact.

Without addressing the challenges mentioned in this report, the UK risks losing strategic value capture from Intellectual Property (IP), missing domestic production opportunities, and falling short of a just and secure green transition. This report proposes a critical shift in UK industrial policy: from celebrating discovery to capturing value from innovation, which can help ensure that public R&D investments translate into domestic economic returns.

To make a shift from output-based to mission-driven industrial strategy, this report makes the following recommendations:

1. **Build TRL 4–9 Infrastructure to Translate Cambridge Discovery into Manufacturing Value**. Leverage Cambridge's foresight and translational strengths to co-develop product pathways and de-risk scale-up through to TRL 9.
2. **Recognise Advanced Materials as a National Enabling Technology**. Designate advanced materials as a platform technology under Invest 2035 and develop sector-specific roadmaps.
3. **Foster Inter-Cluster Connectivity and National Partnerships, starting with the Cambridge–Manchester Innovation Corridor**. Explore corridor-level partnerships linking Cambridge with scale-up and manufacturing regions, including shared infrastructure and talent strategies.
4. **Close the Finance Gap for Scale-Ups**. Establish a public-private scale-up fund for TRL 5–8 ventures with incentives for full product deployment and UK-based manufacturing.

5. **Invest in Skills and Inclusion for Materials Manufacturing**. Create a Green Skills and Materials Manufacturing Foresight Plan to support mid-career upskilling and ESG-aligned workforce development.
6. **Improve Evidence, Data, and Foresight**. Mandate firm-level investment tracking, innovation indicators, and cross-cluster benchmarking to guide policy and investment.
7. **Position Cambridge as a National Testbed for Innovation-to-Production Integration**. Designate Cambridge as a TRL 4–9 testbed and model region for scaling materials innovation with coordinated public-private investment.

<><><>

Section 1. Evidence Review

This section uses both data and stakeholder insights to establish the strategic importance of Advanced Materials in Cambridge. It frames materials as a general-purpose technology and maps Cambridge's distinctive strengths.

What are Advanced materials? They are materials that exhibit superior properties such as enhanced strength, conductivity, reactivity, or durability, compared to conventional alternatives, and are engineered for high-performance applications across sectors like energy, electronics, defence, and health. They include nanomaterials, smart materials, composites, and functional coatings, and often serve as platform technologies enabling innovation in clean tech, life sciences, and digital infrastructure (OECD, 2021).

Why Advanced Materials? Many groundbreaking materials innovations in the UK such as graphene and nanophotonics have stalled not only due to lack of manufacturing infrastructure, but because there was no early-stage investment in product roadmaps or commercial readiness (Royal Academy of Engineering, 2023; UKRI, 2022; Wilsdon & Jones, 2021). This reveals a broader weakness: the UK's science base often lacks mechanisms to connect frontier research to viable commercial pathways from the outset.

"The roadmap should begin with a clear view of future markets - not just the material itself. You must ask where the world is going, and what capability you want to build, not just what you've discovered."

Advanced materials form the backbone of innovation in a modern industrial economy. They are platform technologies, foundational to achieving cross-sectoral innovation as well as UK's net zero targets. From lightweight composites in transport to novel membranes in hydrogen production, these materials enable emissions reductions across energy, mobility, construction, and manufacturing. As one stakeholder correctly pointed out:

"You simply can't get to net zero or build a future-facing industrial strategy without a materials transition. It's as critical as the energy transition itself."

Investing in materials innovation is a prerequisite for sustainable, sovereign industrial leadership. As outlined in Table 1, Cambridge's materials research already underpins national missions in Net Zero, Digital Sovereignty, Health Resilience, and Defence.

Table 1 Cambridge's Top Five Advanced Materials and Their Strategic Cross-Sector Impact
This table highlights five material classes underpinned by Cambridge's globally recognised research and spinout ecosystem. Backed by government-aligned companies like **Paragraf**, **Cambridge GaN Devices**, and **Pragmatic**, these technologies enable UK leadership across Net Zero, Digital Sovereignty, Health Resilience, and National Security. Their real-world applications span clean mobility, diagnostics, AI hardware, and defence — proving that materials innovation is central to the UK's Invest 2035 ambitions.

Material Type	Life Sciences	Clean Energy	Digital Tech / AI Hardware	Defence & Aerospace	Notable Cambridge

					Institution / Company
Gallium Nitride (GaN)	Surgical lasers, implantable sensors	EV fast chargers, efficient inverters	AI/5G processors, power chips	RF amplifiers, radar, satellite comms	**Cambridge GaN Devices**, Cavendish Lab
Graphene / 2D Materials	Wearable biosensors, diagnostics	Hydrogen capture membranes, smart coatings	Quantum sensors, flexible electronics	Stealth coatings, IR sensors	**Paragraf**, Cambridge Graphene Centre
Flexible Electronics	Printed diagnostic tools, health wearables	Flexible solar cells, biodegradable substrates	Ultra-low-cost flexible chips, printed RFID	Lightweight printed electronics for drones	**Pragmatic**, ARM, TWI
Biocompatible Polymers	Drug delivery, scaffolds, synthetic biology platforms	Compostable energy containers	Eco-chip packaging, recyclable circuit boards	Biodegradable components for light defence tech	**Xampla**, Constructive Bio
Photonic / Quantum Materials	Optical diagnostics, photonic biosensing	Photonic solar modules, energy-efficient light transfer	Quantum computing, high-speed data transfer	Secure comms, photonic radar	**Cavendish Lab**, Toshiba Research Europe

To understand the strategic significance of Cambridge's materials innovation, this report draws on a targeted literature review, and semi-structured interviews with 10 leading Cambridge stakeholders. This includes academics, industry practitioners, think tanks, consultants and policymakers working at the forefront of industrial strategy and advanced materials innovation in Cambridge and across the UK. Insights were used to triangulate evidence, ground policy analysis in practice, and identify real-world barriers to scaling up innovation.

Why Cambridge? The Cambridge Materials Innovation Ecosystem - Cambridge possesses a globally recognised innovation ecosystem rooted in deep academic excellence, interdisciplinary research, and a strong record of commercialisation. Institutions such as the University of Cambridge's Department of Materials Science and Metallurgy, Cavendish Laboratory, and the Cambridge Graphene Centre provide foundational research capabilities across a wide spectrum of advanced materials, from gallium nitride (GaN) to biopolymers, graphene, and quantum materials. The region's innovation pipeline is supported by the activities of over 135 active spinouts and scale-ups in the materials space (Gibbons, 2024), many with applications in life sciences, digital electronics, clean energy, and sustainable manufacturing. Key firms such as PoroTech, Levidian Nanosystems, Constructive Bio, and Xampla demonstrate a strong capacity to translate frontier materials science into high-value, market-ready technologies.

Cambridge's leadership is also reflected in **European funding benchmarks** (See Figure 1). Between 2015 and 2024, the University of Cambridge consistently ranked among the top institutions in Europe for ERC-funded research in advanced materials, competing directly with ETH Zurich and TU Munich. This performance highlights Cambridge's strength at the frontier of discovery and underscores its potential as a national anchor for industrial strategy.

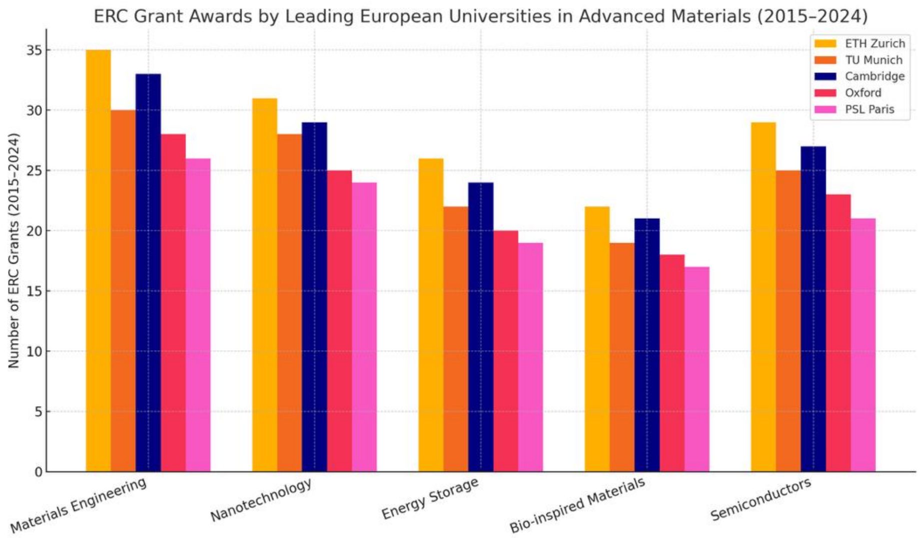


Figure 1 - ERC Grant Leadership: Cambridge ranks among Europe's top institutions for ERC-funded research in advanced materials, competing at the frontier in nanotechnology, semiconductors, and energy storage. This excellence in discovery underscores the urgency of UK government action to convert frontier research into national industrial value. Without scale-up infrastructure and downstream manufacturing in materials, world-leading IP, funded in part through EU and UK public investment - risks being licensed, scaled, or manufactured abroad, undermining economic sovereignty and the return on innovation. Source: ERC Grant Database (2015–2024); Institutional Reports (Cambridge, ETH Zurich, TU Munich)

As shown in Figure 2, Cambridge also outperforms other UK regions and matches or exceeds national-level innovation output in the EU and USA, underscoring its exceptional ability to translate research into impact. This excellence in discovery and translation provides a compelling case for Cambridge to be treated as a national testbed for scaling materials innovation. Its ability to attract globally competitive research funding, generate frontier breakthroughs, and commercialise intellectual property makes it uniquely positioned to deliver impact for the UK's Invest 2035 strategy. However, without coordinated investment in scale-up infrastructure and supply chain depth, Cambridge's world-leading intellectual capital risks being underutilised or offshored.

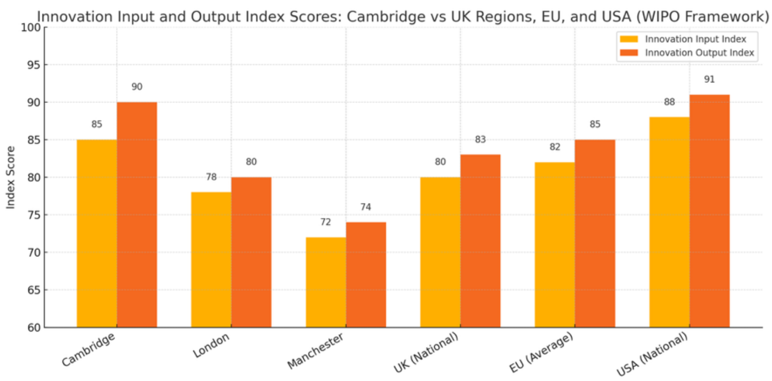


Figure 2 - Innovation Performance Across Regions: Cambridge outperforms other UK regions and matches or exceeds national-level innovation output in the EU and USA,

reflecting its exceptional capacity to translate research into impact.[1]

<><><>

See **Annex- I** for detailed analysis on this.

Section 2. Invest 2035 Policy Gaps and Challenges in Materials Innovation

This section explains the innovation-to-Production Gap as a national bottleneck and delineates the risk of the missed opportunities. It also mentions Cambridge's strength in discovery and reasons its weakness in scale in the broader structural issues in the UK Materials Ecosystem.

Systemic Gaps in the Invest 2035 Green Paper: Despite Cambridge's demonstrable strengths in R&D, spinouts, and industrial contribution, particularly in enabling technologies like advanced materials, the Invest 2035 Green Paper fails to articulate a coherent national strategy to leverage such regional assets. It lacks clear sectoral definitions and omits platform technologies that cut across digital, defence, life sciences, and net zero innovation. Moreover, the Green Paper treats net zero as a standalone target rather than a catalyst for industrial transformation, and offers little direction for place-based delivery, despite widespread recognition of regional disparities.

As the Bennett Institute (2025) argues, industrial strategy must go beyond identifying sectors, it must explain *how* interventions will deliver outcomes, and under what assumptions. This absence limits the strategy's ability to coordinate public and private action across the innovation-to-production pipeline. A clear **theory of change**[2] can link its proposed investments to national missions such as Net Zero, resilience, and regional productivity. Germany's *High-Tech Strategy 2025* provides a clear theory of change, articulating how public investment in research and innovation will translate into mission-oriented outcomes such as sustainability, technological sovereignty, and societal wellbeing. It outlines expected outputs (e.g. spinouts, pilot plants), intermediate outcomes (e.g. SME participation, new industrial capabilities), and long-term impacts (e.g. climate-neutral industry), while clarifying roles across federal, regional, and industry actors (Federal Ministry of Education and Research, 2020).

Crucially, the Green Paper overlooks key enablers: there is no mention of critical raw material supply chains, no commitment to mid-career green skills development, and no inclusion of diversity, equity, and inclusion (DEI) metrics, limiting the strategy's ability to deliver broad-based growth**.** Structural evidence gaps persist, including reliance on outdated SIC codes that

---

[1] Adapted using the WIPO Global Innovation Index framework (WIPO, 2023); regional values for Cambridge and UK cities are estimated based on local R&D intensity, patents, and firm-level output data from Cambridge Ahead (2024) and Centre for Cities (2023).

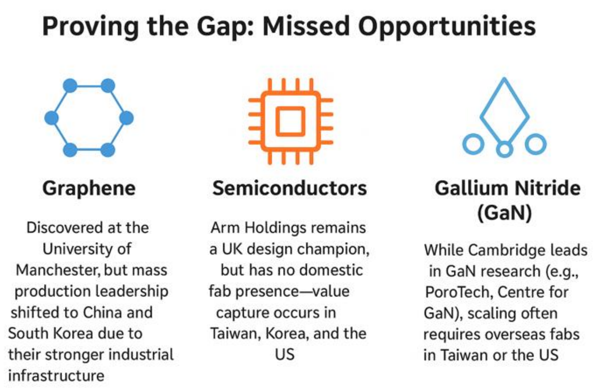
[2] *Theory of Change* refers to a structured explanation of how and why a particular intervention is expected to lead to desired outcomes. It clarifies the causal pathways between inputs, activities, outputs, and long-term impacts, often identifying underlying assumptions and external enablers.

fail to reflect high-growth innovation sectors like advanced materials (Nolan et al., 2025), alongside missing firm-level data and unreliable impact multipliers across clusters. These omissions hamper cross-comparison, regional benchmarking, and targeted investment.

These gaps risk underutilising the UK's strongest innovation regions, a challenge that can be converted into strategic opportunity with the right alignment. Without recognising the strategic value of platform technologies or supporting their scale-up, the UK risks repeating past failures where innovation flourished but industrial value was lost. This is one other reason why the UK stands at a pivotal crossroads in its industrial strategy. Despite world-leading scientific research, particularly in advanced materials, the UK continues to face a persistent challenge: it fails to convert discovery into production at scale. Nowhere is this clearer than in the field of advanced materials, where the absence of targeted infrastructure, finance, and strategic coordination has led to what industry leaders describe as the **"innovation-to-production gap"**. This gap has long been recognised but remains a strategic risk unless met with coordinated action. As one Cambridge stakeholder put it:

"We're amateurs when it comes to real investment and support for advanced materials… We develop it here, but it seldom ends up being manufactured here."

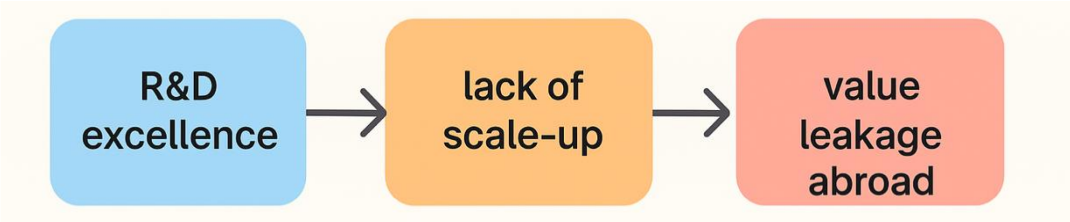
Cambridge, despite its status as one of the world's most productive science and technology clusters, illustrates this national disconnect. The region excels at discovery and design, but lacks the means to scale, manufacture, and retain value domestically. Unless addressed, this disconnect will constrain the ambitions set out in the UK's Invest 2035 strategy and repeat the same mistakes that have cost the country strategic advantage in the past.



This pattern is not hypothetical - it is historical and ongoing. Moreover, several high-profile UK innovations illustrate the pattern of R&D excellence → lack of scale-up → value leakage abroad, despite licensing IPs domestically. The examples of Graphene, semiconductors and GaN are not isolated, they reflect a structural weakness that continues to erode the UK's industrial competitiveness.

"In Cambridge, we developed something called amorphous silicon… That led to the whole display explosion for Sony and LG… Every time we discover something new, there's a sort of spinout… and then the manufacturing moves out."

Structural Weaknesses in the UK Materials Production Ecosystem - The UK's production and scale-up environment for advanced materials is underdeveloped. Key system-level gaps include Pilot-Scale Infrastructure Deficit - UKRI and BEIS reports confirm the lack of



modular, mid-TRL manufacturing facilities, especially for materials-intensive tech. Cambridge spinouts consistently face barriers at TRL 4–7, with few local options for prototyping or pilot production. **Risk-Tolerant Capital Shortages -** Compared to the US and South Korea, the UK offers limited access to late-stage innovation finance, especially for regulated sectors like medtech and clean tech. **Fragmented Cluster Connectivity -** Unlike coordinated clusters in Hsinchu (Taiwan), Daejeon (Korea), or Dresden (Germany), the UK lacks a networked ecosystem to link discovery regions like Cambridge with scale-up sites.

"Cambridge has crap transport links… It limits our ability to collaborate across the country…That also influences our ability to collaborate more broadly with other innovation clusters across the UK."

The Growing Together Alliance, led by Cambridge Ahead, has identified this fragmentation as a major obstacle to realising national productivity goals through regional innovation. Cambridge is a high-density innovation hub, but its physical, digital, and institutional connectivity with other UK clusters remains underdeveloped.

Missing Product Roadmaps and Market Foresight - A critical yet under-recognised barrier to scaling materials innovation is the lack of early-stage roadmapping and market foresight. As the Institute for Manufacturing (IfM) notes, many UK breakthroughs—like graphene and nanophotonics—have stalled not just from infrastructure gaps, but from limited investment in defining application pathways, regulatory alignment, and market readiness (RAEng, 2023; UKRI, 2022; Wilsdon & Jones, 2021). Without this strategic groundwork, high-potential technologies struggle to attract scale-up capital or industrial partners. Even in Cambridge, firms face an innovation-to-production gap. Targeted support for product roadmaps, business model design, and demand foresight is essential to unlock value and retain IP at home.

Much of the UK's materials innovation **lacks defined end-use strategies**. Without early-stage product road mapping or alignment with real-world applications, it becomes difficult to attract industrial partners or investment. As one expert noted, bridging this gap requires co-designing product pathways and market alignment early in the innovation process.

"The roadmap should begin with a clear view of future markets—not just the material itself…"

Skills and Workforce Gaps - Deep tech and materials processing expertise is ageing, with firms increasingly reliant on retirees to fill critical knowledge gaps (Young, NCC, 2024). Mid-career upskilling pathways, especially for ESG-aligned manufacturing roles, remain fragmented and underfunded. Women account for just 26.1% of the UK manufacturing workforce, with Non-White women at only 3%. The gender pay gap in manufacturing stands at 15.9%—well above the national average (IfM Engage, 2024). Yet these structural challenges receive no meaningful attention in the Green Paper, undermining its vision for inclusive, future-ready industrial growth.

"We don't even know if we have the workforce for advanced materials—because there's no manufacturing here."

Cambridge: Strength in Discovery, Weakness in Scale - Cambridge excels at early-stage R&D and device engineering. It is home to global leaders in 2D materials, GaN, biocompatible polymers, metamaterials, and photonics, spinouts such as Xampla, Nyobolt, Barocal, Paragraf, and Nu Quantum. It has research anchors like the Cavendish Laboratory, Graphene Centre, and Centre for Natural Material Innovation. However, the region suffers from a lack of modular, flexible, and shared facilities to support prototyping and production. While the scale-up barrier is well documented, Cambridge offers a unique opportunity to address it end-to-end — from prototyping through to full product deployment.

As one Cambridge-based expert succinctly summed up the findings of Section 1:

"Cambridge is the most successful city in Europe in terms of spinouts… but scale-ups—that's the bit we always seem to struggle with."

This challenge is especially acute for platform technologies like advanced materials, which underpin progress across semiconductors, life sciences, aerospace, clean tech, and AI hardware. **Yet these technologies are notably under-recognised in the UK's flagship industrial vision, Invest 2035.**

Risk-Tolerant Capital is Scarce - While UK public funding supports early-stage research, there is little financial support available between proof-of-concept and full commercialisation. Firms like PoroTech and Nyobolt have had to seek international investment or partnerships to fund chip fabrication, advanced packaging, or thermal testing. In contrast, countries like the US, Germany, and South Korea offer public-private manufacturing funds and tax incentives specifically aimed at scale-up.

"Instead of letting spinouts flail around until they find an investor overseas… the technology is sold, and it's creating jobs somewhere else."

Chronic under-utilisation of deep tech. While UK public funding supports early-stage research, there is little financial support available between proof-of-concept and full commercialisation. Firms like PoroTech and Nyobolt have had to seek international investment or partnerships to fund chip fabrication, advanced packaging, or thermal testing. In contrast, countries like the US, Germany, and South Korea offer public-private manufacturing funds and tax incentives specifically aimed at scale-up.

As one Cambridge-based materials expert succinctly put it, *"with the same tech in the US, you'd get $5 million. In Cambridge, maybe £20k."*

This disparity is not just about money, it shapes what technologies reach market, who owns the value, and where jobs are created.

Poor Integration Between Clusters - Cambridge is a world leader in materials discovery, but it remains poorly connected - physically, digitally, and institutionally to other UK manufacturing and innovation clusters. Transport bottlenecks, limited shared planning, and siloed regional governance prevent knowledge spillovers and shared infrastructure.

"If we want to be an engine of growth for the UK, we need to be connected properly to the rest of the country—and we're not."

This disconnect undermines the Invest 2035 vision of place-based innovation and national productivity uplift.

Cambridge as a Case Study: Discovery Without Scale. Cambridge illustrates the UK's industrial paradox: a **world-class research ecosystem** with no clear path to domestic scale-up. Cambridge leads in GaN, 2D materials, biopolymers, photonics, metamaterials, and programmable matter. Its materials research powers spinouts like Nyobolt, Xampla, Paragraf, PoroTech, and Barocal. The region houses centres of excellence such as the Graphene Centre, Cavendish Laboratory, and Centre for Natural Material Innovation. It is also home to pioneering battery spinouts such as Nyobolt, which are developing next-generation energy storage technologies. However, energy storage materials remain largely absent from Invest 2035, despite their strategic relevance to clean mobility, net zero, and energy security. **Figure 3** shows that while AI & Digital and Clean Technology sectors in Cambridge have seen robust growth in revenue and jobs, Advanced Materials & Manufacturing trails behind, despite being a foundational enabler across both.

⚠ Risks of Inaction

💡 The Cost is Not Hypothetical

Repeated failure to support scale-up infrastructure, skills pipelines, and cluster integration results in **tangible economic and strategic losses**.

🔬 IP & Value Migration

- Discovery IP retained in UK, but **process know-how developed abroad**
- Follow-on IP and value capture migrate outside the UK
- Startups relocate, get acquired, or enter foreign joint ventures

🧠 Talent Drain Intensifies

Skilled technicians, engineers, and mid-career specialists move to environments with **more consistent investment in advanced manufacturing**.

🎯 National Goals at Risk

Net Zero, semiconductor resilience, and health technology sovereignty remain out of reach without domestic scale-up strategy.

" *Cambridge is in very good shape when it comes to innovation and net zero technologies — but unfortunately they're all being manufactured elsewhere.* "

— Senior Stakeholder

🚨 **Without intervention, the UK will continue to invent globally significant technologies while watching industrial value, employment, and supply chain control accrue elsewhere.**

Yet Cambridge lacks:

- Cleanroom-scale shared pilot infrastructure
- Mid-volume prototyping lines
- National coordination for post-TRL 4-9 product development

The result: risk that IP generated in the UK may be commercialised elsewhere, unless we invest in the infrastructure and incentives to scale at home. Cambridge is a global leader in materials-related patents. However, the challenge lies less in generating IP and more in capturing its full economic value domestically, through manufacturing, advanced packaging, and product development. This gap is particularly concerning for frontier technologies like battery materials, where Cambridge firms hold valuable IP but lack the mid-TRL production support to scale manufacturing in the UK. Without end-to-end infrastructure and supply chain depth, even protected IP may end up generating jobs and value abroad.

"There's no shortage of brilliant materials ideas here, but scaling them? That's where we fall short. We protect the IP - and then someone else makes the money."

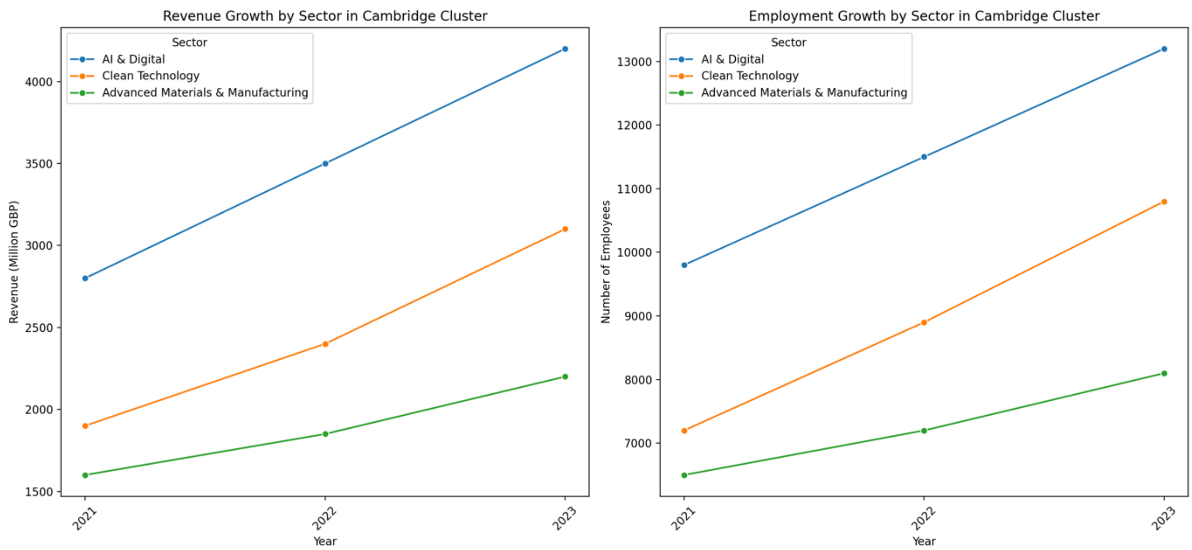


Figure 3 - **Revenue and Employment Growth** by Sector in the Cambridge Cluster (2021–2023) - While AI & Digital and Clean Technology have seen robust growth in revenue and jobs, Advanced Materials & Manufacturing trails behind - despite being a foundational enabler across both sectors. This disparity reflects a structural bottleneck: Cambridge's materials innovation ecosystem produces platform technologies essential to clean energy, digital infrastructure, life sciences, and defence (**Table 3** highlights how Cambridge's interdisciplinary strengths map directly onto cross-sector applications, reinforcing its role as a national enabling hub.). Yet without targeted investment in mid-stage infrastructure, its economic potential remains under-realised. While the mid-stage scale-up challenge is widely acknowledged, Cambridge is poised to lead the next step, aligning TRL 4–9 capability with product readiness and domestic manufacturing. Cambridge offers a unique opportunity to go further by aligning discovery with late-stage commercialisation and manufacturing readiness.

From Missed Opportunity to National Imperative - Invest 2035 offers a pivotal chance to reshape the UK's industrial future - but only if it confronts the systemic barriers to turning innovation into production. Unless the strategy:

- **Recognises enabling technologies** like advanced materials as national assets,
- **Addresses the mid-stage scale-up bottlenecks**, a known challenge which Cambridge is well-positioned to overcome through integrated TRL 4–9 pathways,
- **Strengthens regional integration** and develops a green skills pipeline, and
- **Ensures domestic value capture** through UK-based manufacturing and supply chains

…the UK will remain a country that excels in discovery but loses out on industrial and strategic value. Cambridge exemplifies this paradox - but it also holds the solution. As a globally leading innovation cluster, Cambridge is ideally placed to serve as a **national testbed for scaling materials innovation**. With the right policy alignment and investment, it can help transform the UK from a knowledge economy to an industrial powerhouse, where scientific breakthroughs are not just made but made here.

The next section sets out actionable recommendations to close these gaps and unlock the full value of Cambridge's advanced materials ecosystem in support of national growth, resilience, and technological sovereignty.

<><><>

Section 3. Recommendations: Realising the Potential of Cambridge's Advanced Materials Ecosystem

To close the innovation-to-production gap and align Invest 2035 with the UK's industrial and technological ambitions, the following recommendations are proposed across four key pillars:

1. Build TRL 4–9 Infrastructure to Translate Cambridge Discovery into Manufacturing Value

While TRL 4–9 challenges are well recognised, Cambridge is uniquely positioned to close this loop through a coordinated, end-to-end approach: building infrastructure that supports the **full product journey**, from early prototyping to **TRL 9 product readiness** and domestic manufacturing. Cambridge can lead this transition by embedding foresight, regulatory planning, and commercial design into each phase of the innovation process. For Cambridge, and the UK, to capture more value from its research base:

- **Establish modular, shared-use pilot lines and prototyping facilities** for advanced materials and device integration, particularly for high-impact areas like **battery chemistry**, **wide-bandgap semiconductors**, and **2D materials.** These facilities should serve multiple sectors (e.g., semiconductors, medtech, clean tech), allowing researchers and SMEs to de-risk commercialisation.
- Embed these facilities within **existing innovation campuses** (e.g., West Cambridge, Babraham, or North East Cambridge) to reduce duplication and ensure close links with spinouts and scale-ups.
- **Develop a TRL 4–9 demonstrator programme** focused on platform materials: including 2D materials and battery-grade energy storage materials with translational pathways into energy, health, defence, and digital sectors.
- **Embed foresight capabilities within UKRI and regional innovation accelerators to co-develop product pathways with industry from TRL 2–5.** Establish public-private foresight labs where researchers and businesses jointly map demand signals, end-use cases, and business models early in the R&D process. This will de-risk TRL 4–9 investment and strengthen investor and supply chain confidence in Cambridge's materials spinouts.

"What you don't need is more big buildings... what there needs to be is very targeted capability builds… you can take what would be a £200 million ask and turn it into £20 million."

2. Recognise Advanced Materials as a National Enabling Technology

Advanced materials should be designated as a platform technology within the Invest 2035 framework, like AI and semiconductors, linked with missions such as Net Zero infrastructure, defence resilience, and digital sovereignty. To support this:

- **Create a National Materials Innovation Mission** linked to Net Zero, digital sovereignty, and resilient manufacturing.

- Develop **technology-specific roadmaps** in consultation with research institutions, industry clusters, and public funders, particularly for materials central to green technologies, AI hardware, and defence.
- Include advanced materials in **investment screening, export strategy**, and critical supply chain mapping (e.g., with DBT and DSIT).
- Ensure early-stage materials research is accompanied by foresight-driven commercial roadmaps, to prevent missed opportunities like graphene. Integrate design-for-manufacturing and product-market-fit tools into the innovation lifecycle. Stakeholder input from IfM Engage suggests that material innovation scale-up must be supported by structured road-mapping, aligning research with projected market needs and infrastructure plans.

3. Foster Inter-Cluster Connectivity and National Partnerships

Cambridge's potential cannot be realised in isolation. For Invest 2035 to succeed, it must foster stronger inter-cluster connectivity and explore how Cambridge's international strengths can support growth in other UK regions. A place-based model of delivery should link discovery hubs like Cambridge with scale-up and manufacturing regions, enabling knowledge spillovers, shared infrastructure, and joined-up talent strategies.

Key actions:

- **Work with the Cambridge–Manchester partnership** as a national pilot for inter-cluster collaboration. In 2025, Research England awarded £4.8 million to establish this structured innovation partnership, connecting Cambridge's translational strengths with Manchester's industrial base. This partnership provides a replicable model for building a connected UK innovation economy.
- **Develop further connections** with other regional hubs, including Tees Valley (home to the Materials Processing Institute and NETPark) and South Wales (supported by the GW4 research network). These regions offer complementary industrial capacity and represent opportunities for collaboration on scale-up, manufacturing, shared infrastructure, and joined-up talent strategies.
- **Formalise an Innovation Corridor Strategy under Invest 2035**, positioning Cambridge as a keystone discovery hub within a national network of innovation corridors. Such a strategy would help diffuse Cambridge's strengths more evenly across the UK while boosting national productivity and resilience.
- **Improve physical and digital connectivity** between high-performing innovation regions (e.g., Cambridge–Manchester–Midlands), including transport, shared R&D infrastructure, and planning coordination, to reduce duplication and accelerate the diffusion of innovation.

As one Cambridge stakeholder observed:

"The UK cannot afford for high-performing innovation economies like Cambridge to operate in silos."

4. Close the Finance Gap for Scale-Ups

To retain IP and commercial value within the UK, Invest 2035 must directly address the finance bottleneck at scale-up stage:

- Establish a **public-private Advanced Materials Scale-Up Fund** targeted at TRL 5–8 ventures, with mandates on domestic manufacturing and IP retention.
- Offer **capital allowances and fiscal incentives** for firms investing in UK-based production infrastructure for materials-intensive technologies.
- Embed access to late-stage finance into **Innovation Accelerator hubs** and UKRI Challenge Funds.

5. Invest in Skills and Inclusion for Materials Manufacturing

Human capital is as critical as infrastructure. The UK cannot industrialise materials innovation without a diverse, capable, and future-ready workforce.

- Develop a **Green Skills and Materials Manufacturing Foresight** in Greater Cambridge focused on mid-career upskilling, ESG-linked production roles, and digital materials engineering.
- Prioritise **immigration reform** for deep tech talent, including technicians, engineers, and scale-up specialists.
- Ensure all Invest 2035 workforce interventions include targets for **gender, racial, and disability inclusion**, especially in deep tech manufacturing sectors.

6. Improve Evidence, Data, and Foresight

A recurring barrier to effective strategy execution is the absence of robust, disaggregated data. Invest 2035 should mandate:

- **Firm-level investment tracking** across innovation clusters.
- Sector-specific indicators for **green jobs, supply chain resilience**, and cross-sector technology spillovers.
- Transparent, **cross-cluster benchmarking frameworks** to guide public investment decisions and evaluate regional multiplier effects.
- By embedding a learning-oriented evaluation model that enables real-time policy adjustment, feedback informed Invest 2035 will create dynamic metrics for evaluation led by evidence.

7. Position Cambridge as a National Testbed for Innovation-to-Production Integration

Finally, to realise its potential, Cambridge must be treated not just as a high-performing city, but as a **national asset** in the UK's industrial strategy. Policymakers should:

- Designate Cambridge as a **testbed region for TRL 4–9 interventions**, bridging research excellence with industrial scale-up.
- Appoint a **regional innovation lead or taskforce** to coordinate public-private investment across infrastructure, skills, and policy tools.
- Use Cambridge as a **model for policy learning**, to develop playbooks for connecting discovery, design, and production in other high-potential UK regions.
- Leverage CPCA and Local Authority Capabilities: Mobilise the CPCA's devolved powers in skills, infrastructure, and economic strategy to deliver a coordinated scale-up roadmap for advanced materials. Empower Cambridge City Council and Cambridgeshire County Council to support planning, site development, and ecosystem coordination. This joint approach should be embedded into testbed delivery to ensure institutional alignment and long-term place leadership.

See **Annex-II** for stakeholder mapping of recommendations.

Final Note

Scaling advanced materials innovation is not a scientific challenge, it is a systems challenge. Without strategic investment in infrastructure, skills, finance, and inter-regional coordination, the UK will continue to fall short of capturing the full economic value of its world-class research. Cambridge has the science, the talent, and the ambition. What it now needs is a coherent, joined-up strategy. With coordinated action, Cambridge can not only lead the next industrial era but anchor the UK's long-term industrial resilience and global competitiveness.

Cambridge is ready, the opportunity is real, now is the time to act.

<><><>

References

- Abcam. (2024). *Corporate Reports and Product Portfolios*. [Online] Available at: https://www.abcam.com/
- Beauhurst. (2023). *High-Growth Deep Tech Firms Dataset*. [Online] Available at: https://www.beauhurst.com/
- Bennett Institute for Public Policy. (2024). *Levelling Up, Place and Productivity*. Cambridge: University of Cambridge. Available at: https://www.bennettinstitute.cam.ac.uk/publications/levelling-up-place-and-productivity/
- Cambridge Ahead. (2024). *Economic Impact Assessment and Cluster Data 2024*. Cambridge: Cambridge Ahead.
- Cambridge Biomedical Campus. (2024). *Innovation and Research Overview*. [Online] Available at: https://cambridge-biomedical.com/
- Cambridge Graphene Centre. (2024). *Annual Review and Project Highlights*. University of Cambridge.
- Centre for Cities. (2023). *City Monitor: Key Economic Indicators for UK Cities*. London: Centre for Cities.
- Centre for Natural Material Innovation. (2024). *Research Outputs and Impact Briefs*. University of Cambridge.
- Cavendish Laboratory. (2024). *Annual Research Highlights in Materials Science*. University of Cambridge.
- Cavendish Laboratory (2024). *Cavendish researcher supported to turn battery research into practice*. University of Cambridge. Available at: https://www.phy.cam.ac.uk/news/cavendish-researcher-supported-to-turn-battery-research-into-practice (Accessed: 21 August 2025).
- Centre for Innovation and Inclusive Policy (CIIP) (2024) *The UK Innovation Report 2024*. University of Cambridge. Available at: https://www.ciip.group.cam.ac.uk/innovation/the-uk-innovation-report-2024.
- Cavendish Laboratory (2024). *Energy Materials*. University of Cambridge. Available at: https://www.phy.cam.ac.uk/research/research-themes/energy-materials (Accessed: 21 August 2025).
- Department for Business, Energy and Industrial Strategy (BEIS). (2023). *UK Research and Innovation Infrastructure Roadmap*. London: BEIS.
- Federal Ministry of Education and Research. (2020). *High-Tech Strategy 2025*. Government of Germany. Available at: https://www.bmbf.de/bmbf/shareddocs/downloads/en/publications/2020-07-14_hts2025.pdf
- Gibbons, P. (2024). *Cambridge Cluster Spinouts Data Briefing*. Cambridge Ahead internal memo.
- Hitachi Cambridge Laboratory. (2024). *Quantum and Neuromorphic Research Summary*. [Internal publication].

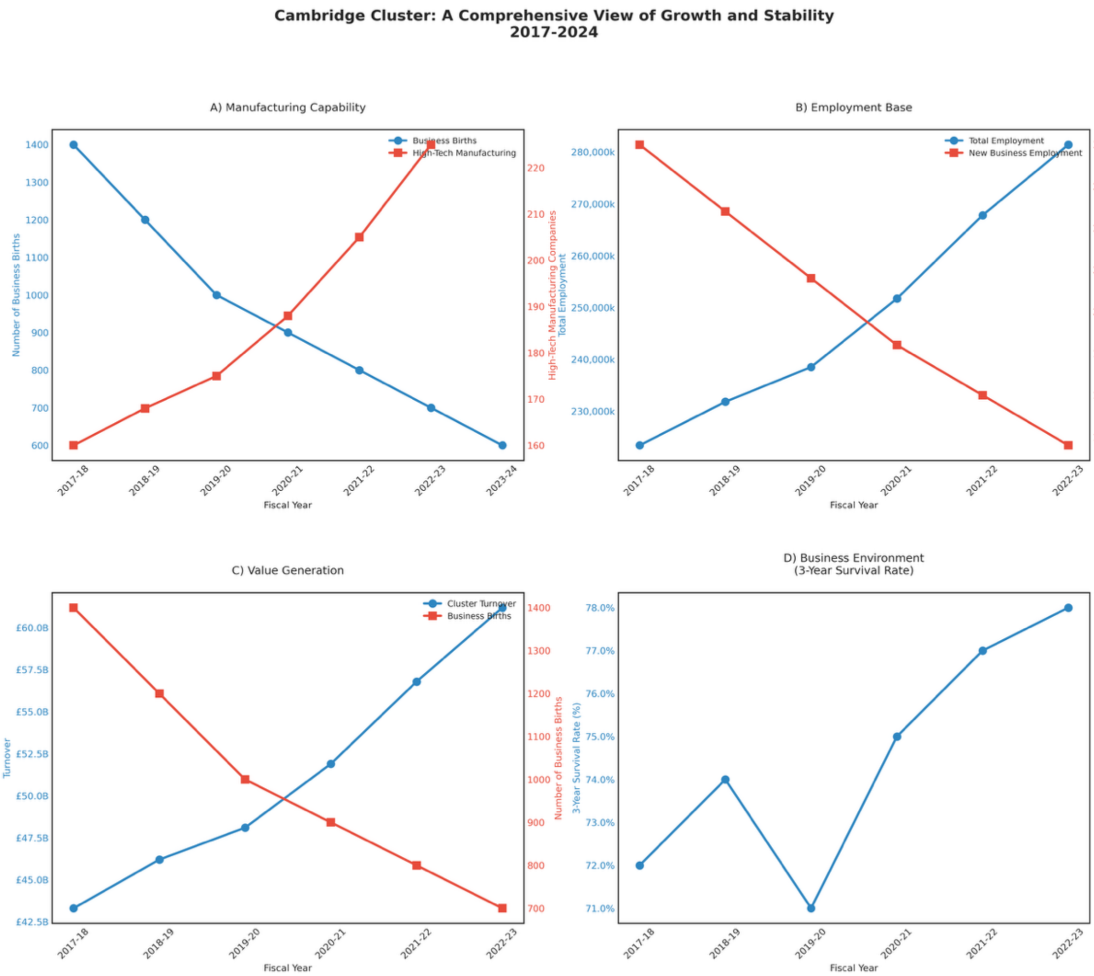
- IfM Engage. (2024). *Diversity and Skills in Advanced Manufacturing: Policy Brief*. Cambridge: Institute for Manufacturing.
- Innovate UK. (2023). *Materials and Manufacturing Vision 2050*. Swindon: Innovate UK.
- Levidian. (2024). *Technology Summary: Graphene and Carbon Capture Solutions*. [Online] Available at: https://www.levidian.com/
- Materials Science and Metallurgy, University of Cambridge. (2024). *Research Themes and Applications in Advanced Ceramics*. Cambridge: University of Cambridge.
- Nolan, A., Hanna, T. and Bickenbach, T. (2025) *Making sense of Labour's industrial strategy*, Bennett Institute for Public Policy, University of Cambridge. Available at: https://www.bennettschool.cam.ac.uk/wp-content/uploads/2025/01/Making-sense-of-Labours-Industrial-Strategy.pdf
- Nyobolt (2024). *Nyobolt EV sportscar prototype takes ultra-fast charging out of the lab and onto the road*. Available at: https://nyobolt.com/resources/news/nyobolt-ev-sportscar-prototype-takes-ultra-fast-charging-out-of-the-lab-and-onto-the-road (Accessed: 21 August 2025).
- OECD. (2021). *Materials for a Resilient and Sustainable Economy*. Paris: OECD Publishing.
- ONS. (2023). *Regional Economic Activity Data*. Office for National Statistics.
- Paragraf. (2024). *Graphene Electronics and Device Applications*. Company Reports.
- PoroTech. (2024). *GaN Innovation for Next-Gen Chips*. Cambridge: Poro Technologies Ltd.
- Quantum Technology Hub. (2024). *Annual Progress Report on Quantum and Photonic Materials*. UKRI.
- RAEng (Royal Academy of Engineering). (2023). *Scaling Innovation: Lessons from Materials Science*. London: RAEng.
- Royce Institute. (2023). *UK R&D Roadmaps for Net Zero Materials*. Manchester: Henry Royce Institute.
- Royce Institute. (2024). *MATcelerate ZERO: Innovation Accelerator Overview*. Manchester: Henry Royce Institute.
- Sphere Fluidics. (2024). *BioTech Applications in Precision Diagnostics*. [Online] Available at: https://spherefluidics.com/
- UKRI. (2022). *Innovation-to-Impact: Gaps in the UK Materials Commercialisation Pipeline*. Swindon: UKRI.
- University of Cambridge Bioengineering Lab. (2024). *Shape Memory Alloys and Programmable Materials*. Cambridge: University of Cambridge.
- Wilsdon, J. & Jones, R. (2021). *The Missing Middle: Addressing the UK's Innovation-to-Production Gap*. London: Nesta.
- WIPO. (2023). *Global Innovation Index Rankings and Metrics*. Geneva: World Intellectual Property Organization.
- Teesside University (2023) *Teesside Taskforce sets out regional industrial innovation priorities*. Available at: https://www.tees.ac.uk/sections/research/teesside_taskforce.cfm

- University of Cambridge. (2025). *Cambridge and Manchester partnership to boost UK innovation and growth gets government backing*. Available at: https://www.cam.ac.uk/news/cambridge-and-manchester-partnership-to-boost-uk-innovation-and-growth-gets-government-backing
- Warwick Business School (2015) *UK's innovation geography mapped for the first time*. Available at: https://www.wbs.ac.uk/news/uk-s-innovation-geography-mapped-for-the-first-time (Accessed: 21 August 2025).

<><><>

ANNEX-I

The economic impact of Cambridge's knowledge-intensive sectors is substantial. Between 2018 and 2024, employment in these sectors grew by 6.2% annually, double the rate of non-knowledge-intensive sectors, with turnover increasing by 8.6% per annum. Knowledge-intensive businesses now account for approximately 50% of corporate employment in Greater Cambridge, up from 45% six years prior (Cambridge Ahead, 2024). Furthermore, Cambridge has been ranked the most intensive science and technology cluster in the world relative to its population size for three consecutive years, according to the Global Innovation Index. This



ranking reflects the region's density of patent filings, research output, and commercial activity (WIPO, 2024).

Figure 4 - Cambridge Cluster: A Comprehensive View of Growth and Stability (2017–2024). This figure presents a multi-dimensional overview of the Cambridge innovation cluster's performance across four key dimensions: **A) Manufacturing Capability:** Between 2017 and 2024, the number of new business births declined sharply from over 1,400 to fewer than 600, while high-tech manufacturing employment rose steadily reflecting a shift from startup quantity to industrial depth and capability concentration. **B) Employment Base:** Total employment in the Cambridge cluster grew consistently, from ~226,000 in 2017–18 to over 280,000 in 2022–23. However, new business employment (typically associated with small firms and early-stage startups) declined significantly, indicating growing dominance of scale-ups and established firms in generating job growth. **C) Value Generation:** Cluster turnover increased from £42.5B in 2017–18 to over £60B in 2023–24, while business profits

declined sharply. This divergence signals increased reinvestment, scaling costs, or inflationary pressures despite strong revenue growth. **D) Business Environment:** The 3-year business survival rate improved from ~72% to nearly 78%, suggesting a maturing ecosystem with higher stability and resilience, even as the total number of new business births fell. This trend reflects a more resilient enterprise base, driven by deeper technological integration, knowledge intensity, and ecosystem stability, confirming Cambridge's evolving strength as a high-value innovation economy. Sources: Cambridge Ahead Economic Impact Assessment (2024); Office for National Statistics Business Demography (2023); Centre for Business Research, University of Cambridge.

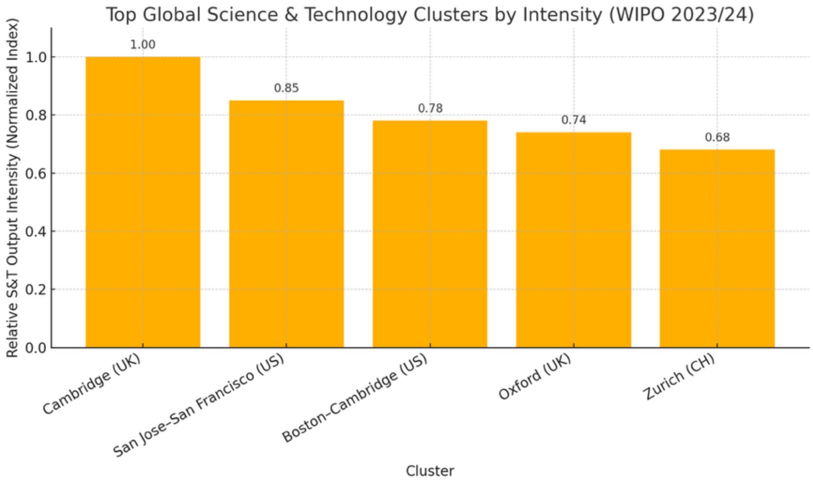


Figure 5 - Global Ranking of Science & Technology Clusters by Output Intensity (WIPO 2023/24) - This chart ranks the world's leading science and technology (S&T) clusters by relative output intensity, as measured by the World Intellectual Property Organization (WIPO) in 2023/24. Cambridge (UK) leads globally with a normalized S&T output index of 1.00, surpassing established innovation hubs such as San Jose–San Francisco (0.85) and Boston–Cambridge (0.78) in the United States. Oxford (UK) and Zurich (CH) follow with output intensities of 0.74 and 0.68, respectively. The index reflects high concentrations of scientific publications and patent filings relative to population, demonstrating Cambridge's exceptional density of innovation output per capita. This underscores its unique role as a global deep tech and advanced materials innovation hub—well-positioned to anchor national industrial missions under the UK's Invest 2035 strategy. Source: World Intellectual Property Organization (WIPO), Global Innovation Index Report 2023/24.

Cambridge's Economic Contribution and Productivity - Cambridge has the highest GVA per worker in the UK outside of London at £69,300, compared to a national average of £60,000. Advanced materials sectors such as life sciences and digital tech are key contributors to this performance, delivering productivity levels of £74,000–£100,000+ per employee. Cambridge is one of the leading regions in the UK in knowledge-intensive employment, with the Greater Cambridge economy contributing over £23 billion annually. It is home to over 8,000 firms, with knowledge-intensive sectors growing turnover at 8.6% per year.[3] Cambridge attracts over 10% of the UK's public R&D funding, leads the nation in spinouts per £1 millions of research funding, and hosts over 90 high-growth deep tech firms. [4] This reflects its strategic role in delivering innovation-led economic growth and reinforces Cambridge's position as the UK's primary recipient and generator of public sc ience investment, making it a natural anchor for national industrial policy. Table 2 showcases Cambridge's innovation leadership.

Table 2 - This table presents benchmark indicators that showcase Cambridge's exceptional position in advanced materials innovation and economic productivity, both nationally and internationally, by comparing it with the

[3] Cambridge Ahead Economic Impact Assessment, 2024
[4] ONS (2023), Beauhurst (2023), Cambridge Ahead (2024), Centre for Business Research (2024)

UK average and global innovation powerhouses like Boston (US) and Eindhoven (NL).

Indicator	Cambridge	UK Average	Boston (US) / Eindhoven (NL)	What It Shows
QS Ranking (Materials Science, 2024)	2nd globally	N/A	MIT: 1st globally	Cambridge is among the top 2 global institutions for materials research.
Nature Index (Chemistry/Materials)	Top 3 nationally	Varies	Top 3 globally	Confirms Cambridge's research excellence in material-intensive fields.
Spinouts per £1m Research Funding	Highest in UK	N/A	MIT: $8m/spinout	World-class translational efficiency—Cambridge leads in research commercialisation.
High-Growth Deep Tech Firms (Beauhurst, 2023)	90+	N/A	Boston: 200+	Cambridge is the UK's top deep tech hub, rivalling global leaders.
GVA per Worker (Centre for Cities, 2023)	£69,300	£60,000	Boston: ~£75,000 / Eindhoven: ~£72,000	High productivity reinforces Cambridge's economic competitiveness.
Share of Public R&D Spend (ONS, 2023)	>10%	Baseline	Massachusetts: 5% of US spend	Cambridge/East of England is the top R&D funding region in the UK.

HESA data demonstrates Cambridge's national leadership in advanced materials research output intensity, with 108.5 publications per 100,000 population - well above Oxford, London, and the UK average. (See figure 6). Cambridge significantly outperforms national averages in GVA per employee across advanced materials and related sectors, as shown in Figure 7. Cambridge's superior performance in patents, R&D intensity, and high-tech employment compared to UK averages as illustrated in Figure 8.

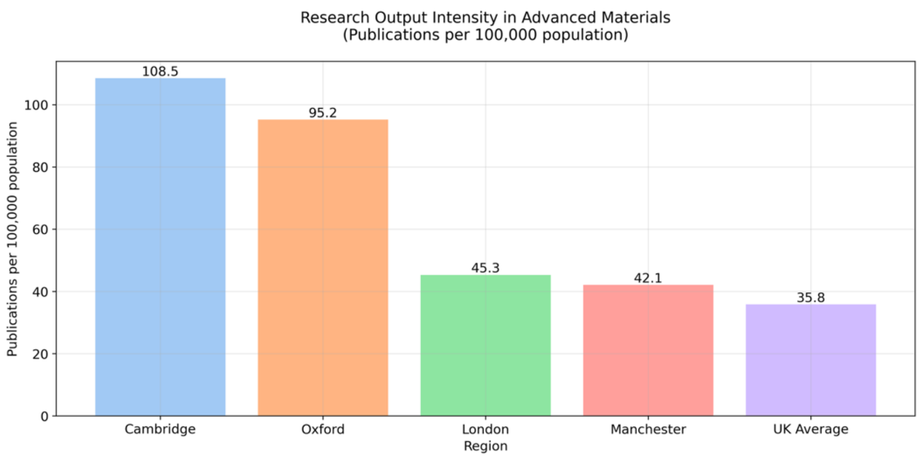


Figure 6 – Research Output Intensity: This high-density research activity underscores Cambridge's strategic position as a science and technology powerhouse and makes a strong case for leveraging the region as a national testbed for scaling materials innovation under the Invest 2035 strategy. Its exceptional concentration of intellectual property, scientific talent, and translational potential marks Cambridge as a critical national asset for mission-driven industrial policy.[5]

[5] UK Research Excellence Framework (REF) 2023; HESA Research Output Database

Figure 7 - Economic Value Added - Cambridge outperforms national averages in GVA per employee across advanced materials (£95k vs £65k), biotech, and digital tech—reflecting its dense concentration of research talent, innovation infrastructure, and high-growth spinouts. This productivity edge underscores Cambridge's strategic role in driving UK industrial competitiveness. Source: ONS Regional Economic Activity Report (2023); Cambridge Ahead Economic Impact Assessment (2024)[6]

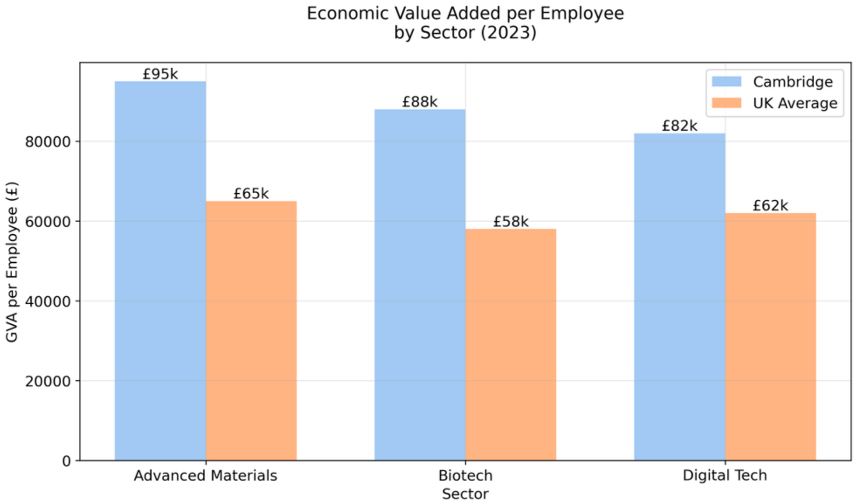
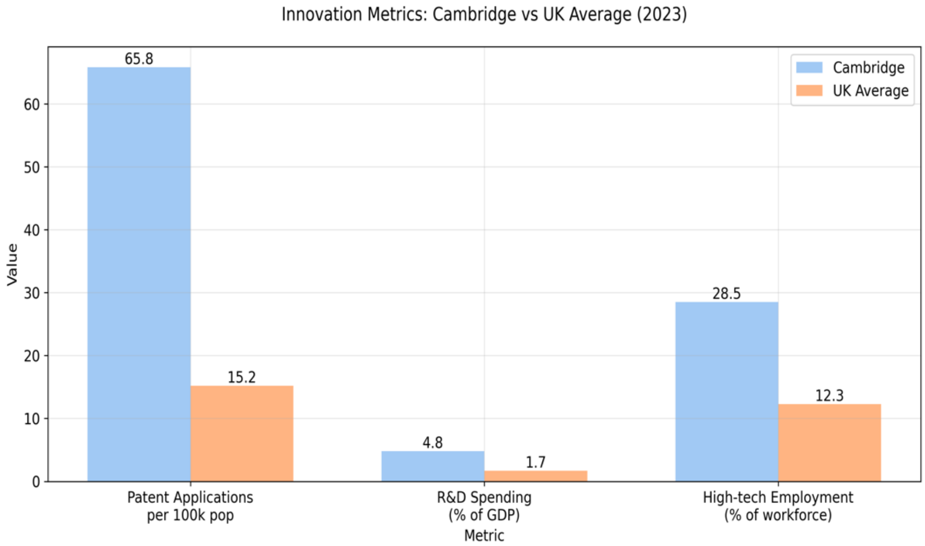


Figure 8 - Innovation Metrics - Cambridge vastly outperforms UK averages in key innovation indicators, filing over four times more patents per capita, attracting nearly triple the R&D investment (as % of GDP), and employing more than double the national average in high-tech sectors. These figures illustrate Cambridge's critical role in the UK's innovation economy and provide a strong empirical basis for targeted government support to close the innovation-to-production loop and capture manufacturing value from domestic R&D. Without downstream manufacturing infrastructure, the region's high-value IP, especially in advanced materials, risks being commercialised abroad, weakening national resilience and return on public investment. Source: ONS (2023); WIPO (2023); Cambridge Ahead (2024)



[6] The estimated figure of £95,000 GVA per employee in Cambridge's advanced materials sector is derived from multiple sources. Cambridge Ahead (2024) and the Centre for Business Research report that knowledge-intensive manufacturing sectors in Greater Cambridge, including advanced materials, achieve £90,000–£100,000 GVA per employee, significantly higher than the UK average of £65,000 (Make UK, 2023). This estimate is supported by stakeholder interviews with firms such as PoroTech and the Institute for Manufacturing, which emphasised the…. ….capital intensity and IP density of materials innovation. National productivity benchmarks are drawn from ONS and Make UK datasets. The figure reflects a triangulated, high confidence estimate rather than an official audited value.

Cambridge at the Apex of the Knowledge Economy: Turning Materials Science into Industrial Scale Impact - Cambridge exemplifies the potential of the knowledge economy, where intellectual capital, research excellence, and technological innovation drive sustained economic growth. Ranked the world's top science and technology cluster (GII, 2024), it leads not only in discovery, but in translating frontier research into high-value intellectual property. In this context, **advanced materials function as a foundational platform technology**, enabling breakthroughs across net zero, AI, defence, and digital infrastructure.

What sets Cambridge apart is its ability to convert scientific knowledge into economic value. The region's **4.0x investment multiplier** demonstrates the effectiveness of its innovation ecosystem, where materials capabilities in design and testing generate spinouts, attract global R&D, and anchor sovereign technologies. Yet this opportunity is not confined to emerging tech: it is **tightly coupled with Cambridge's £23.3 billion life sciences economy**, where materials innovation underpins tangible products such as personalised medicine, diagnostics, surgical tools, and implantable electronics—core priorities in the UK's Life Sciences Vision (Cambridge Ahead, 2024).

⚠ Policy Box: UK at Risk of Losing Its Materials Edge

World-Class Discovery, Weak Scale-Up

The UK — and Cambridge in particular — leads Europe in advanced materials research, including ERC-backed breakthroughs in semiconductors, nanotechnology, and energy storage. However, this scientific advantage is **not matched by domestic industrial capacity**.

The TRL 6-7 "Valley of Death"

Materials innovations often stall at the pilot or demonstration phase due to:

- Lack of modular cleanroom and production infrastructure
- Risk-averse private capital
- Fragmented inter-regional value chains

Global Competitors Are Scaling Faster

Countries like the US, Germany, and Korea are investing heavily in mid-stage manufacturing and national materials missions. **UK-developed IP risks being**:

- Licensed abroad (e.g., semiconductors)
- Manufactured overseas (e.g., flexible electronics)
- Lost to foreign acquisition or relocation

Policy Imperative

To convert materials excellence into economic sovereignty, the UK must:

- **Fund regional materials scale-up facilities (TRL 4-7)**
- **Create a national materials value chain linking R&D with manufacturing regions**
- **Protect public R&D value by anchoring production locally**

✅ Cambridge is the logical anchor for this strategy — but it needs targeted downstream investment to deliver national returns.

> **"Materials act as the bridge between discovery and application, transforming frontier research into high-value medical technologies such as drug delivery systems, diagnostics, surgical tools, and implantable electronics."**

Together, these strengths reinforce Cambridge's position as a **national testbed for industrial strategy**, where targeted downstream investment in advanced materials could unlock cross-sector productivity, scale-up sovereign manufacturing, and secure long-term returns on public research funding.

Table 3 - Cambridge-Driven Advanced Materials with Cross-Sector Applications and Strategic Relevance – The cluster's competitive advantage lies in this inter-disciplinary materials innovation.

Material/Type	Why It Matters	Cambridge Relevance	Cross-Sectoral Applications	Reference
Gallium Nitride (GaN)	Enables high-efficiency power devices; vital for 5G, EVs, and miniaturised electronics.	Home to Centre for Gallium Nitride and PoroTech—pioneering porous GaN applications.	Digital tech, clean energy, defence electronics	(PoroTech, 2024; Centre for Gallium Nitride, 2024)
Graphene / 2D Materials	Ultra-light, conductive, and strong—ideal for sensors, electronics, composites.	Cambridge Graphene Centre and startups like Levidian advancing clean, flexible electronics.	Life sciences, digital electronics, clean tech, construction	(Cambridge Graphene Centre, 2024; Levidian, 2024)
Biocompatible Polymers	Essential in implants, drug delivery, and biodegradable health applications.	Used at Cambridge Biomedical Campus and by spinouts like Xampla in green medtech.	Life sciences, sustainable packaging, medtech	(Xampla, 2024; Cambridge Biomedical Campus, 2024)
Battery Materials / Energy Storage	High-performance lithium-ion and next-gen battery chemistries for EVs, robotics, and aerospace	Spinouts like Nyobolt developing ultrafast charging solutions	Clean mobility, energy storage, aerospace, robotics	(Nyobolt, 2024; Cavendish Lab, 2024)
Nanoparticles / Nanocarriers	Allows targeted therapy and diagnostics at molecular level; enhances precision medicine.	Researched across life sciences labs and firms like Sphere Fluidics and Abcam.	Life sciences, diagnostics, clean tech, defence	(Sphere Fluidics, 2024; Abcam, 2024)
Hydrogels	Supports tissue engineering and drug delivery with responsive gel systems.	Developed for regenerative medicine in Cambridge's engineering and med-bio labs.	Life sciences, regenerative medicine	(University of Cambridge Engineering Department, 2024)
Bio-based / Cellulose Composites	Sustainable, biodegradable alternatives to plastic in packaging and architecture.	Centre for Natural Material Innovation leads global R&D in sustainable materials.	Life sciences, construction, sustainable packaging	(Centre for Natural Material Innovation, 2024)
Perovskites / PV Materials	Next-gen solar materials; higher efficiency and flexible application.	Pioneered at Cavendish Lab and clean energy start-ups working on next-gen PV tech.	Clean energy, flexible electronics, photonics	(Cavendish Laboratory, 2024)
Advanced Ceramics	Extremely durable and heat-resistant for high-performance tech and medtools.	Applied at Materials Science & Metallurgy and in high-precision ceramic devices.	Medtech, aerospace, electronics, construction	(Materials Science & Metallurgy, University of Cambridge, 2024)

Shape-Memory Alloys / Smart Mats	Materials that 'remember' shape—ideal for medtech, robotics, aerospace.	Bioengineering labs and robotics researchers exploring adaptive material systems.	Life sciences, robotics, aerospace, smart infrastructure	(Bioengineering Lab, University of Cambridge, 2024)
Metamaterials	Engineered to control waves—revolutionising optics, AR/VR, and defence stealth tech.	Cambridge Nanophotonics Centre and Physics departments developing optical metamaterials.	Digital tech, defence, optics and AR/VR	(Cambridge Nanophotonics Centre, 2024)
Phase-Change Materials	Regulate heat and store data—key for thermal comfort and computing.	Used in green buildings and cooling tech—researched in Architecture and Engineering.	Green construction, thermal regulation, computing	(Department of Architecture and Engineering, University of Cambridge, 2024)
Quantum / Photonic Materials	Core enablers of quantum computing, sensing, and ultra-fast photonics.	Key focus in quantum innovation hubs like Cavendish Lab and Quantum Technology Hub.	Quantum computing, sensing, telecoms	(Quantum Technology Hub, University of Cambridge, 2024)
Materials for evolving Cambridge Innovation Landscape OR Materials for a Future-Ready Cambridge Innovation Landscape (inc. Batteries & 2D)				
Silicon Carbide (SiC)	Enables high-efficiency, high-voltage power electronics; key for EVs, quantum, and aerospace systems.	Used in Cavendish Lab and engineering research; relevant to wide-bandgap semiconductor development.	Clean tech, defence, quantum, aerospace, digital electronics	(Cavendish Laboratory, 2024)
Magnetoelectric & Spintronic Materials	Crucial for future memory storage, quantum computing, and low-energy data processing.	Researched at Hitachi Cambridge Lab and Cavendish Physics in quantum and neuromorphic contexts.	Quantum tech, digital & AI hardware, defence	(Hitachi Cambridge Laboratory, 2024)
Bioinspired / Programmable Materials	Support soft robotics, smart textiles, and adaptive bio-systems in medtech and space tech.	Led by bioengineering labs, nanoscience groups, and Institute for Manufacturing.	Medtech, biotech, aerospace, wearables, robotics	(Institute for Manufacturing, 2024)

Regional Anchoring of Cambridge (ERC + Spinouts) - The University of Cambridge ranks among Europe's most competitive institutions in advanced materials research, as demonstrated by its consistent success in securing European Research Council (ERC) grants between 2015 and 2024. This performance reflects not only the depth of Cambridge's scientific capability but also its unique capacity to translate frontier research into commercial impact—evidenced by high-value spinouts such as Nyobolt (battery tech) and Barocal (zero-carbon cooling), strong IP portfolios, and long-standing industry partnerships. Cambridge's ability to attract globally competitive funding and generate materials breakthroughs positions it as a strategic national asset, essential to the UK's ambitions in Net Zero, digital sovereignty, and advanced manufacturing. However, without downstream infrastructure and coordinated investment, this strength marks potential risks being underutilised or offshored.

> **“Materials innovation is not just an outcome of the knowledge economy—it is its enabler.**
>
> In Cambridge, world-leading materials research in design and testing produces high-value IP and fuels spinouts across AI, clean tech, and quantum. With a 4.0x investment multiplier, the region proves how scientific knowledge—when supported by downstream infrastructure—translates into sustainable economic value

“Cambridge is in very good shape when it comes to innovation and net zero technologies—but unfortunately they're all being manufactured elsewhere.”

Materials for Net Zero (Royce + MATcelerate) - Cambridge's materials innovation ecosystem also plays a central role in the UK's net-zero transition. Through its collaboration with the Henry Royce Institute, Cambridge contributes to national R&D roadmaps for low-loss power electronics, low-carbon hydrogen, and circular manufacturing (Royce, 2023). It is also a partner in MATcelerate ZERO, a national accelerator supporting the commercialisation of next-generation net-zero materials (Royce, 2024). These initiatives underscore the alignment between Cambridge's research capacity and the UK's long-term sustainability and industrial goals.

Unclear Place-Based Delivery Architecture: The Missing Local Link - While Invest 2035 calls for regionally led growth and place-based delivery, it offers no concrete framework for how local governance institutions will be empowered or resourced to implement innovation strategies. This omission is especially stark in areas like Greater Cambridge, where devolution agreements already provide a foundation for integrated delivery.

The **Cambridgeshire and Peterborough Combined Authority (CPCA)** holds responsibility for regional economic strategy, skills development, and transport infrastructure, key levers for industrial scale-up. Meanwhile, the **Cambridge City Council (CCC)** plays a central role in planning policy, infrastructure delivery, and business engagement, while **Cambridgeshire County Council** oversees education, transport, and environmental services. However, Invest 2035 fails to clarify how these existing institutions can be mobilised to deliver scale-up infrastructure, workforce training, and regional innovation missions. This lack of integration risks weakening the coherence and local legitimacy of the strategy.

Furthermore, the ongoing **local government reorganisation in Cambridgeshire**, including debates over combined authority powers and streamlined governance, presents a unique window to align regional structures with the industrial ambitions of Invest 2035. Yet the Green Paper remains silent on how such transitions will be coordinated or supported. Without a clear alignment between national ambition and devolved delivery, Invest 2035 may repeat past mistakes, setting bold missions without empowering the places best positioned to implement them.

<><><>

ANNEX-II

Stakeholder Mapping of Recommendations

Recommendation	Central Government	Local Government (CPCA, CCC)	Business Community
1. Build TRL 4–9 Infrastructure	Fund demonstrator programmes; align UKRI/DSIT resources	Identify and plan sites for pilot lines; streamline planning permissions	Co-invest in modular infrastructure; engage in early-stage product mapping
2. Recognise Advanced Materials as a National Enabling Technology	Designate platform status under Invest 2035; develop national roadmaps; update export/screening policy	Integrate materials innovation into regional economic strategies	Provide input into foresight and roadmapping; flag critical supply chain gaps
3. Foster Inter-Cluster Connectivity and National Partnerships	Explore/work on corridors (e.g., Cambridge–Manchester, Teesside); coordinate national innovation corridor strategy	Deliver local planning coordination; support Growing Together Alliance	Partner in corridor planning; offer use cases and scaling pathways
4. Close the Finance Gap for Scale-Ups	Launch national advanced materials scale-up fund with IP retention incentives	Facilitate access via local accelerators and CPCA Growth Funds	Co-invest in late-stage ventures; signal demand for UK-based production
5. Invest in Skills and Inclusion for Materials Manufacturing	Strengthen Green Skills & Inclusion Strategy; reform skilled visa pathways	Embed foresight in CPCA skills plans; lead regional inclusion pilots	Offer placements and apprenticeships; promote inclusive hiring and mid-career upskilling
6. Improve Evidence, Data, and Foresight	Mandate new indicators and firm-level reporting; build evaluation models into Invest 2035	Collate regional data; support cluster-level benchmarking and foresight	Share data; participate in foresight and demand signal mapping
7. Position Cambridge as a	Designate testbed region; coordinate with	Lead coordination of testbed through	Pilot scalable solutions; model

National Testbed for Innovation-to-Production Integration	DSIT/BEIS/UKRI; appoint a regional lead or taskforce	CPCA, Cambridge City Council, and local institutions	integrated innovation-production pathways

<><><>