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The case for a UK Silicon Photonics Pilot Line

Our Funders:

UKRI Engineering and Physical Sciences Research Council

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Government investment in a UK silicon photonics pilot line can contribute a GVA of

~£2.9Bn

to the UK economy by 2040.

Creating over

~2,850

new jobs and expanding the UK's position as R&D leaders in the technology to a dominant global player in scale-up manufacturing.

Providing a conservative

>8x

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1. Strategic Case

Government investment in a UK silicon photonics pilot line can contribute a GVA of ~£2.9B to the UK economy by 2040, creating ~2,850 new jobs, and expand the UK's position as R&D leaders in the technology to a dominant global player in scale-up manufacturing, providing a conservative >8x return-on-investment.

Evidenced by 22 UK company interviews, the biggest barrier faced when scaling silicon photonics technologies, also referred to as Photonic Integrated Circuits (PICs), is connecting multiple supply chain partners together, who are often on opposite sides of the globe. This business case proposes to remove this barrier by building a **first of its kind capability:** A national scale-up pilot line and low volume manufacturing facility that combines PIC wafer manufacturing, heterogeneous integration and advanced packaging, all under one-roof.

A recommended £305M capital investment will provide UK companies with a **competitive advantage,** validated via 22 1-to-1 interviews and multiple workshops with prospective UK industry end-users, in the following ways:

- Dramatically **streamlines the supply chain** and removes the majority of supply chain risk to reduce product development time and accelerate time-to-market.
- Enables converging innovation in the individual elements of the overall system, i.e. PIC, integration, packaging etc. to enable **step-changes in performance** that are otherwise out of reach.
- Provides **sovereign capability and resilience** in critical areas such as defence and quantum.
- Provides **clustering effect** of talent, investors, vendors and suppliers to create a flywheel of growth.
- Creates innovation at "wartime pace" with rapid **pull-through of dual-use technologies,** operationalising the innovation cycle envisioned in the Strategic Defence Review.

The next era of the **frontier technologies** recognised in the Industrial Strategy demands PIC technology, where photons instead of electrons generate, transmit and process data. PICs are foundational to advancements in AI hardware, quantum technologies, advanced connectivity technologies, biosensors and more. PICs are the UK's ticket to becoming an innovation and scale-up powerhouse in these frontier technologies, underpinning the government's growth mission with projected **26.5% CAGR and a global market size of $46.5B in 2035[1].** Just as the explosive growth in electronics was driven by integration, the same course is being paved for photonics, with integration via PICs the key to unlocking cross-sector growth in the frontier technologies.

The UK is well positioned to prosper. **We rank 3rd in the world for innovation in photonics[2]**, a sector that already contributes **£18.5B annually to the economy** and supports over **84,000 jobs,** making it one of the most productive UK manufacturing industries[3]. The potential of PICs is such that Sequoia Capital, the investor famed for its 'legendary' early bets including Google, Apple, and NVIDIA, predicted that the technology could be as impactful in the next 50 years as electronics[4], an industry with a staggering revenue of $793B in 2025[5].

A pilot line provides a **semi-flexible environment** that has sufficient process control to enable reproducibility not possible in a research environment, and sufficient flexibility to enable innovation and rapid adoption of new technologies not possible in a commercial environment. This is provided by a suite of equipment dedicated to individual processes. There is a **market failure** because researchers change everything in a manufacturing process; commercial manufacturing changes nothing and therefore scaling up new processes is a significant challenge. A pilot line acts like production but provides some flexibility to enable research to flow through.

This intervention requirement is evidenced by significant white papers and reports explicitly recommending investment in a PIC pilot line or scale-up infrastructure including a **letter from the Council for Science and Technology directly to the Prime Minister** in March 2026[6]. PICs are widely expected to significantly penetrate all these markets over the coming years:

- Photonics AI hardware (**CAGR: 26.3%; market value: $14.6B in 2034[7]**): PICs reduce power consumption of interconnects by 5x, aligning to the government's clean growth priorities. Photonic AI accelerators offer a substantial leap in compute performance compared to electronics because photons are faster and lower energy than electrons, and have inherent parallel processing ability.
- Advanced connectivity / telecoms (**CAGR: 7.2%; market value: $28.6B in 2030[8]**): UK PIC pilot line recommended by *UK Telecoms Innovation Network Future Telecommunications Report 2025*[9]: PIC transceivers, switches and beam steering devices are essential for secure networks & satellite comms.

1 Future Markets Inc, "The Global Silicon Photonics Market 2025-2035," 2025.
2 J. Lincoln, "Global Trends in Photonics," in SPIE Global Business Forum, San Francisco, USA, 2025.
3 Photonics Leadership Group, "UK Photonics 2025: The Hidden Economic Engine," 2025.
4 [Online]. Available: https://sequoiacap.com/article/seed-venture-funds-2025/.
5 [Online]. Available: https://www.gartner.com/en/newsroom/press-releases/2026-01-12-gartner-says-worldwide-semiconductor-revenue-grew-21-percent-in-2025.
6 Council for Science & Technology, "CST advice on growth and global leadership in photonics," 2026.
7 Data Intelo, "Photonic AI Accelerator Market," 2025.
8 Mordor Intelligence, "Global Optical Network & Communications Market," 2025.
9 UKTIN, "Future Telecommunications: A Technology Roadmap & Ecosystem View for the UK," 2025.

- Quantum technologies (**market value: $46B in 2035[10]**): UK PIC pilot line recommended by Royal *Academy of Engineering Quantum Infrastructure Review 2024*[11]: PICs are critical to most scalable and useful quantum systems and provide the route to ROI for the UK's >£3B quantum programmes including **ProQure:Scaling UK Quantum Computing,** which commits £90M to quantum infrastructure[12].
- Semiconductors: UK PIC pilot line recommended by *Institute for Manufacturing Semiconductor Infrastructure Initiative 2024, Compound Semiconductor Applications Catapult Unlocking the Future with Photonic Integrated Circuits Report 2026*[13] and *eFutures Semiconductor R&D The UK Academic Landscape Report 2025*[14]: **PICs are fundamental** to the future of semiconductors.
- Defence: PICs provide smaller, lighter, cheaper and more resilient technologies in areas such as position, navigation & timing (PNT) (**$15.7B in 2031[15]**), sensing (**$18.3B in 2030[16]**), secure comms (**$19.5B by 2035[17]**), LiDAR (**$17.8B by 2035[18]**) and electronic warfare (**$43.1B in 2035[19]**).
- Photonics Biosensors (**CAGR: 26.7%; market value: $3.2B in 2035[1]**): Lab-on-a-chip miniaturised, and low-cost PICs can democratise healthcare and reduce critical delays in NHS testing.

Why should the government invest in a PIC pilot line? It can conservatively contribute **~£2.9B GVA** to the UK economy by 2040, based on modelling developed in partnership with Moor Economics, and create ~2,850 jobs. The facility will support companies to prove their innovative technology is manufacturable at scale, **bridging the scale-up gap.** Investment in scale-up infrastructure for the frontier technologies is a committed intervention in the Industrial Strategy because it is recognised that the high upfront capital costs make it extremely challenging for all but the largest companies to fund, which does not **unleash UK start-ups and SMEs to drive growth.** Further, no individual UK company could fill the capacity alone, making private investment non-viable. An open-access national pilot line enables a **team of specialist engineers** to develop and optimise a library of advanced manufacturing processes for all UK companies to access on a pay-as-you-go basis.

Why do we need a pilot line in the UK? It will enable ~100 UK companies to scale domestically, generating ~£4.7B cumulative revenues by 2035. It will attract **inward investment:** If the UK were as successful in attracting scale-up funds as it is in founding companies, it would secure >£7B additional capital per year[20]. The **clustering effect of underpinning scale-up infrastructure** will capture a share of this, attracting companies, talent and investors[21]because close collaboration between the end-user and the pilot line is essential in the innovation phase. For example, Mark Wade, CEO of Ayar Labs, a >$3.5B PIC company based in the US commented on recently opening a manufacturing branch in Taiwan, *"We can't solve problems from far away, we need to be here, on the ground, next to our manufacturing partners"*[22]. Investment in a national PIC pilot line is the only way to ensure **economic impact of UK innovation is realised in the UK,** creating a circular scale-up ecosystem.

The time is right for government investment. PIC technology is booming with significant global investments from governments (e.g. €380M EU pilot line), RTOs (e.g. €615M imec investment in Spain) and major companies (e.g. Nvidia $2B investment in both Lumentum[23] and Coherent[24]). Prominent UK deep-tech VC firm Foresight note that **"demand for photonics foundry slots is significantly outpacing supply"[25]**, so we are not too late to invest. Only the telecoms applications noted above are mature; the UK can lead in the other emerging applications. If we don't act now, the opportunity to **anchor growth in the UK** rather than acting as an innovation pipeline for other countries to reap the economic benefits is missed.

The UK stands at a critical juncture. We have world-leading innovation in photonics, the scientific excellence to pioneer emerging PIC-based technologies, and a **historic window of opportunity** as global investment accelerates. Yet without decisive action now, we risk ceding this frontier technology, and the $46B global market it will command by 2035, to competitors. A national PIC pilot line is not a research facility; it is the **infrastructure that transforms UK innovation into UK prosperity,** anchors high-value manufacturing on British soil, and secures our competitive advantage in the defence, quantum, sensing and AI technologies that will define the next decades. The choice is clear: **invest now and lead,** or watch the opportunity pass to others.

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11 Royal Academy of Engineering, "Royal Academy of Engineering Quantum Infrastructure Review," 2024.
12 [Online]. Available: https://www.gov.uk/government/news/uks-quantum-leap-tohelp-beat-diseasedeliver-high-paid-jobs-and-strengthen-national-security-as-first-country-in-the-world-to-roll-out-quantum.
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25 Foresight, "Investing in light: building the foundations of the photon economy," 2025.

2. Economic Case

Various investment options have been considered and summarised below. **Option 2* is the recommended approach.** GVA & revenues between 2035-2040 are **conservative** with only 10% market growth. Section 3. discusses differences between 300mm and 200mm technology. Building costs have high degree of uncertainty.

#	Option	Capability (defined below)	UK Economic Impact†	Cost exc. VAT	Benefits	Risk
1	National pilot line based on 300 mm technology – new building	Front-end, mid-end, back-end	Revenues: ~£5.6B GVA: ~£4.1B New jobs: ~4,000	Equipment: ~£325M Building: ~£150M Opex: ~£30M/annum	Highest performance enabled by highest spec. equipment; clustering effect of companies, talent & investors; UK company priority; Supply chain risk significantly reduced for UK companies; Faster time to market; Most futureproof approach	Access too expensive; Construction timeline too long for maximum impact; Long-term financial sustainability; Over-specified for many applications
2	Rapid deployment of R&D Hub national capability in existing building with parallel construction of new national pilot line building based on 200 mm technology	Pilot line: Front-end, mid-end, back-end R&D Hub: Front-end, limited mid-end	Revenues: ~£4.7B GVA: ~£2.9B New jobs: ~2,850	Equipment: ~£185M Building: ~£120M Opex: ~£20M/annum	First-of-its-kind capability; rapid & seamless translation of new technology from R&D hub to pilot line; redundancy in critical equipment; clustering effect of companies, talent & investors; UK company priority; Supply chain risk significantly reduced for UK companies; Faster time to market; Rapid deployment of capability following sign-off	R&D Hub utilisation limited due to more advanced pilot line; Some applications may require 300 mm performance
3	National pilot line based on 200 mm technology – new building	Front-end, mid-end, back-end	Revenues: ~£4B GVA: ~£2B New jobs: ~1,950	Equipment: ~£150M Building: ~£100M Opex: ~£18M/annum	Clustering effect of companies, talent & investors; UK company priority; Supply chain risk significantly reduced for UK companies; Faster time to market	Construction timeline too long for maximum impact; Some applications may require 300 mm performance
4	National pilot line based on 200 mm technology – existing building	Front-end, limited mid-end (due to space limitations)	Revenues: ~£3.0B GVA: ~£0.8B New jobs: ~780	Equipment: ~£75M Building: ~£15M Opex: ~£9M/annum	Clustering effect of companies, talent & investors; UK company priority	No back-end capability limits impact; Most significant end-user barrier of supply chain management not removed; Some applications may require 300 mm performance
5	Upgrading distributed academic facilities already in UK	Research / early-stage prototyping	Revenues: ~£2.6B GVA: ~£0.45B New jobs: ~440	Equipment: ~£60M Opex: ~£6M/annum	Total processing flexibility; UK company priority	Lack of step change from business as usual; Challenging coordination; Misaligned priorities; No scale-up possible
6	Government support to access overseas facilities	Dictated by partners	Revenues: ~£2.5B GVA: ~£0.36B New jobs: ~340	Capex: £0 Opex: ~£10M/annum	No infrastructure investment required	No sovereign capability; UK companies de-prioritised; Permanently dependent on overseas facilities
7	Business as usual	/	Revenues: ~£2.1B GVA: £0 New jobs: 0	Capex: £0 Opex: £0	No investment required	UK innovation scales-up internationally; Permanently dependent on overseas facilities

Definitions: Front-end: Core PIC wafer manufacturing; mid-end: Heterogeneous integration & processing of external wafers to prepare for packaging; back-end: Advanced packaging, testing and system validation.

†Cumulative revenues are for UK end-users of the pilot line up to 2035; GVA up to 2040, and no. new jobs in 2040. Enticing an international company to build a pilot line in the UK was considered and deemed not feasible due to commercial viability. **Only government can intervene on a facility that optimises for innovation and scale-up** rather than volume and profits, e.g. imec, Belgium; CEA-leti, France; AIM Photonics, US; PIXEurope, EU.

3. Commercial / Financial / Management Case

End-user demand clearly exists, providing confidence that the facility will be sustainable, evidenced by:

- Interviews with **22 UK end-user companies** all expressing a strong need for a UK PIC pilot line and an anticipated requirement of typically 3-6 batches per year valued at £250-500k per annum per end-user.
- **Extensive list of UK white papers / reports** in Section 1. explicitly recommending a UK PIC pilot line.
- Track-record of CORNERSTONE, UK's only PIC prototyping service, which has over **125 customers in 26 countries,** including 72 international customers; many of these customers will ramp up their usage of a new pilot line due to the far expanded capabilities, providing inward investment. The current platform lacks the necessary infrastructure to support customers in the scale-up phase, necessitating translating manufacturing to an overseas partner, **currently a missed opportunity for UK economic growth.**

The proposed business model is that government fund the upfront capex as a grant. Opex will be funded 50% by commercial contracts, 25% by competitive research funding, and 25% by an underpinning government grant. The underpinning grant is essential to **fuel the next generation of innovative technology,** working with partner universities to mature emerging technologies to a higher TRL. The facility will be managed by pilot line staff led by industry experts. Access will be via service provision, delivered by pilot line staff, following semiconductor industry best-practice. This is essential to maintain the **required level of process control and yield.** The proposed legal structure is a not-for-profit company with a host University joint venture.

Access to foundry services including PIC manufacturing, integration and packaging, will be via two mechanisms:

- Bespoke/dedicated runs tailored to individual companies' requirements (~80% of sales).
- Multi-project-wafer (MPW) runs with standard processes where multiple companies each buy a fraction of the wafer area as a cost sharing mechanism to **lower the barrier to entry** (~20% of sales).

Pricing will be heavily dependent on fabrication process complexity, process development required, number of wafers etc. but will typically be £20-80k for MPW runs and £100-500k for bespoke runs. There is a **critical mass, including anchor companies, to sustain the facility** and the anticipated opex outlined in Section 2. At just 5% of total capex, incorporating packaging and integration capabilities on-site is a negligible cost premium that **eliminates the biggest barrier of connecting a complex supply chain** for UK companies.

300 mm technology has some performance advantages over 200 mm technology due to more advanced fabrication equipment driven by the huge volume electronics industry. However, the price is significantly higher and access to this technology is better served with a **strategic partnership for high volume manufacturing,** e.g. TSMC. More advanced equipment provides improved uniformity, tighter tolerances and lower waveguide losses, which is important is some areas such as silicon-based quantum photonics computing. These limits can be overcome with alternative material choices, e.g. silicon nitride, which the recommended approach will enable.

CASE STUDY: SEAGATE, NORTHERN IRELAND

Seagate, one of the world's two dominant hard disk drive manufacturers, has spent more than two decades developing Heat-Assisted Magnetic Recording (HAMR), a technology now **reshaping the global data storage industry[26].** HAMR relies on integrated PICs within the recording head to focus laser energy onto the disk surface, heating a nanoscale spot to over 400 °C for a fraction of a nanosecond to enable data to be written at **unprecedented densities.**

Why does this matter?

- It demonstrates that **innovation centred around PICs can deliver sustained competitive advantage** in a global market worth tens of billions.
- It demonstrates that **world-leading, high-volume PIC manufacturing** is not only possible in the UK but already happening at scale in Northern Ireland.

CASE STUDY: HIGH VALUE MANUFACTURING (HVM) CATAPULT

The HVM Catapult contributes £609M of net additional GVA per year (including multipliers) to the UK economy[27]. This model demonstrates: 1) a **clear return on government investment** in shared manufacturing infrastructure; (2) the ability to **de-risk technology adoption** for SMEs and scale-ups; (3) **regional economic anchoring** and inward investment attraction; and (4) a **bridging model** that moves technology from research readiness to commercial exploitation. **The model is directly transferable to PICs.**

PHOTONICS IN THE UK

Photonics innovation is well distributed around the UK, with significant clusters in Bristol, Cambridge, London, the Scottish Central Belt, Sheffield and Southampton. Figure 1 shows a map of prospective pilot line industry end-users and suppliers in year 1 of operation, i.e. PICs are on their very near-term roadmaps. Figure 2 shows the distribution of photonics and quantum academic projects between 2010 and 2023, with around 100 universities developing these technologies. Most are potential end-users of the pilot line, which would **accelerate the translation of world leading research at these universities into economic impact in the UK.**

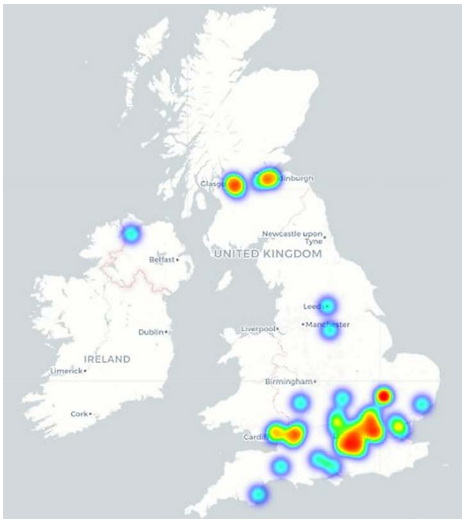

Figure 1
Map of prospective pilot line industrial end-users and suppliers

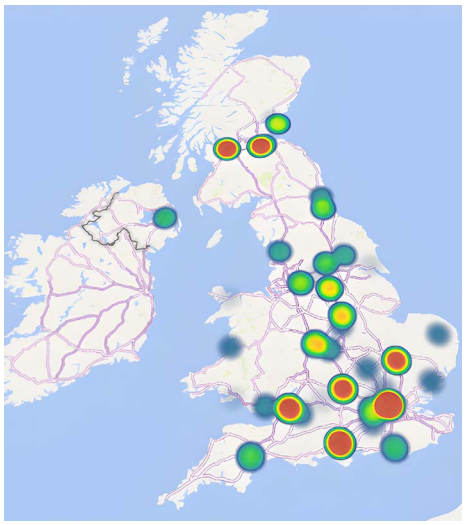

Figure 2
Map of UK academic projects in photonics and quantum (total £720M, source GtR).

26 [Online]. Available: https://www.seagate.com/gb/en/innovation/hamr/.
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The CORNERSTONE Photonics Innovation Centre is the UK's leading technology hub for silicon photonics.

Our mission is to realise a continuous pipeline of silicon photonics-enabled technologies and companies that can serve a wide range of global industries by 2030. We offer:

- **Training opportunities**
- **UK SME foundry support programme**
- **Innovation funding for university-industry collaborations**
- **Start-up support**
- **Public policy engagement**

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