UK Semicondustor Strategy: Call for evidence

Response submitted by the Photonics Leadership Group to the Department of Business Energy & Industry Strategy Committee call for evidence on the Semiconductor Industry in the UK

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Responses are provided from the Photonics Leadership Group, based on discussions at past PLG meetings and surveys of the industry as representative of the consensus views of the £14.5bn UK photonics industry. Whilst providing a overall input, the views of individual organisations may differ and should be consulted for detailed responses that maybe more specific that the overview represented here.

Original call for evidence at https://committees.parliament.uk/work/6724/the-semiconductor-industry-in-the-uk/

Original questions are given in bold . PLG's submission in black

What is the current and future anticipated demand for common products built with semiconductor materials (e.g. computer chips) both in the UK and globally?

1. The importance of semiconductors to the modern economy is immense and goes far beyond the role on silicon chips in computers. Embedded digital control electronics are now invisibly ubiquitous in all products from critical national infrastructure in power water and internet services, to vehicles and consumer white goods to defence systems and almost all medical equipment.

2. Specialist compound semiconductors are essential for the conversion of light to electricity & vs vera. They are at the core of the telecommunications from the wireless access and the optical fibre networks that connect every radio mast and every street (and increasingly every home or business), to the networks, processors and digital storage arrays that power the digital economy. Remove the semiconductors and we revert to communicating with semaphore and calculating on abacuses.

3. Semiconductors are vital to delivering sustainability and progressing toward net zero. Photovoltaics are semiconductors directly generating energy from sunlight. Wind, wave and solar depend on power semiconductors to input renewable generated power into the electricity grid. Optical semiconductor have a vital role in optimising power generation from the detection of wind for optimising turbine performance and location in renewable, for optimising the efficiency of traditional gas turbines and in emissions sensing. Semiconductor lasers and digital control systems are at the core of laser based material processing and 3d printing processes revolutionising manufacturing efficiency. Photonic semiconductors and related integrated photonics are also essential for the digital economy used throughout datacentres and telecommunications networks which are increasingly significant energy users. Double innovation in these is vital to enable the digital economy to both gown whilst reducing the energy footprint of those datacentres and networks.

What is the UK's semiconductor supply chain and is this secure? If not, how can this be improved? What specific strengths does the UK have to contribute to regional or global semiconductor supply chains? How competitive is the UK within the global context of the semiconductor industry?

4. The UK has notable globally competitive strengths in compound and magnetic semiconductors, especially at the base of the supply chain. IQE (Newport) is a major globally supplier of epitaxially grown materials that form the base of semiconductors components in everything from facial recognition sensors in consumer electronics to the voltage converters in power electronics. Seagate in Northern Ireland are the global centre for the production of magnetic data storage read write heads. 50% of the words data storage starts life as specialist magnetic semiconductor wafers fabricated in the UK.

5. The UK are globally recognised innovations in integrated photonics on both compound semiconductor and silicon platforms. Integrated photonics is as revolutionary for the 21st century as integrated electronics was for the 20th. Vital for delivering digital growth with reduced impact, vital to deliver the quantum 2.0 revolution, and the only pathway to mass production of the sensors needed for autonomous vehicles. Companies from around the globe come to the UK to access this expertise and collaborate with are world renowned research centres across the UK e.g. Compound Semiconductor Centre (Newport), James Watt Nano Fab (Glasgow), National Epitaxy Centre (Sheffield), Queens University (Belfast), Zepler Institute (Southampton).

6. The UK has extensive capability in eco-system around semiconductor fabrication, including test and measurement (e.g. Spirent, Yelo) and manufacturing systems (Oxford Instruments, Brooks Automation, M-solv, Optek Systems)

7. The UKs weakness are in manufacturing of the highest performance silicon digital circuits where only a few facilities exists globally. Whilst the UK has strengths in low to mid volume packaging of semiconductor chips (Alter, Bay Photonics etc) there has been in sufficient support for scale-up and to the ultra-high volumes requires in consumer facing applications.

Are there opportunities for strengthening different parts of the current UK semiconductor industry? What are the potential weaknesses and strengths of the UK semiconductor industry to meet future requirements of electronic device manufacturing?

8. The most significant opportunities for strengthening the Uk semiconductor industry are in

a) Supporting scale-up, recognising the high capital equipment investments required both in production, but also in R&D e.g. to support development of automated processes suited to higher volume production that require substantial pre-production capex investment
b) Supporting compound semiconductors where the UK has extraordinary strength
c) Supporting value capture higher in the value chain as the device level above the current wafer production strength the UK has.
d) Support for the key test measurement and fabrication equipment development. Leadership in which is key to accessing the very latest processes and capability.

In which industries does the UK not have an end-to-end semiconductor supply chain? Are there any opportunities for these supply chain gaps to be filled within the UK?

9. This can depend where one defines the end of the semiconductor value chain and whether one includes the critical test and manufacturing equipment. In many cases the UK exports semiconductors at the wafer level for them to be further processed into components and

systems for the UK to reimport them higher in the value. Often this is a legacy of the previous focus on globalisation of supply chains, selecting the lowest cost location for each processing step.

10. Many of the drivers of the original globalisation of the semiconductor value chain have now moved on. Automation, scale-up and access to capital are now much more significant, giving the UK the opportunity to capture more of the value chain in the UK, especially if scale-up and automation were better supported in the UK.

11. However it is unlikely to be viable to support end-to-end, wafer to device, production in all types of semiconductors. For example, manufacture of the latest cutting edge integrated electronics silicon in the UK is unlikely to be practical due to the multi £ billion scale of investment required and the prospect of significant oversupply in the 2-3 year time scale. Rather the UK should focus on higher value semiconductors where there is less commoditisation e.g. photonics devices, integrated photonics circuits, power electronics and RF electronics, many of which leverage the UKs leading capability in compound semiconductors.

How can the Government strengthen semiconductor research and innovation? Are there any current areas of weakness in the present Government strategy to semiconductor innovation? Is there effective communication between the various stakeholders within the UK's semiconductor ecosystem?

12. Government innovation strategy has for more than a decade focused on vertical market challenges, supporting interventions with a relatively short 2-3 year time scale. In this environment there is little to no time to innovation the critical enabling semiconductor technologies, rather vertical market demonstrates must use off the shelf, often imported devices. Vertical market support should be balanced with support for enabling technologies, as recommended in the Government's 2021 Innovation Strategy, setting aside a fraction of support for any vertical for innovation in the enabling components those vertical market systems require.

13. Semiconductor innovation is capital intensive requiring different approaches to the support of capital equipment in innovation grants. To innovate e.g. semiconductor automation enabling UK device manufacture requires investment in e.g. robotics and scale-up tools during the R&D phase that are not carried over into manufacturing. Allowing support for only the depreciation on such equipment, not the full cost, as allowable project expenses is a major barrier to companies investing in collaborative R&D investment in scale-up.

Does the UK have the required skills, talent and diversity to be able to boost its current semiconductor industry and to respond to future disruption?

14. The UK has most of the required skills to boost its semiconductor industry but these are frequently aging and lacking in diversity. Both issues are exacerbated by the excessive focus on verticals in innovation policy and lack of support and championing of enabling technologies.

15. Vocational training routes should provide a valuable boost yet are hampered by the scale of commitment required from individual companies to support vocational program development. This puts engagement with vocational training beyond the reach of most

SMEs. Further education colleges also require support to deliver content applicable to modern hi-tech, often clean room based manufacturing of semiconductors that is very different to traditional manufacturing models.

16. Young people of wider diversity also need to be inspired to take up careers in the sector requiring more championing of UK prospects, education of educators in the strengths of the UK and the significant career prospects and especially alignment with key topical issues such as climate change.

What are the potential national security concerns or vulnerabilities in our semiconductor industry? How should the UK collaborate with the United States and European Union? What are the ramifications on other industries and the wider economy within the UK?

17. The UK defence industry requires access to semiconductors, but rarely does it provide sufficient demand alone to support an independent semiconductor supply chain. Rather access to semiconductor capability by the defence sector must leverage of other markets and applications that drive greater volume and commercial return and/or make strategic use of collaboration with key allies.

18. The product lifecycles in defence are notably longer, i.e decades, than the innovation and product lifecycles in semiconductors where products often only remain current for 1-2 years. This creates challenges for the defence industry to access what rapidly become obsolete or previous generation semiconductor capability. Collaboration with allies again is a route to overcoming by providing greater volume.

19. Where UK based capability is in the national interest additional innovative mechanisms of support may be warranted. For example, direct investment in select fabrication capital equipment by government, to be hosted in commercial UK facilities with surplus capacity not needed by defence made available to the commercial sector on an access / lease basis agreement basis. Such types of intervention would invert the normal emphasis on industry to make the capex investment first, resolve challenges around return on investment risk and increase breadth of such capability to a wider range of innovators.

Is the Government currently providing the clarity and direction required to enable growth and security in the semiconductor industry? Are the right governmental organisations involved with ensuring effective development of our current semiconductor industry to thrive in the future?

20. Further clarity is certainly needed. The Government's 2021 Innovation Strategy highlighted the need to support enabling technologies for the UK's future prosperity, but little or no action has been evident from the UK's innovation agencies to support that strategy.

21. Lack of access to semiconductors impacts the digital economy and thus is of a concern to DCMS. Support for hardware innovation and the electronics sector in the UK traditional sits within BEIS.
22. Semiconductors strategy therefore risk falling between departments creating confusion in direction and intention.

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