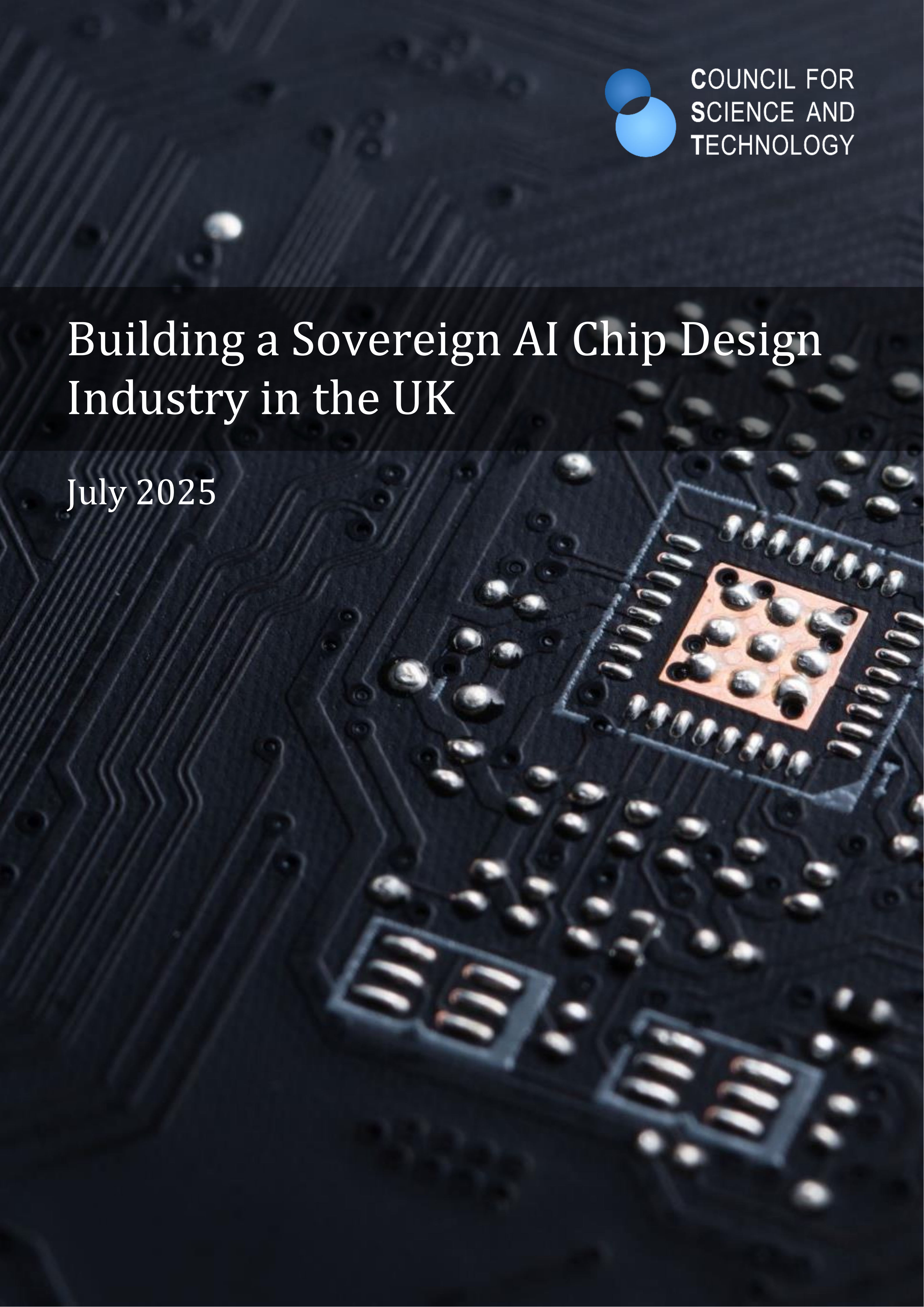

COUNCIL FOR SCIENCE AND TECHNOLOGY

Building a Sovereign AI Chip Design Industry in the UK

July 2025

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100 Parliament Street
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BUILDING A SOVEREIGN AI CHIP DESIGN INDUSTRY IN THE UK

Executive Summary

Semiconductors (or 'chips') have rightly been identified by the government as a priority technology for the future of the UK.[1] Their development and usage underpin many of our strategic goals, cutting across sectors, and they make a significant contribution to our ambitions for economic growth and security.[2]

The UK has a niche and highly specialised chip industry, so it is unlikely that the UK will ever catch up to the current front-runners by taking a broad, generalist approach. **If we are to see economic returns for the UK, the government must focus investment and activity on the parts of the chip industry where the greatest growth is expected and where the UK can achieve strategic advantage.**

There is growing consensus that over the next 10 years the fastest growing part of the global chip industry will be in AI chip products (accelerators, memories, Graphics Processing Units (GPUs), Central Processing Units (CPUs), interconnects and packaging). The global market for AI chips is forecast to grow at approximately 30% per year from now to 2030, at which point AI chips will be over 50% of global semiconductor revenue.

Fortunately, with the right investment and capabilities in place, the UK could create a meaningful AI chip design industry. We have strong AI and design expertise and creativity in our universities; a growing ecosystem of AI companies; and ARIA's Scaling Compute program has identified and brought together, for the first time in the UK, talent and ideas with the potential to create novel vertical AI systems.[3] However, this would require bold commitments from the government to put the right foundations in place, including the training of an AI chip workforce. We believe this is likely a once-in-20-years opportunity for the UK to build a profitable AI chip design industry in one of the largest markets in the world.

Our recommendations cover the skills (recommendations 1 and 2), finance and investment (recommendations 3 and 4) and infrastructure capabilities (recommendations 5 and 6) the UK would need to build to achieve this:

Recommendation 1: DSIT and DfE should increase the number of new chip designers in the UK workforce by 2030. This should be achieved through an increased number of bursaries

[1] The UK's modern Industrial Strategy (June 2025). Available at: https://assets.publishing.service.gov.uk/media/68595e56db8e139f95652dc6/industrial_strategy_policy_paper.pdf

[2] Department for Science, Innovation and Technology (2024). Semiconductor sector study. Available at: https://www.gov.uk/government/publications/semiconductor-sector-study/semiconductor-sector-study

[3] ARIA (n.d.), Scaling Compute. Available at: https://www.aria.org.uk/opportunity-spaces/nature-computes-better/scaling-compute/

and fellowships for students to pursue this career path, and commissioning a nationally curated, high quality chip design course to be replicated across UK universities.

Recommendation 2: DSIT and DfE should consider how to expand investment in training and skills for optoelectronics, in particular through the Optoelectronics Research Centre (ORC). AI chips will soon require optical chip-to-chip communications, which will likely lead to far greater growth in optoelectronics, a field in which the UK is already strong. Training for future optoelectronic engineers will allow the UK to capitalise on this growth.

Recommendation 3: DSIT and MOD should set clear strategic objectives on semiconductors to send a strong signal to the UK semiconductor industry on where activity is most useful. Both departments should collaborate more closely to analyse the risks and opportunities in semiconductors and coordinate investment, with a view to creating early-stage dual-use opportunities.

Recommendation 4: Government should coordinate investment through the entire innovation pipeline to support growth of the UK AI chip industry. This will require deprioritising funding where there is less growth. If the UK is to play a large global role in AI, we need more companies designing AI chip products in the UK.

Recommendation 5: DSIT should ensure the UK's semiconductor infrastructure provides SME chip companies and academics with affordable and timely access to facilities. The UK Semiconductor Centre will be a positive step towards providing this coordination and should have clear, measurable metrics for success.

Recommendation 6: DSIT and DBT should explore UK access to the leading-edge technology required by UK startups. This can be done directly with companies and when negotiating international trade agreements.

CST report on building a sovereign AI chip design industry in the UK

Background

1. The field of semiconductors (or 'chips') is a complicated topic in the UK, and generates spirited debate about government's role, what its priorities should be, and how much it should invest.

2. There is a national tendency to conflate chip design (one of the fastest growing industries in the world) with chip manufacturing (one of the most expensive industries in the world). It helps to be clear that the two industries are completely different, with different dynamics, requiring different skill sets and very different levels of investment. At a high level, a chip designer is like an architect whose output is the detailed design of a building. A chip manufacturer is like a building firm, who takes those drawings to build a finished product.

3. Today, it costs approximately $50-100 million to design a leading-edge chip, about $100 million to manufacture the chip, and about $20 billion to build a manufacturing plant ('fab').[4] Chips are designed by startups, chip vendors (e.g., Nvidia, Intel, AMD) and by large technology companies (e.g., Apple, Google, Amazon Web Services) using specialised electronic design automation tools (e.g., from Cadence and Synopsys). Chip manufacturing is more of a 'nation state activity': Taiwan Semiconductor Manufacturing Company (TSMC) started because of significant investment by the Taiwanese government, hence the US and EU CHIPs Acts to stimulate more global diversity (e.g., Intel, Global Foundries, Tower).

4. The UK chip industry has declined since its peak, leading to a loss of confidence, and disagreement over where, how and whether to rebuild. The first commercial computer, the first electronic memory, the first parallel computer (the Inmos Transputer) and the first widely used chip IP model (ARM, whose licensed CPU designs are in almost every smartphone in the world) all happened in the UK. However, with ARM's ownership by Softbank, its listing on Nasdaq and with a majority of its employees outside the UK, it feels to *some* like a lost opportunity.

5. The UK has a strength in non-standard manufacturing processes based on compound materials. About 80-90% of the world's chips are built from pure silicon: this is how CPUs, GPUs, memories and the majority of chip designs are manufactured. The rest of the market consists of compound materials, including silicon-germanium (SiGe) for high-speed RF circuits, aluminium-gallium-arsenide (AlGaAs) and indium-phosphide (InP) for optoelectronics, and gallium-nitride (GaN) for power electronics. Southampton's world-class Optoelectronics Research Centre (ORC) has created a local industry over many years in fiber optic communications, specialised lasers and chip-to-chip communications. GaN is a

[4] In the past, most chip companies designed and manufactured chips, in a process called "Integrated Device Manufacture" (IDM). Well-known chip companies such as Intel, Motorola, Samsung, AMD, Texas Instruments and IBM started this way. The model started to change with the creation of TSMC in 1987, the world's first fabrication-only chip company. Today, the vast majority of chip manufacturing has been out-sourced to TSMC and other fabrication-only companies. (The main exceptions are Intel and Samsung, who still design and manufacture chips.) The two largest chip companies (Nvidia and AMD) are now "fabless"; and many large tech companies (e.g. Apple, Google, AWS) design their own chips using the fabless model and outsource manufacturing to TSMC.

more recent UK strength, with growing expertise, startups and investment in power electronics.

The North Star: A profitable UK industry for AI chip design

6. The AI Opportunities Plan[5] outlined the Prime Minister's intent to invest heavily in AI, with three primary goals, one of which is to "position the UK to be an AI maker, not an AI taker." However, the Plan is quiet on UK-designed chips for AI despite the opportunity and the risks.

7. Between now and 2030, the global market for semiconductors is forecast to grow at approximately 8% per year (from $625 billion in 2024 to $1 trillion in 2030).[1,6] The global market for power semiconductors is estimated to grow at around 4% per year (from $40-50 billion in 2023 to $50-60 billion in 2030). The global market for optoelectronic semiconductors is expected to grow at about 7% per year.[7] **Yet, the global market for AI chips is forecast to grow at 30% per year from now to 2030,[8,9,10] at which point AI chips will comprise over 50% of global semiconductor revenue.**

8. AI chips are forecast to be the largest growth area in the chip industry for the next decade, with six of the seven largest companies in the world investing billions where they perceive low hanging fruit for more efficient, faster, lower power AI chips.

9. **There are therefore disproportionate opportunities for businesses, and nations, with the right capabilities.** And, as companies like Nvidia continue to prove, it is possible to be successful and profitable even through a fabless approach. **As the UK government considers where to prioritise investment over the next four years, we recommend specific focus is given to AI chip design in the UK.**

10. In the absence of a sovereign AI chip industry, we risk AI data centres in Growth Zones filled with graphics processing units (GPUs) from a single dominant supplier, which is problematic for many reasons. History shows that a vendor with 90% market share and 75% gross margin is not sustainable. When the market diversifies, which it inevitably will, there is an opportunity for the UK to have a stake. It would also help us secure our hardware supply chain for domestic commercial and military applications, in an uncertain era of tariffs and export restrictions.

[5] Department for Science, Innovation & Technology (2025). AI Opportunities Action Plan. Available at: https://www.gov.uk/government/publications/ai-opportunities-action-plan

[6] McKinsey & Company (2022). The semiconductor decade: A trillion-dollar industry. Available at: https://www.mckinsey.com/industries/semiconductors/our-insights/the-semiconductor-decade-a-trillion-dollar-industry

[7] Fortune Business Insights (2025). Optoelectronics Market Size, Share & Growth | Forecast [2030]. Available at: https://www.fortunebusinessinsights.com/optoelectronics-market-108775

[8]Grand View Research (n.d).Artificial Intelligence Chipset Market | Industry Report, 2030. Available at: https://www.grandviewresearch.com/industry-analysis/artificial-intelligence-chipset-market

[9] Roots Analysis (n.d.), AI Chip Market. Available at: https://www.rootsanalysis.com/ai-chip-market

[10] Business Research Insights (2025). AI Chips Market Size, Share, Growth, And Industry Analysis, By Type (GPU, ASIC, FPGA, CPU) By Application (Electronics, Automotive, Consumer Goods), Regional Insights and Forecast From 2025 To 2033. Available at: https://www.businessresearchinsights.com/market-reports/artificial-intelligence-ai-chips-market-105026

Recommendations

11. Building a profitable AI chip design industry in the UK will first require us to establish the right conditions, which in turn require a feasible objective for the UK: **to create the environment for new and existing UK companies – including small, medium and large companies, and UK headquartered or outpost design centres from overseas – to launch 50 new AI chip products in five years.** Achieving this would require bold commitments from the government to create the foundations for success.

Skills

Recommendation 1: DSIT and DfE should increase the number of new chip designers in the UK workforce by 2030. This should be achieved through an increased number of bursaries and fellowships for students to pursue this career path, and commissioning a nationally curated, high quality chip design course to be replicated across UK universities.

12. Estimates based on DSIT's most recent analysis of the UK semiconductor workforce show the existing UK chip industry already needs approximately 7,000 new chip designers over the next five years.[11] If the UK were to launch fifty new AI chip products over the next five years, it would require a further 5,000 chip designers (approximately 100 chip designers per design[12]), leading to a total of 12,000 new chip designers over the next five years.

13. Today, we graduate about 9,000 electronic engineers per year,[13] and if just 10% become chip designers, we would only produce 4,500 chip designers in five years, just over a third of what we will need.

14. To increase supply, the UK should train more chip designers at our universities (through undergraduate and Masters programmes), attract chip designers to the UK, and collaborate with third party organisations (e.g., Interuniversity Microelectronics Centre (IMEC)) to whom we can outsource work. Preliminary plans to fund bursaries directly to students who study semiconductors are a very welcome step in the right direction.

15. UK universities will need to reintroduce electronics and chip design courses for undergraduate and masters students, courses that were widely taught in the past, but now only offered by a few. These courses should cover computer architecture, chip design,

[11] Our existing chip companies will need more chip designers for two reasons: (1) As they grow – With 12,000 UK chip designers at present, and assuming global growth of 8% per year, the UK will require approximately 16,800 in five years, an increase of 4,800 new designers. (2) As they replace retiring designers – "An estimated 39% (over 10,000 workers) are expected to retire within 15 years, presenting a major skills and succession planning challenge." Assuming 64% are design-related, 6,400 workers will retire in 15 years, and 2,100 in 5 years. Hence a total of 4,800 + 2,100 = 6,900 in 5 years, rounded up to 7,000. Department for Science, Innovation & Technology (2025), UK Semiconductor workforce study. Available at: https://www.gov.uk/government/publications/uk-semiconductor-workforce-study/uk-semiconductor-workforce-study-executive-summary

[12] By "chip designer" we include those involved in architecture, design, verification, simulation, validation and low-level software.

[13] About 180,000 students study engineering in the UK (Higher Education Statistics Agency (2025). Higher Education Student Statistics, Available at: https://www.hesa.ac.uk/news/20-03-2025/sb271-higher-education-student-statistics/subjects), and I assume 60,000 graduate per year (3 year degree), of which about 15% study electrical or electronic engineering (The Engineer (2023). EngineeringUK reveals higher education insights. Available at: https://www.theengineer.co.uk/content/news/engineeringuk-reveals-higher-education-insights/), or about 9,000 graduates per year.

verification and validation, as well as optoelectronics.

16. We can and should rely on our centres of excellence (e.g., Edinburgh, Bristol, Southampton, and Sheffield) in these disciplines to help create courses and then share course material nationwide to ramp up quickly. **A nationally curated curriculum could accelerate widespread adoption.** Lessons should be learnt from the Taiwan Semiconductor Manufacturing Company Fin Field effect Transistor (TSMC FinFET) University program.

17. The course could include access to chip design services in collaboration with companies such as IMEC and Muse Semiconductors, both of whom offer privileged access to TSMC's FinFET University Program, giving students experience with advanced 16nm and 7nm PDKs and fabrication processes. These programmes can help with lower cost access to advanced EDA tools.

Recommendation 2: DSIT and DfE should consider how to expand investment in training and skills for optoelectronics, in particular through the Optoelectronics Research Centre (ORC).

18. It is widely predicted that AI chips will increasingly be interconnected using optical communications, which in turn will likely expand the optoelectronics industry (beyond its current 7% Compound Annual Growth Rate).

19. Adjacent racks of AI servers will continue to be connected by hundreds of optical cables, powered by fiber-optic modules. Servers inside the racks, which are usually connected by copper cables today will not be able to keep up with demand, and copper will increasingly be replaced by short-reach optical cables. The accelerator, memory and interconnect chips that comprise the server will be increasingly co-packaged with optoelectronic chiplets (photonic integrated circuits or PICs).

20. To give a sense of the magnitude of communication inside an AI system: today, the data communications inside a single cloud data centre is about 10,000 times larger than the *entire* public internet. A single rack of AI accelerators communicate about 10 times faster than an equivalent rack of CPUs. Hence AI systems already require more communications and are growing faster still.

21. This is good news for the UK because of our strength in all aspects of optoelectronics from optical subsystems and modules to specialised manufacturing. We can anticipate far larger growth in manufacturing processes for optoelectronics than other compound manufacturing.

22. IMEC has a good optoelectronics programme and has access to modern leading edge commercial silicon-photonic manufacturing processes. There is likely an opportunity for greater collaboration and leverage of IMEC, allowing us to avoid any unnecessary replication, particularly for expensive manufacturing capability. **Our focus in the UK should be on the skills and training for future optoelectronic engineers.**

Targeted investment and finance

Recommendation 3: DSIT and MOD should set clear strategic objectives on semiconductors to send a strong signal to the UK semiconductor industry on where activity is most useful. Both departments should collaborate more closely to analyse the risks and opportunities in semiconductors and coordinate investment, with a view to creating early-stage dual-use opportunities.

23. Today, the MOD and DSIT appear to analyse and work with the semiconductor industry independently of each other, even though both are aligned in their reasoning: to seek UK sovereign expertise in chip design, packaging and manufacturing; to create a resilient supply chain in a time of global uncertainty; and to invest in UK-sovereign AI chip products.

24. It is a lost opportunity that DSIT and MOD do not coordinate more closely on their analysis and spending, particularly as there are significant dual-use opportunities across industry and defence. There is ample low-hanging fruit in the creation and early-stage investment, which could later be funded for dual-use by the National Security Strategic Investment Fund (NSSIF).

Recommendation 4: Government should coordinate investment through the entire innovation pipeline to support growth of the UK AI chip industry. This will require deprioritising funding where there is less growth.

25. We have a small number of AI chip startups right now, typified by Fractile, headquartered in London and with chip designers in the UK. There are very few other UK AI chip startups.

26. If the UK is to play a large global role in AI, we need more companies designing AI chip products in the UK. Government has announced promising plans in the Spending Review to significantly increase funding and investment in UK technology companies in a more coordinated way through the entire pipeline. This includes Innovate UK grants for very early stage spinouts and startups developing new technologies and products; NSSIF investment in early stage companies for security, defence and dual-use purposes; Sovereign AI Unit funding for AI-specific technologies at various stages; British Business Bank (BBB) investment in early and growth stage opportunities; and the National Wealth Fund (NWF) making large investments in significant UK infrastructure.

27. However, government can go further by delivering a prioritised list of technologies and sectors – defined by DSIT, MOD, DBT and HMT based on the UK's strategic and economic goals. For the growth of the UK AI chip design industry, this should include explicit guidance on the types of business that are necessary to deliver against national goals, the underpinning technologies and infrastructure required for them, and the kinds of interventions required at each stage of the pipeline for them to succeed.

28. DSIT and HMT should advise Innovate UK to make grants to risky early-stage ventures, and NSSIF and Sovereign AI should invest in the early, capital intensive phase where talent, design tools and multi-project wafers are expensive; ideally alongside other investors, on terms to encourage participation.

29. DSIT and HMT should empower the BBB to invest in the early stages and in the growth phase, where ‘tapeout’ costs are high, to get new products into production, while enabling companies (headquarters and outposts) to stay in the UK. The BBB should also recruit experts or seek external expertise to help identify AI chip companies to invest in, and to bolster its due diligence.

30. The BBB should invest to encourage more venture capital (VC) funding of AI chip companies, including investing in VC funds willing to commit to a minimum fraction of their investments in UK semiconductors.

31. The NWF should identify and fund infrastructure to support clusters of chip design companies, as well as advanced chip packaging companies, particularly for the rapidly growing market for high density chiplets in a single package or on a single panel.

32. All such investments, throughout the pipeline, will require significant input and advice from experienced members of the UK chip industry – the UK has many to call on, and we encourage all investment bodies to take full advantage of the resident expertise.

33. Targeted investment may require trade-offs to be made. Although the UK has a history of investing in compound materials, DSIT should consider deprioritising them in favour of activity in support of AI chips. Within the field of compound materials, optoelectronics should continue to be a relatively high priority as the market for it is expected to grow at a greater rate.

34. There will be continued innovation in advanced chip assembly and packaging, and this part of the industry will continue to grow because of the demanding requirements of AI chips. Government should explore investment in advanced chip assembly and packaging.

Infrastructure

Recommendation 5: DSIT should ensure the UK’s semiconductor infrastructure provides SME chip companies and academics with affordable and timely access to facilities. The UK Semiconductor Centre will be a positive step towards providing this coordination and should have clear, measurable metrics for success.

35. Stakeholders have noted that the current remit and capabilities of catapults such as the Compound Semiconductor Applications Catapult are not best serving SME chip companies and academics who need affordable and timely access to facilities. Catapult services are also often expensive and time to market is slow. The above recommendations can only be delivered through a coordinated UK semiconductor sector with a critical mass of capability. The UK Semiconductor Centre will be a positive step towards providing this coordination and government should be bold in deprioritising funding for infrastructure which is not fit for purpose.

Recommendation 6: DSIT, MOD and DBT should explore UK access to the leading-edge technology required by UK startups.

36. Although we recommend pursuing a fabless approach, where chip fabrication is outsourced to an overseas foundry, UK startups will require access to leading-edge technologies such as masks and multi-project wafers (MPWs), and licenses for Electronic Design Automation (EDA) tools and Process Design Kit (PDKs).

37. These technologies are expensive, and typically held by major chipmakers based overseas, such as TSMC, Samsung, and Intel.

38. While startups can negotiate directly with chipmakers for access, this may be prohibitively costly, so the UK should look to negotiate as a nation, include access and licenses in the negotiation of international trade agreements, or enable access as part of the UK funding mechanisms set out at recommendation 4. DSIT, DBT, MOD and HMT should consider the need for access to these technologies as part of their analysis and coordination.

39. The UK may wish to consider encouraging uptake of the TSMC University FinFET programme, which is a promising way for students (undergraduate, masters or retraining) to work through the full semiconductor design process with access to key technologies. Government should establish a national agreement with IMEC (and consider establishing them with companies like Muse Semiconductors) to streamline and reduce cost for small UK companies.

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