

UK Semiconductor Manufacturing: Building a globally competitive sector.

Techworks Semiconductor Leadership Group (techworks.org.uk/nmi-slg)

Techworks SLG published an industry response to the government's Semiconductor Strategy in May where we called for the UK to invest across the whole semiconductor value chain, not only in innovation and design. We note that in the strategy, the government stated, "We will announce plans by the autumn to further support the competitiveness of the semiconductor manufacturing sector that is critical to the UK tech ecosystem".

The Chancellor's Autumn Statement, due on Wednesday 22nd November is an opportunity for the government to show that it recognises the challenges faced by the UK's semiconductor manufacturing sector and to propose meaningful interventions in support of this strategic industry, as indicated in the strategy.

Although the UK does not try to compete with the mass-volume semiconductor chip manufacturing or fabrication facilities (chip fabs) in the far east, we do today enjoy a vibrant ecosystem of more than 20 commercially successful fabs which supply uniquely innovative and valuable products across the globe. In addition, there are also a number of UK based suppliers of chip fab equipment who export globally.

Existing UK fabs work in emerging and strategically valuable markets, such as compound semiconductor (new materials, other than traditional silicon) for power electronics in EVs & renewable energy, radio communications for 5G & radar; photonics (light & optical processing) for augmented reality, high performance computing & telecoms and MEMS (nanoscale structures) for sensors in life science, automotive & robotics. The UK has world-leading innovation in these areas and already exports many millions of such devices.

Exposing the funding gap

However, semiconductor manufacturing is an expensive business due to the high cost of operating expenses (opex) consisting of energy, water and gas supplies together with maintenance and expensive depreciation of the highly complex production equipment. It is also expensive to stay competitive since producers must grow their sales to fill production capacity so that the high opex cost is covered and they can realise a net profit. But, as the market volume grows due to more applications for the technology, global competition also increases, and the market price naturally decreases. To stay competitive, chip producers must expand their capacity, continuing to keep their facilities full and operating efficiently as they follow the global market growth. They achieve this through periodic upgrades and capacity expansion.

The necessary expenditure to carry out such upgrades is significantly less than the original investment to build the fab, however, it is not trivial and can often be as much as £20 - £30 million every few years.

A market failure exists here since even profitable companies with a track record struggle to raise the necessary investment (equity or debt) due to a lack of patience and market understanding among the finance community. The chip design, development and production cycle is usually 2+ years and upgrading a production site can also take around 2 years to complete. Realising the increased net profit to repay the investment can take more than 5 years which is beyond traditional investors' return expectations. However, if these companies can maintain their lead through appropriate investments, they are often highly successful in the long term.

Across the developed world, many countries provide financial incentives to support chip manufacturing, which range from 20% to 40% of revenues. Such countries justify their investment through net positive economic impact due to supply chain multiplication (new businesses and jobs which supply the sector).

There are also numerous schemes - including in the UK - to use public investment to encourage private sector funding. However, public *follow-on* funding is often not enough, as a lead investor from the private sector must still be found to take the largest stake and secure a syndicate of other investors and there are few such investors in the UK with enough market understanding to take on such a role.

This situation is of major concern to UK owned and operated companies which need to upgrade their facilities to compete globally against companies who may already receive significant financial support.

However, this is also a concern shared by the UK based leadership of non-UK owned companies with significant operations in this country. Employing many skilled UK taxpayers, these operations also compete internationally with related operations in other countries to win projects and new production opportunities and ultimately remain strategically important. To secure such commitments from their HQ along with related headcount growth and upskilling, they too must find ways to invest in future capability. Again, in many regions outside the UK, public bodies offer incentives which skew the playing field away from the UK.

How can the Government help?

UK chip manufacturers need a level playing field to compete globally. This means, as a minimum, a support mechanism for capital expenditure and access to finance for the necessary step-up expenditure to remain competitive; to illustrate this, a common issue is wafer size. As volume increases, a fab can 'upgrade' to manufacture chips on larger diameter wafers. However, the size of wafers processed has a major cost impact on the equipment within the facility. Today, very few UK facilities produce wafers larger than 150mm, whilst the standard globally is 200mm or 300mm. Many of these facilities will need to be operating at 200 to 300mm in the next 5 to 10 years to remain competitive.

In the UK, there are several government mechanisms to support innovation and R&D, but these are of limited use in addressing this market failure.

The R&D Tax Credit scheme is designed to support technological advancements but only allows direct project costs such as staff and consumables to be claimed. In the US, by contrast, the Chips Act has added 'Section 48D' to the Internal Revenue Code to incentivize semiconductor manufacturing by allowing tax deductions for investment in new semiconductor facilities.

UKRI and InnovateUK have made significant impact by supporting a wide-range of pre-commercial innovation and R&D, however, all of these programs are targeted at early stage pre-market R&D and claimable costs are limited to staff and consumables directly related to the defined project. Capex costs are limited only to the proportion of depreciation occurring during the project itself, which represents a small fraction of the full equipment cost. Furthermore, such schemes are typically limited to £315,000 over 3 years through the Minimal Financial Assistance (MFA) exemption to the Subsidy Control Act 2022, or a maximum of £1 million with the requirement that the project is referred to the Subsidy Advice Unit. This is still too small to be effective.

In recent years, the UK government has created two important vehicles to stimulate economic growth and both could drive growth and investment in the semiconductor manufacturing sector.

The British Business Bank was established by the Department of Business and Trade to help small businesses prosper and grow, but currently, it does not offer effective support for semiconductor manufacturing. The National Security Strategic Investment fund is targeted at several technology innovation areas, but does not address semiconductor manufacturing, whilst Future Fund: Breakthrough is a more general program, but only provides follow-on funding requiring an existing investment syndicate to be in place first.

The British Infrastructure Bank was established by HM Treasury to enable public-private financing to support climate change mitigation, Net Zero and community infrastructure. Providing support for semiconductor manufacturing here would in turn support levelling up through new highly skilled job opportunities and higher levels of productivity across the whole of the UK, whilst also supporting scale up of emerging semiconductor technologies which are themselves key enablers for many NetZero solutions.

The Government's Automotive Transformation Fund (ATF) programme is an interesting model, designed to support large-scale capital investment projects supporting the electrified automotive UK supply chain. The fund recently co-invested in a battery factory for Tata group in the UK creating thousands of jobs.

It is also important to note that there exists a chronic skills shortage in the UK, which threatens our ability to compete globally. In particular, the UK needs more highly skilled process engineers, technicians and production operators to support growth in chip manufacturing. Many of these enter the industry via apprenticeships and vocational pathways. A recent Inquiry led by Lord Knight and Lord Willetts with EngineeringUK (['Fit for the future: Growing and sustaining engineering and technology apprenticeships'](#)) added to the growing demand for reform of the IfATE and improved funding for resource heavy apprenticeships with strategic importance. We support these recommendations and believe employers need more flexibility in how they spend funding from their Apprenticeship Levy, to better match the needs of industry in training and skills development.

Our proposal to HM Treasury

To address the above market failure, we offer the following suggestions for consideration by HM Treasury:

- Change capex rules for Innovation and R&D schemes (UKRI and R&D Tax Credits) to allow significant capex recovery when investing in strategic enhancements to semiconductor manufacturing.
- Increase the maximum funding available from UKRI / InnovateUK for specific semiconductor manufacturing enhancements to ensure UK business can remain globally competitive.
- Create a matched funding or lead investor scheme in support of strategic upgrades to UK facilities where applicable companies can demonstrate ability to lead globally through such enhancements.
- Address the shortage of process engineers, technicians and operators through apprenticeship system reform, offering employers more flexibility in how they use their Apprenticeship Levy contributions.

The Government has identified several strategic priorities for the UK: AI, Quantum, Telecommunications, Net Zero, Sensors and Semiconductors. Many companies across the whole of the UK are today manufacturing world-leading semiconductor devices which are critical components in these areas. Furthermore, they aim to scale up operations employing more highly skilled people, which in turn supports the Government's levelling up agenda. There is a risk though, that whilst many are in a leading position today, if they are not supported to remain competitive, they may become acquisition targets by foreign entities, leaving the UK economically disadvantaged and potentially damaging national security.

The UK leads the world in innovation, but we must extend that success into manufacturing to reap the full economic and labour-force rewards which result and to ensure we maintain a resilient national security.

We urge HM Treasury to find effective mechanisms to support the UK semiconductor manufacturing sector to ensure it continues to compete globally, even whilst many competitors are unfairly subsidised.