

INPUT TO BEIS SELECT COMMITTEE ON UK SEMICONDUCTOR INDUSTRY BY ALLAN JAMES, FOUNDER AND MANAGING DIRECTOR OF SEMEFAB LTD.

1) The Global Semiconductor industry is a strategic enabling capability across many important diverse manufacturing sectors. Notably in Automotive, Telecoms, Information Technology, Internet of Things, Robotics and Automation, Defence and Homeland security, Smart Grid and Renewable Energy - storage and conversion. These all rely on secure supplies of particular types of Semiconductor devices.

2) It is important to realise that there is no one size fits all semiconductor manufacturing operation. There are silos of expertise in each discipline distributed around the Globe, some of which are; Complex digital Computer Processors and Microprocessors, Analogue IC's eg Operational amplifiers, Mixed Signal - eg Application Specific IC's often embodying Analogue to Digital converters, RF IC's and RF Power (GHz operation for communications), Discrete semiconductors -transistors diodes, JFETS, Power Switching Semiconductors - Plain Silicon and Silicon Carbide Schottky diodes, Power MOSFETS, Superjunction MOSFETS, IGBTs , Thyristors and so on. To these we should add the manufacture of sensors which are an increasingly important capability across diverse sectors including the medical and healthcare sectors. Sensors are set to transform Healthcare from a reactive approach to a pro-active , early diagnosis approach.

3) An emerging consideration are Wide bandgap semiconductors such as Gallium Nitride GaN and Silicon Carbide. Some performance benefits accrue from using such materials such as high speed switching, high temperature operation and high current density. The Welsh Cluster centred around Newport wafer fab, IQE the material supplier and ClassIC in Scotland worthy of consideration as part of the UK's overall strategy for Semiconductors. It should be noted however that Silicon as a material still enjoys use in >90% of devices and R&D into silicon has always been able to 'raise its game'. Particularly in the area of High voltage High performance power switching IGBT's for EV chargers there is still more to be had from silicon, especially coupled with advanced assembly techniques for improved thermal dissipation. GaN and SiC are expensive materials (15-30x silicon) and are not yet available in the large wafer diameters of silicon leading to a manufacturing cost penalty.

4) Given the strategic nature of this manufacturing sector it is obvious that the UK is not well served from a local supply chain standpoint and is increasingly reliant on centres of excellence abroad. To the extent that the nation states involved remain friendly towards the UK, all is well. Serious issues will arise if the converse should become the case.

5) A further concern is that semiconductor technology is advancing at a great rate. There is a risk of the West falling behind the technological advances coming from the East. Should this happen to a significant extent the West will become technically subservient to foreign nation states. Given the pervasive nature of sensors and IOT and the importance of Cyber security, it is conceivable that superior technology could at some point in the future bring the UK to a standstill.

6) The Semiconductor industry has high capital equipment cost needs and investments are cyclic every 4-6 years to remain competitive. The trend is for decreasing feature sizes and larger semiconductor substrate sizes. Semiconductor devices are manufactured on discs of Silicon. The leading companies are now using 300mm diameter wafers at Sub 10nm linewidths in fully robotic Fabs costing >\$5B -\$10Bn

7) It is important to note however that today >50% of the industry is using 150mm or 200mm substrates at 0.8um technology node or higher for more general purpose semiconductor devices including power switching devices and the majority of sensors. This is

the area that my company Semefab Ltd operates in. For the uninitiated, there is a Videotour of our operation available on the home page of www.semefab.com.

8) Start Ups in the sector tend to suffer from the Hype Curve syndrome :

Visibility/Expectations on the Y axis, Time on the x axis. The trend is from Technology trigger rising to a 'Peak of inflated expectations', falling into the 'Trough of disillusionment' then gradually rising along the 'Slope of enlightenment' eventually reaching the 'Plateau of productivity'. In the 'Trough of Disillusionment' investors often lose patience. Government support is safer with a mature company than with a start up, although both are necessary in this sector. Also a technology enabling company like Semefab is better placed to service the needs of start ups than them having to contemplate building their own manufacturing facility for a given semiconductor or sensor. The 'fabless' or 'fab-lite' business model is a recognised method for start ups in both design and devices. Semefab is the only UK semiconductor manufacturing facility that services such opportunities providing there is a fit with our installed equipment base.

9) The products are global in their reach and other nation states have recognised the importance of the semiconductor industry and have nailed their colours to this mast.

10) Some States have supported their semiconductor industries with Capital grants, free land, subsidised power etc to the point that they are now dominating the landscape. Export development is very difficult when there isn't a level playing field in Manufacturing cost terms.

11) A good track record of returning financial support received back to Government through job creation and tax returned to the Exchequer (as Semefab has done under the UK Micro and NanoTechnology Initiative in 2006/7 - see point 11 below)

ought to be taken into account and rewarded by lower barriers to funding support for the semiconductor sector in the future

12) A 50:50 matched funding approach to Capital Expenditure would work in the semiconductor and sensor device manufacturing sector in most cases. Semefab was awarded £6.8M under the MNT Initiative against a Total Project cost of £13.6M to equip two new wafer fabrication facilities at Semefab on 150mm diameter substrates. This award is the reason we are successful today. New job creation and income tax levied, has enabled the Exchequer to recover their investment and has been enjoying a growing surplus from Semefab in the last several years.

13) State Aid rules are often cited as a reason for limiting or restricting aid, but the UK wafer fabs (Semefab- Glenrothes, Bournes-Bedford, Nexperia-Hazelgrove, Diodes Inc -Greenock, Diodes Inc - Oldham, Plessey-Plymouth, Dynex-Lincoln, Classic- Lochgelly, Newport wafer Fab -Newport, IXYS -Swindon , Compound Semiconductor Technologies - Glasgow, Broadex Technologies (Kaiam) -Livingstone) don,t generally compete with each other so there shouldn't be State Aid conflicts, more so since we have left EU.

14) Scotland is home to 45% of the above list of companies and has a proud and successful history in semiconductor technology and manufacture. Academia and start ups are well served by the Scottish Microfabrication center affiliated to Edinburgh University, the Kelvin NanoTechnology centre affiliated to Glasgow University and the Institute for Thin Films, Sensors and Imaging affiliated to University West of Scotland with excellent work being conducted in sensor development by Heriot Watt, St Andrews and Strathclyde Universities over the past several years today.

15) Now that Regional Selective Assistance has disappeared (this was a project and jobs related grant for up to 25% of eligible Capital expenditure costs that vanished around 3 years ago), I would recommend the re-instatement of 50:50 matched funding for the UK semiconductor industry.

16) Supporting the UK semiconductor industry is a raft of small Scottish companies. To name a few : Compugraphics masks/reticles, STS and Quantum Clean for equipment cleaning

Written submission from Semefab Ltd (SEM0046)

services, MEMStar - manufacture of process tools, DepTech -sputtering systems, Ichor Systems -Tool maintenance and spares, Busch and Ebara for vacuum pumps, Quartztec, Reel Services - taping and reeling of components, TechSure -water treatment, RF Global and RF Power for RF Power supplies.

17) The Scottish Government should recognise the infrastructure that still exists, and the synergy here and seize it as an opportunity to better support their enabling semiconductor and sensor manufacturing companies and so catalyse growth into other sectors.

18) Without support, the UK semiconductor industry is at the mercy of better Government funded foreign enterprises (unfair competition). Consequences will be closure of operations in some cases and/or sale to foreign owned enterprises. China has set its stall out to become dominant in this sector. Unless there is change, the UK will become dependent on China for next generation enabling semiconductor and sensor devices, thus weakening the resilience and independent capability of a strategic component of the UK economy.

19) The UK has a thriving, world leading, semiconductor and sensor design and product innovation base often associated with its world class Russell Group Universities. This base needs home based manufacturing or we risk giving away our crown jewels to be manufactured off shore.

With that scenario goes independence and loss of control, loss of IP in some cases and the creation of competition from abroad.

19) Semiconductor manufacturing is a high energy use industry. Foreign competition enjoy substantial subsidies in costs beyond RoFIT (Renewable Obligation Feed In Tariff rebate).

Semefab is a 1.5MW continuous consumer of electricity 24/7, costing 10% of Revenue, impacting Gross Margin by 20%. The UK subsidises electricity for specific groups such as the farming community, why not do more for enabling industries like Semiconductor manufacture?

20) The high capital investment needs, cyclic in nature are not well met by IUK funding which is thematic, often not applicable to capital expenditure, and competitive to obtain. It can seem somewhat of a lottery because good proposals take considerable resource to prepare and most are rejected. It is easy to become disillusioned at applying and being constantly rebuffed. This process is only a good use of a company's resource if application is successful.

21) After Brexit, the UK has new degrees of freedom to support manufacturing industries and its semiconductor industry specifically. There is a political priority to level out the country economically. The Regional Selective Assistance map could be revised to do this and mature yet advanced, high capital cost, multi-technology, enabling industries given a higher percentage of capital expenditure support compared to single product or single technology companies serving narrow UK interests. RSA used to be up to 25% support and was job creation /retention related. The Semiconductor Industry needs 50%. The Chips for America Act in 2021 announced \$50Bn of support and incentives. The European Chips Act Euro 15Bn is proceeding during 2022. This BEIS initiative has been long awaited. I look forward to hearing the outcome of the committee's deliberations.

Allan James
Founder and Managing Director
Semefab Ltd

Founded 1986 as entrepreneurial Start-Up

Written submission from Semefab Ltd (SEM0046)

'The UK's only indigenous Semiconductor device manufacturing company'