

# The UK Semiconductor Industry

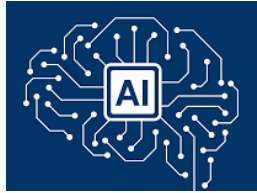
Charles F Sturman, CEO Techworks

June 5<sup>th</sup> 2024

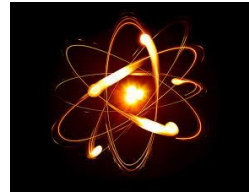
- Future market opportunities
- The UK in a nutshell
- How is UK Gov and Techworks supporting?

# Emerging Deep Tech & Megatrend Drivers

- >> Hyper-connected digitised world • Industry 5.0 • Energy transition (decarbonized, decentralized, democratized)
- >> Future smart mobility • Climate change mitigation • Sustainability • Population growth • Health & wellbeing



AI\*: Generative & LLM /  
ML: Algorithm and embedded



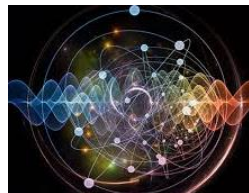
Quantum\*: Computing & Cryptography



Cybersecurity: Identity, Authentication  
& Data security



Biotechnology\*



Photonics: XR, Sensing, Lighting, Solar, Laser (Ind.,  
Med., Cons.), Comm's, Data processing & compute



Robotics: Automation, Human assist  
/ companion, Human-replacement



Future communications\*



e-mobility



Blockchain and DLTs



Semiconductors\*



GreenTech: Sustainability, Renewables and NetZero



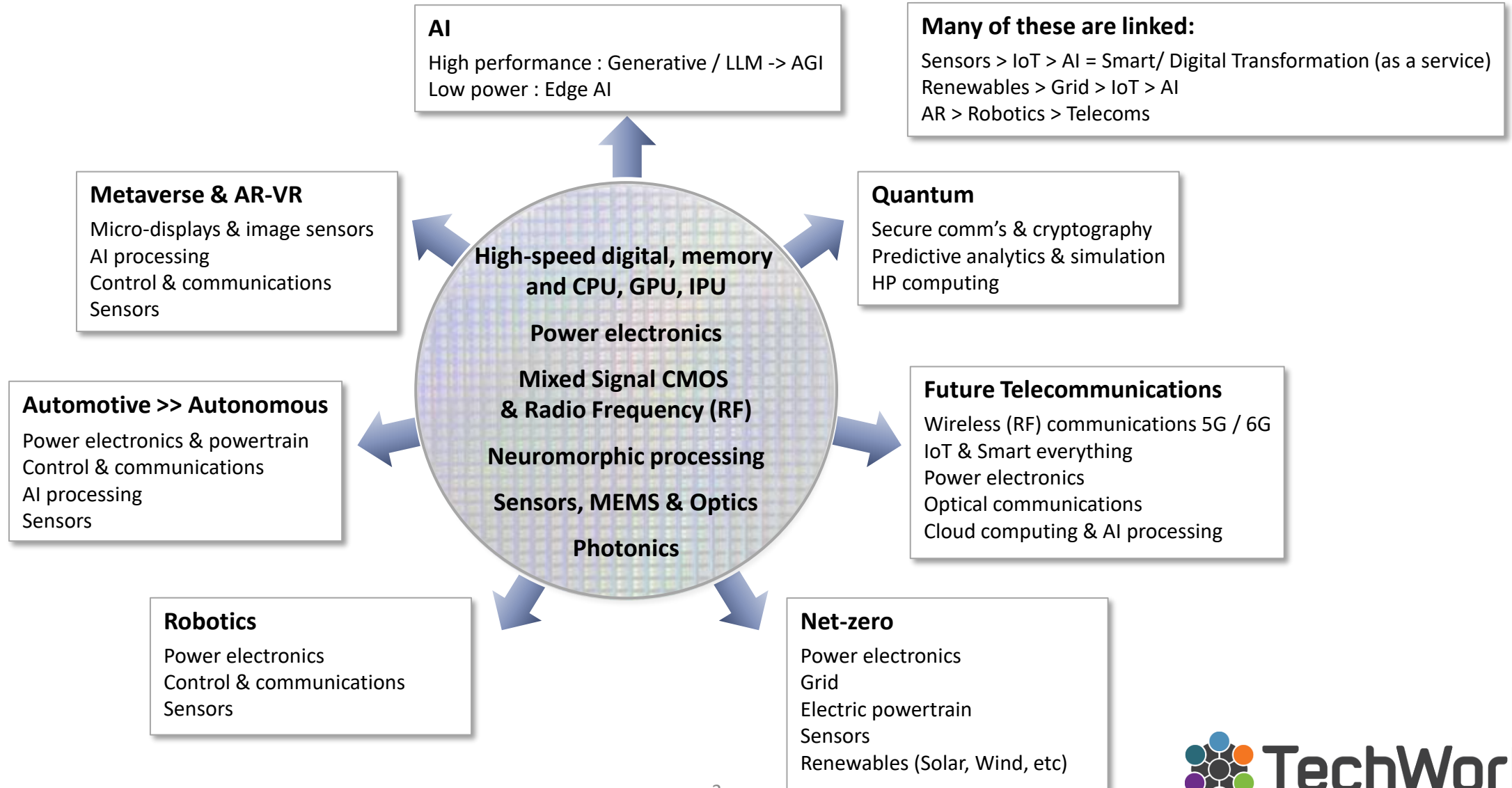
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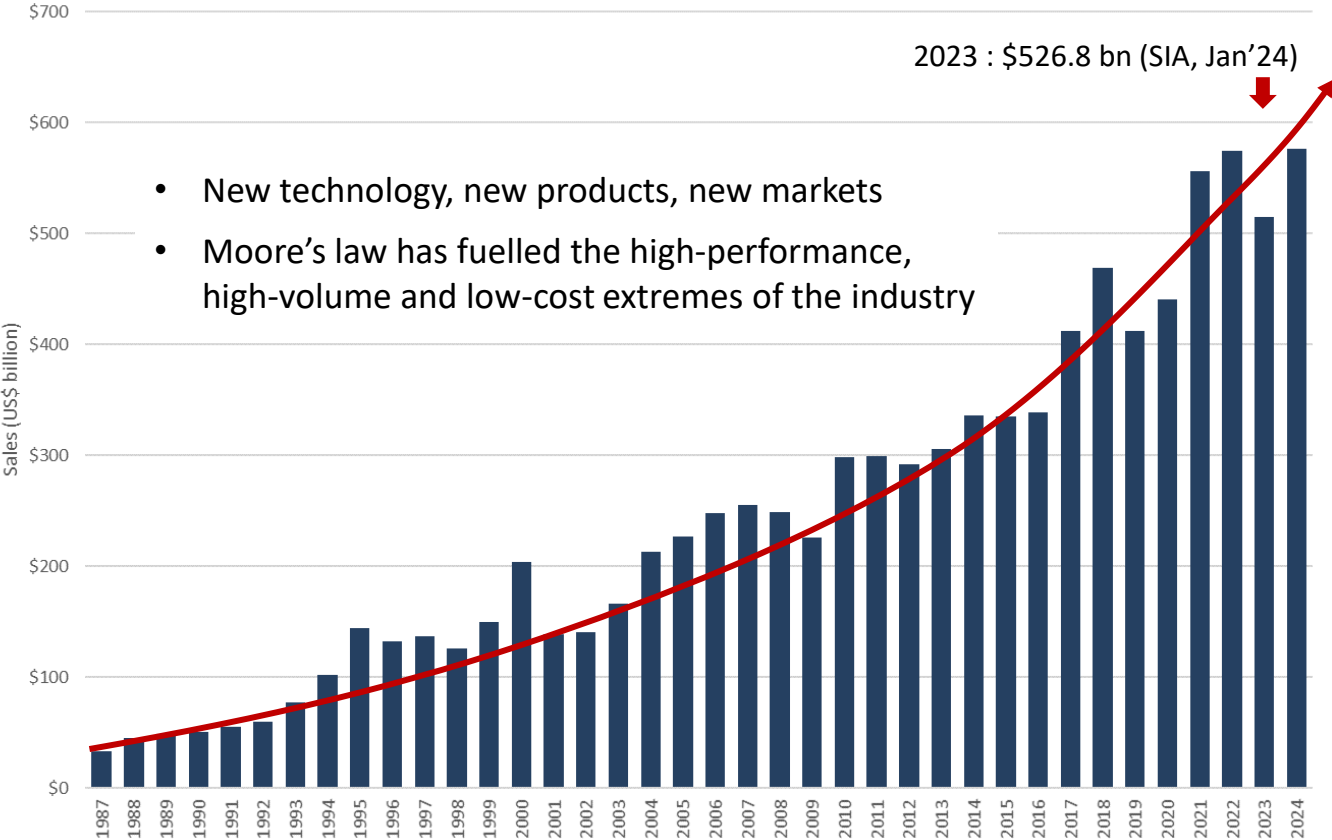


# And they're all enabled by semiconductors

## Semiconductors



# Exponential market growth continues



- New technology, new products, new markets
- Moore’s law has fuelled the high-performance, high-volume and low-cost extremes of the industry

Semiconductor market revenue globally from 1987 to 2024 (in billion USD) - Source: Statista

- Moore’s law is close to retirement !
- So, what next?

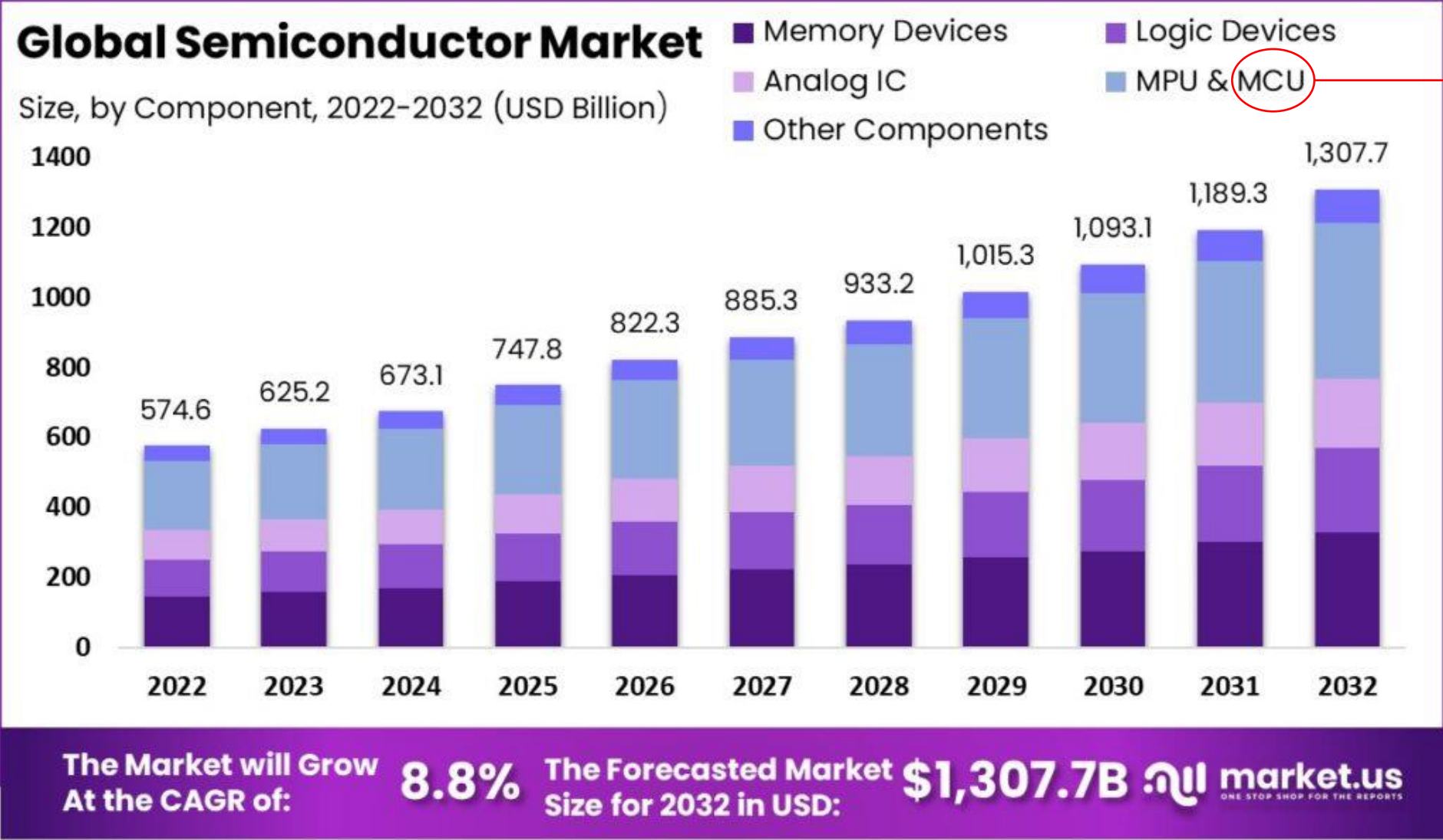
## WSTS Forecast Summary

Fall 2023	Amounts in US\$M			Year on Year Growth in %		
	2022	2023	2024	2022	2023	2024
<b>Americas</b>	141,136	132,536	162,154	16.2	-6.1	22.3
<b>Europe</b>	53,853	57,048	59,480	12.8	5.9	4.3
<b>Japan</b>	48,158	47,209	49,275	10.2	-2.0	4.4
<b>Asia Pacific</b>	330,937	283,333	317,455	-3.5	-14.4	12.0
<b>Total World - \$M</b>	574,084	520,126	588,364	3.3	-9.4	13.1
<b>Discrete Semiconductors</b>	33,993	35,951	37,459	12.0	5.8	4.2
<b>Optoelectronics</b>	43,908	42,583	43,324	1.2	-3.0	1.7
<b>Sensors</b>	21,782	19,417	20,127	13.7	-10.9	3.7
<b>Integrated Circuits</b>	474,402	422,174	487,454	2.5	-11.0	15.5
Analog	88,983	81,051	84,056	20.1	-8.9	3.7
Micro	79,073	76,579	81,937	-1.4	-3.2	7.0
Logic	176,578	174,944	191,693	14.0	-0.9	9.6
Memory	129,767	89,601	129,768	-15.6	-31.0	44.8
<b>Total Products - \$M</b>	574,084	520,126	588,364	3.3	-9.4	13.1

- Extreme high-growth, high-volume segments (e.g. smartphones and data centre) commoditise quickly
  - Margin pressure from OEM’s and OEM consolidation leads to a few, large vendors
- But there is a long and diverse tail of medium to large markets with better value recognition; eg Industrial, Automotive and Medical.
- Emerging markets are a level playing field, for now.



# Market volumes of types of chips

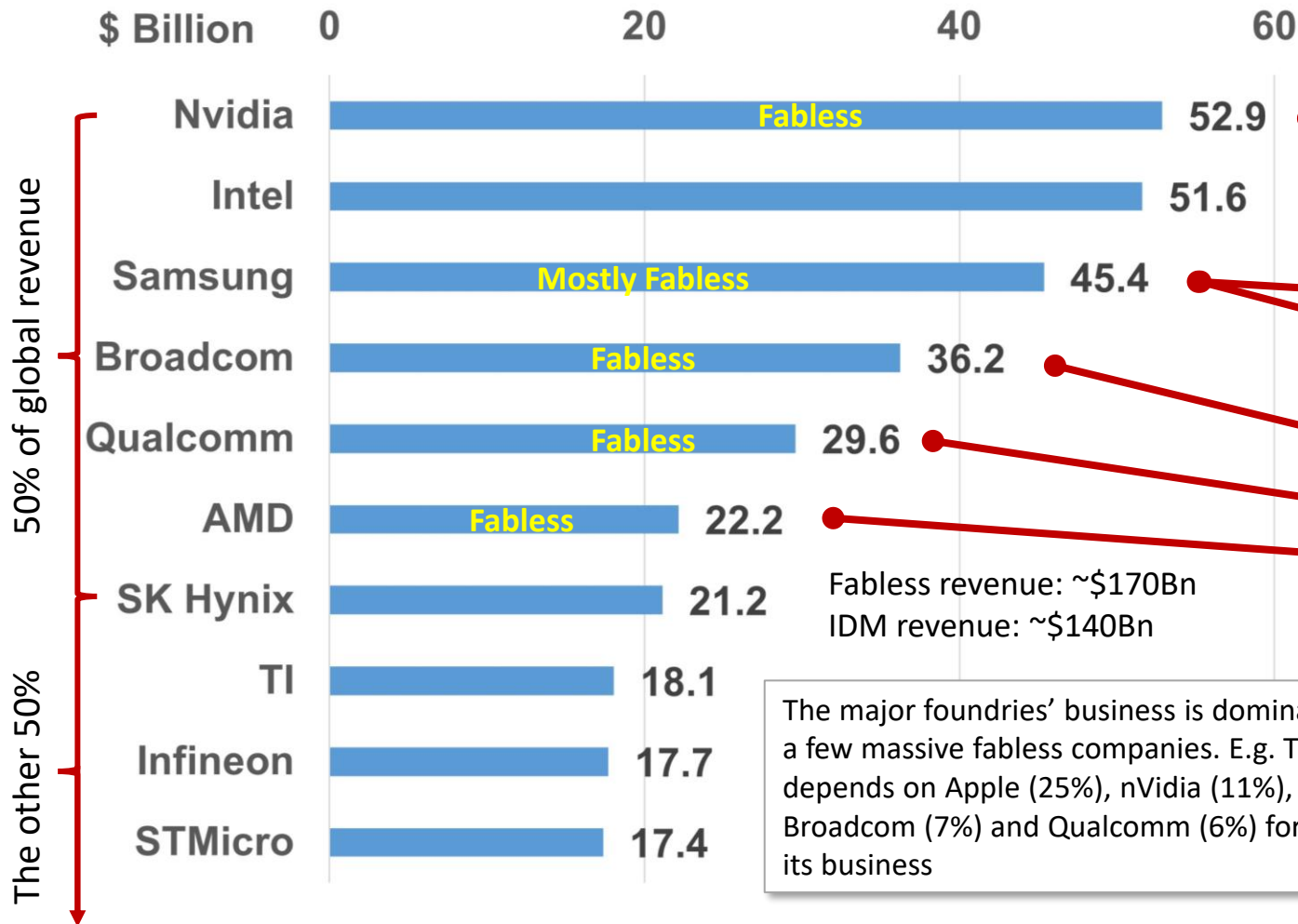


Typically, ASSP SoC's

# Top 10 chip companies by revenue & where the chips come from

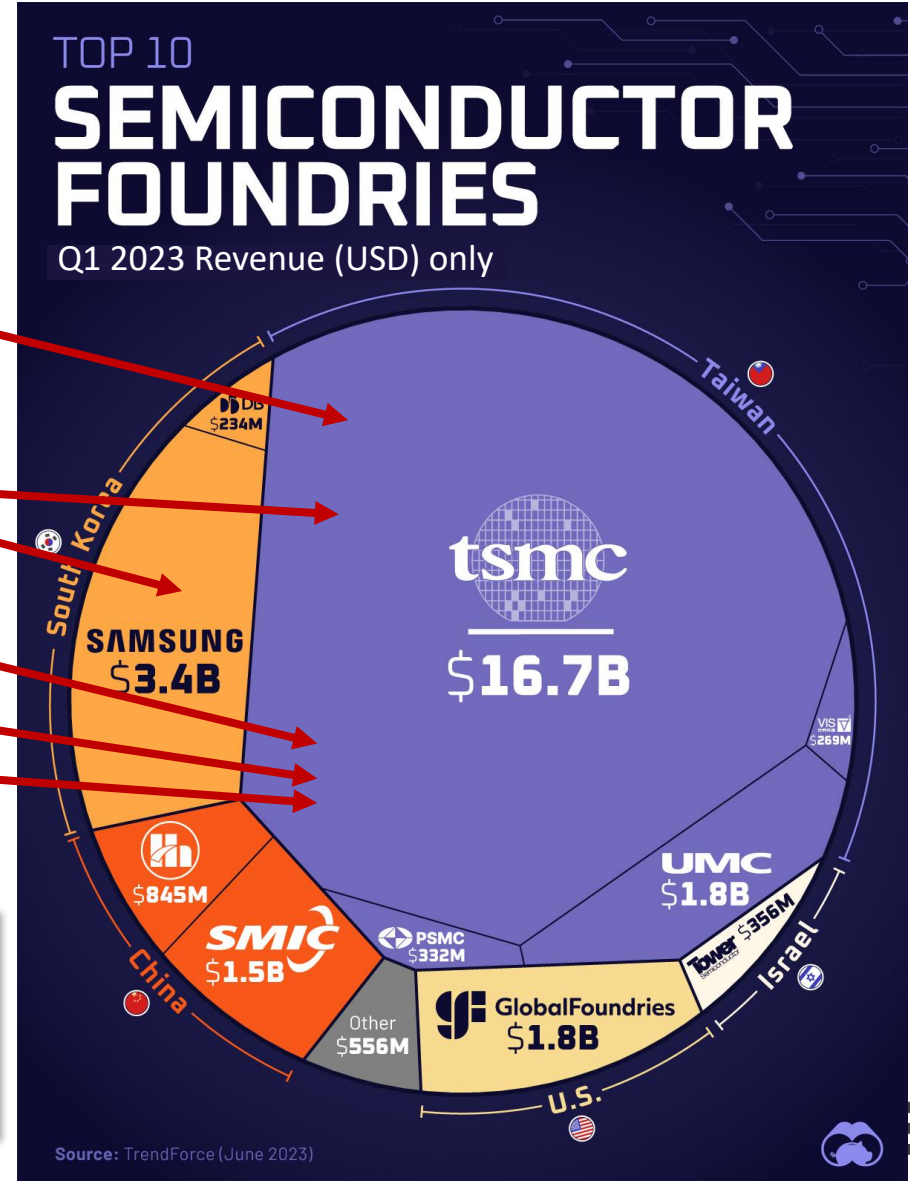
## Top Ten Semiconductor Companies, 2023

Source: Semiconductor Intelligence



Fabless revenue: ~\$170Bn  
IDM revenue: ~\$140Bn

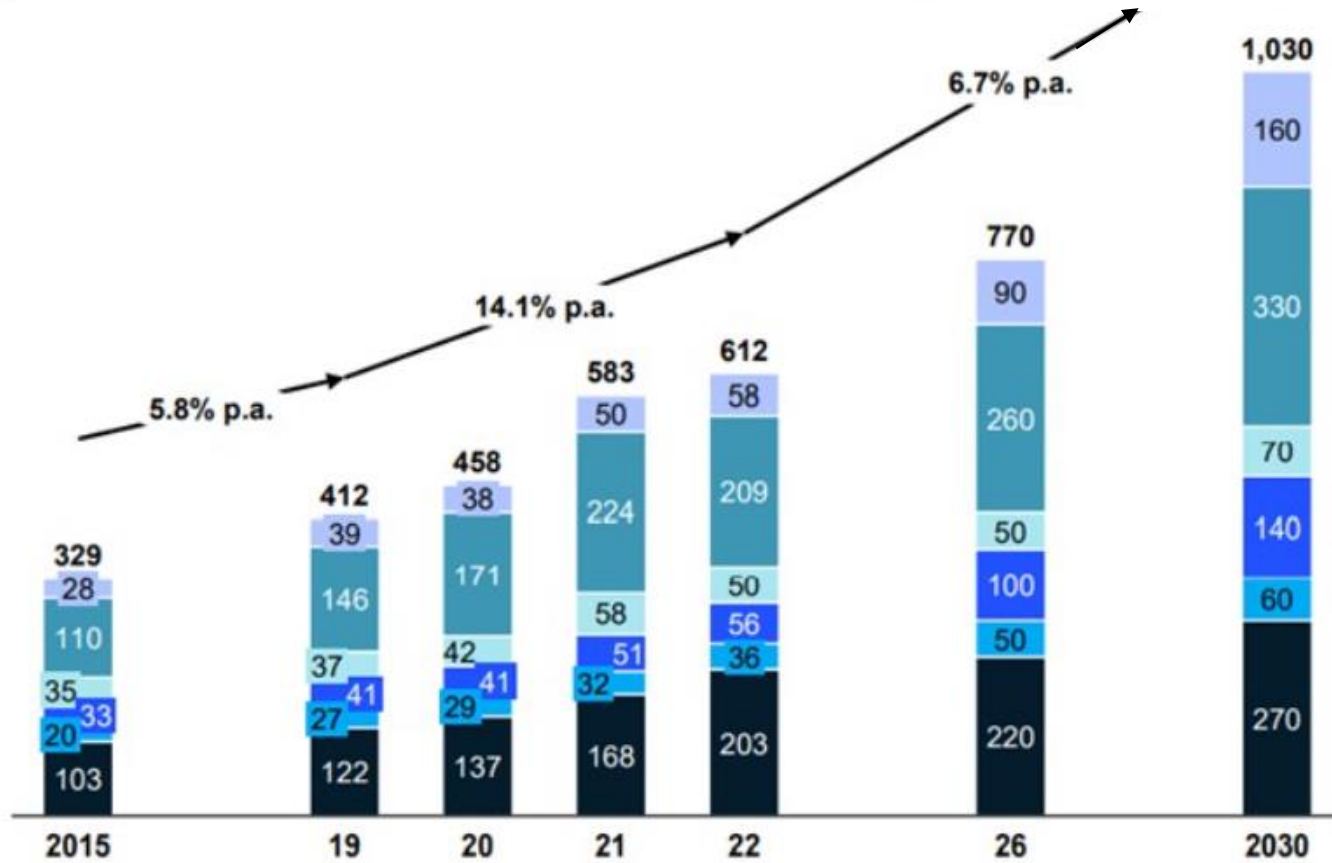
The major foundries' business is dominated by a few massive fabless companies. E.g. TSMC depends on Apple (25%), nVidia (11%), Broadcom (7%) and Qualcomm (6%) for 50% of its business



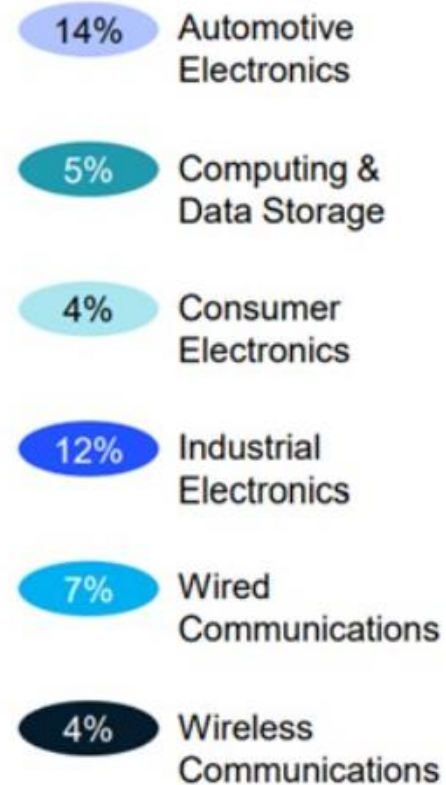


# Global chip end-markets

Global semiconductor demand by end-market<sup>1</sup>, in USD bn



CAGR 2021-30, in %



## Example chip vendors

Automotive Electronics: Infineon, NXP, Renesas, Texas Instruments (TI), ST Micro, Toshiba, Microchip, nVidia, Intel

Computing & Data Storage: Memory (60%): Samsung, SK HYNIX, Micron; Processors (40%): nVidia, Intel, AMD, Google

Consumer Electronics: Qualcomm, Intel, AMD, Samsung, Mediatek, Broadcom, ST Micro, and many more

Industrial Electronics: Infineon, NXP, ST Micro, Renesas, Broadcom, Microchip, and many more

Wired Communications: Broadcom, Microchip, TI, Infineon, Intel

Wireless Communications: 1.2Bn smartphones per year (30% MediaTek / 30% Qualcomm / 25% Apple / 15% others)

Other: WiFi, Bluetooth, etc: Qualcomm, TI, SiLabs, Microchip, NXP, ST Micro Nordic

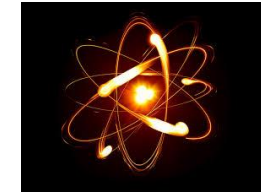
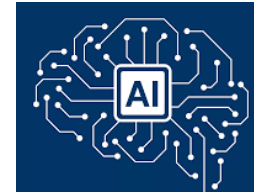
Source: McKinsey, 3Q2022

Automotive, Industrial and non-consumer Communications & Computing are strong growth sectors worth ~ 50% of the total!

# New semiconductor growth opportunities

So, there is plenty of business to go after !

- Novel AI / ML compute engines & in-memory compute
- Distributed compute / computing continuum
- Quantum & Optical compute
- Quantum Cryptography
- Sensing, MEMs, LiDAR, Sensor processing, Edge intelligence
- Biotech sensors, On-chip assays
- Short, medium and long-range wireless, Telecom's, On-chip & Inter-chip optical interconnect
- IoT (everything connected), Cybersecurity
- Micro-displays, Image sensors, Optical sensors, Solar, Lasers
- Power electronics
- Navigation





# UK Semiconductors Today

UK Chip Fabs: ~27

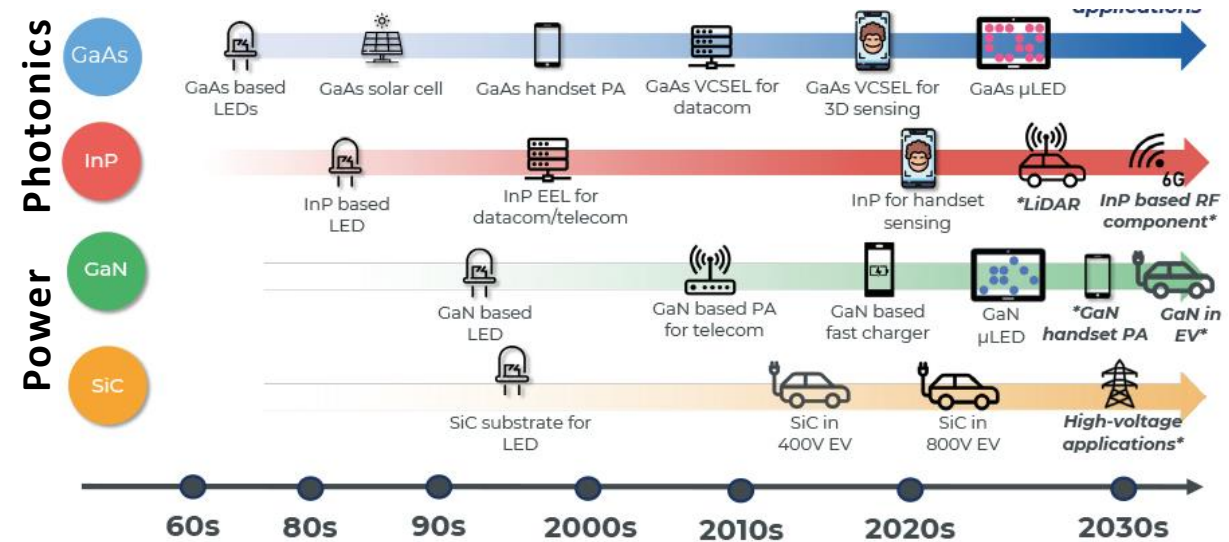
MEMS, Sensors, Photonics, Mixed Signal MOS, MOSFET, Power devices (Diodes & MOSFETs), SiC, RF & MMIC

UK Design co's: ~160

Above, plus digital / mixed signal ASSP (Telecom's, Consumer, Auto, IoT), CPU, GPU, AI, Neuromorphic, Novel memory

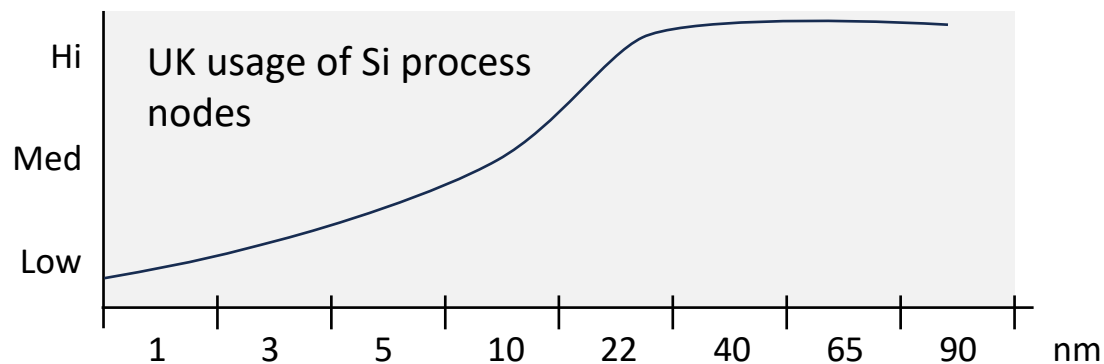
UK Packaging co's: ~10

RF, Power, Mixed signal, 2D Wirebond



CS semiconductor markets 1960-2030, (Yole Intelligence, Jan'24)

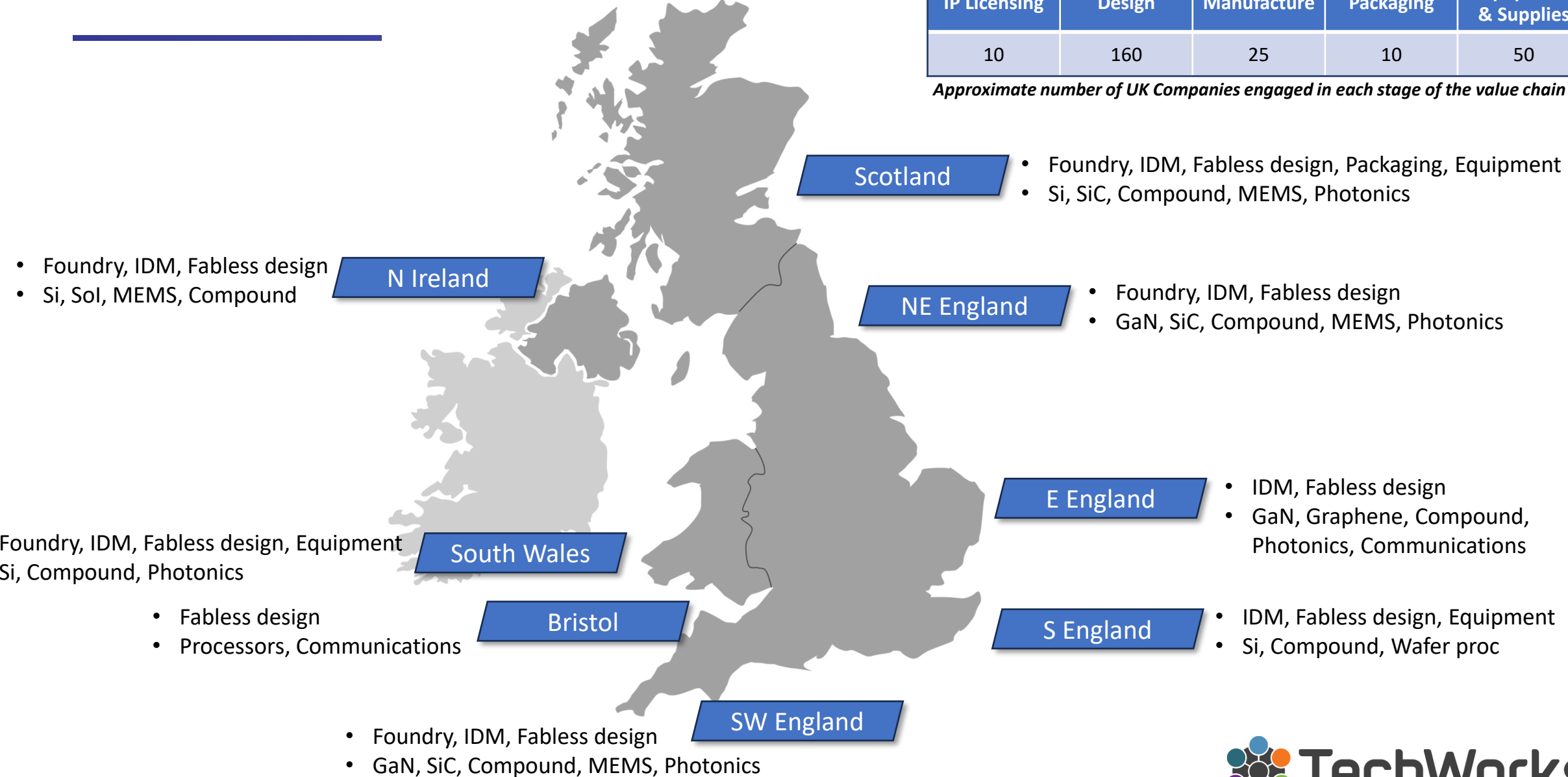
- The UK has a rich design activity, a full range of CS fab capability and a capable Silicon MEMs, Photonics and discrete fab capability.
- We need to invest in what we have and add the missing pieces of the puzzle to compete globally



# UK Semiconductor Clusters

IP Licensing	Design	Manufacture	Packaging	Equipment & Supplies
10	160	25	10	50

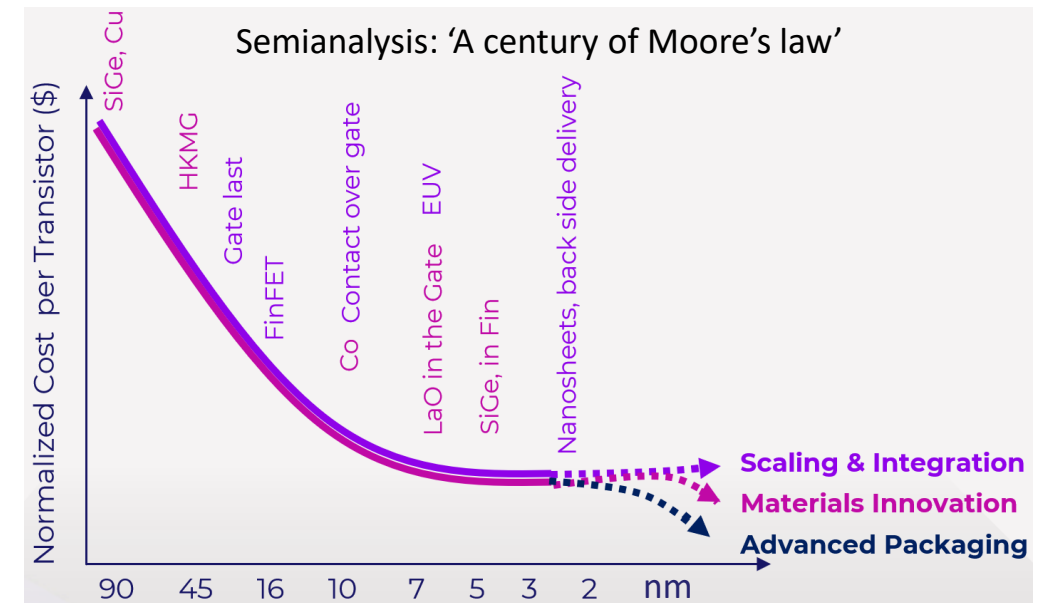
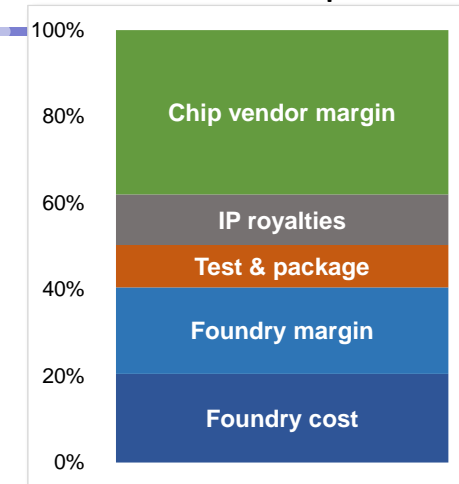
*Approximate number of UK Companies engaged in each stage of the value chain*



# The UK opportunity

- Innovation, IP, Design AND Manufacture .....
- Silicon is not going away, it's just taking a left turn!
  - MEMs, Mixed signal, Power
  - Passive photonics, 3D interposers
- New CS materials: Diamond, Chalcogenides, Q-dots, Superlattices, Ga<sub>2</sub>O<sub>3</sub>, Cubic SiC, Perovskites, LiNbO<sub>3</sub>, Metamaterials, Doped Graphene, etc, etc
- Photonics
  - Both CS (active) and Si (passive)
- Power
- Compute
- 3D integration & Chiplets
  - **Bringing it all together**
- Enabling exciting new markets in .....
- Not phones & laptops !

Value in the chip





# The challenge

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- Build-up and strengthen the UK ecosystem
  - Shared innovation, Long term understanding and trust, New business incubation, Attraction of people, skills and recycling across multiple ventures, Small, medium and large enterprises, M&A & Increased investment faith
- Need long term investment & strategy
  - Commitment from government & Industry partnership
- Capex to support scale up: Though matched funding, tax incentives, ....
- Build domestic demand to grow our own supply chains (cf US, EU, China)
- Access to skills at all levels: Technician to PhD; Design, fab, test; UK organic and immigration
- Investment across the whole industry
  - Not just seed and not just design. Need A, B, C, D; True patient capital, with a keen interest in the sector
- International trade
  - Reduce friction; Speed up export licensing; Pragmatic export controls
- International partnerships
  - Build win-win relationships which benefit UK business
- Promote the sector to attract skills, investment and public support (value, excitement, future societal impact)

# So what has happened since the UK strategy?

- DSIT Team
  - Domestic: Industry & Innovation, Policy, Strategy and Finance, Resilience and Skills
  - International: International trade and Policy, Security
- Oct '23: ChipStart launched to boost UK semico design startups
  - 2-year pilot incubator for start-ups / spin-outs providing technical and business support to bring new products to market. Two cohort (9 month) programme delivered by SiliconCatalyst UK. Access to chip design tools, commercial expertise, specialised mentorship, and connections to investors and partners.
- Nov'23: UKIB's £22bn funding mission clarified to add Semiconductor Manufacturing alongside NetZero and Levelling Up. First beneficiary was Pragmatic.
- Feb'24: EPSRC invested £22 million in two new Innovation and Knowledge Centres at Bristol and Southampton to boost innovation and commercialisation in high voltage electronics and silicon photonics
- Mar'24: UK gained access to Horizon Europe's €1.3 billion Chips Joint Undertaking
- May'24: UK Semiconductor institute announced with independence from government to bring together government, universities and industry to support the government's Semiconductor Strategy and provide a single point of contact to promote the sector to investors and overseas entities looking to invest in the UK.
- Trade discussions & missions



Department for  
Science, Innovation  
& Technology



# UK Semiconductor Infrastructure Initiative

- Following the Gov strategy published in May'23 the IFM Engage report commissioned by DSIT (Mar-Dec 2023) aimed to understand the technical and economic feasibility of developing specific capabilities to support commercial R&D, grow the UK semiconductor sector and contribute to supply chain resilience.
- Four intervention areas were studied:
  - **WP1:** Moderate node silicon manufacturing capability to support start-up/SME prototyping, initial pilot volume, ASIC capability and Si/CMOS Process innovation
  - **WP2:** Advanced packaging capability to bridge the gap between current capability and next generation chip-to-chip 2.5 & 3D heterogenous integration.
  - **WP3:** Compound open-access foundry capability to scale UK strengths in CS through volume manufacture
  - **WP4:** Design IP/tooling to reduce barrier to entry faced by early-stage design businesses or larger companies with a desire to create custom ASICs due to the high cost of EDA tools, availability of IP and availability of skilled designers.
  - **WP5:** A strategic coordination capability to provide an institutional framework around the components.
- This report continues to feed into government planning





# What is Techworks doing?

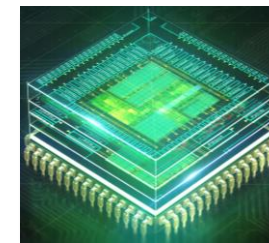
## New Techworks SiGs

- Engineering trustworthy AI
  - Building frameworks and methodologies for certifiable safe and trustworthy AI systems
- Power Electronics UK
  - EV powertrain plus NetZero, Renewables: Chips, Modules & System perspective: Use-cases

## NMI WGs under discussion

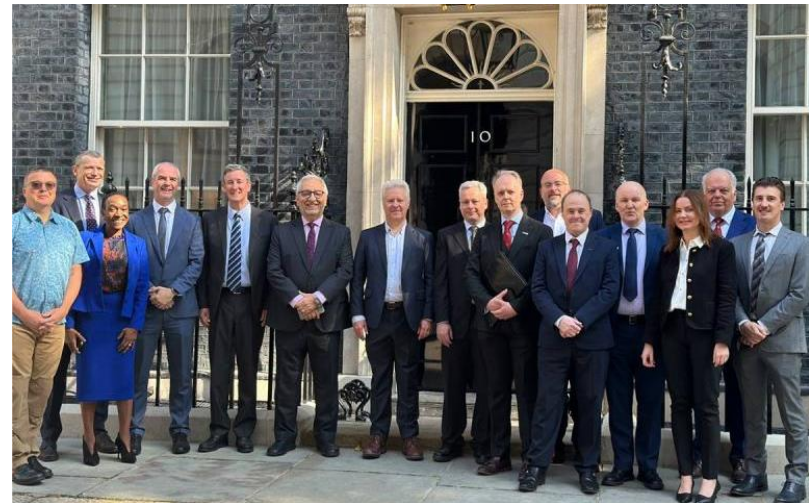
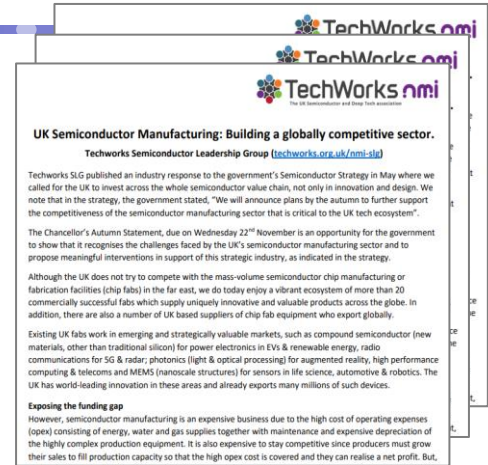
- Advanced Packaging
  - 2.5D & 3D Heterogenous packaging, Chiplets and system integration
- New materials and processing
- Photonics

## International partnerships

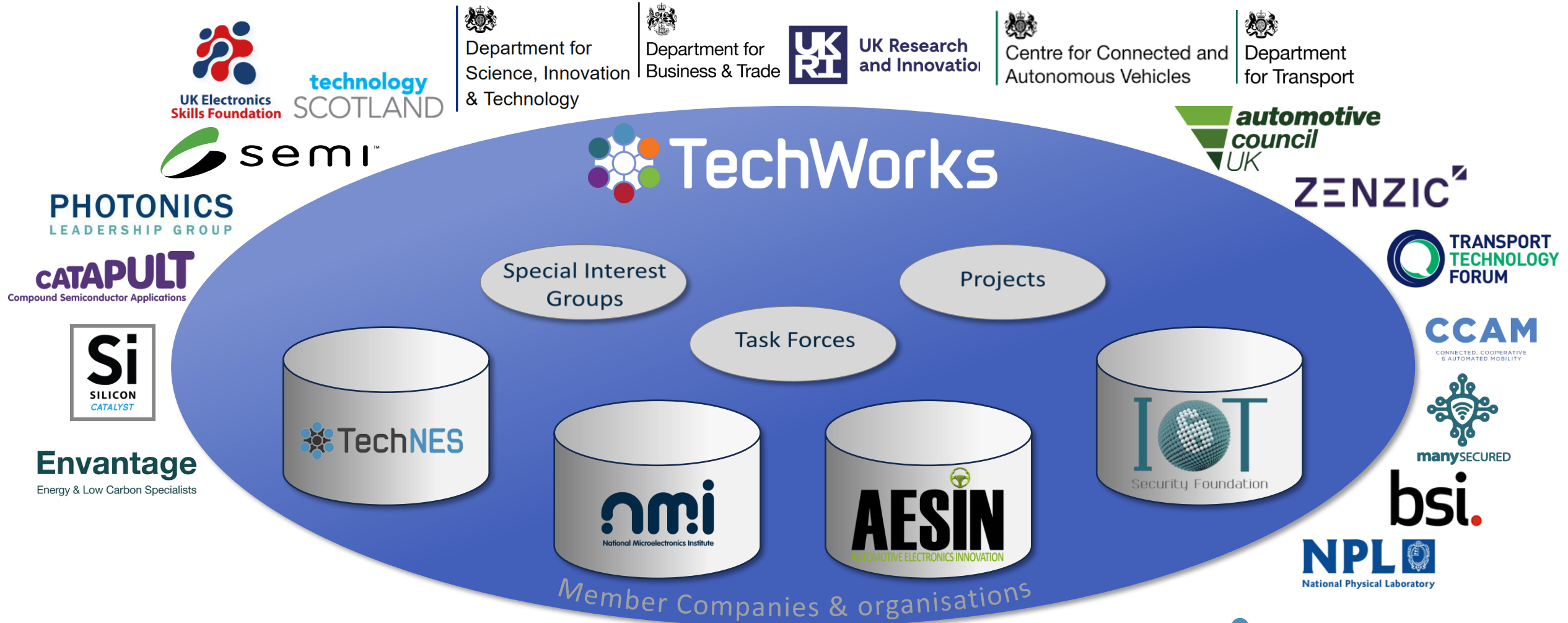


# Gov Advocacy & Techworks SLG

- The Semiconductor Leadership Group is an informal representative group of UK industry participants from the whole value chain: IP, design, IDM, foundry and equipment supply.
- The aim is to provide a unified and balanced industry voice to UK Government and other stakeholders.
- This also supports Techworks' ongoing sector advocacy.



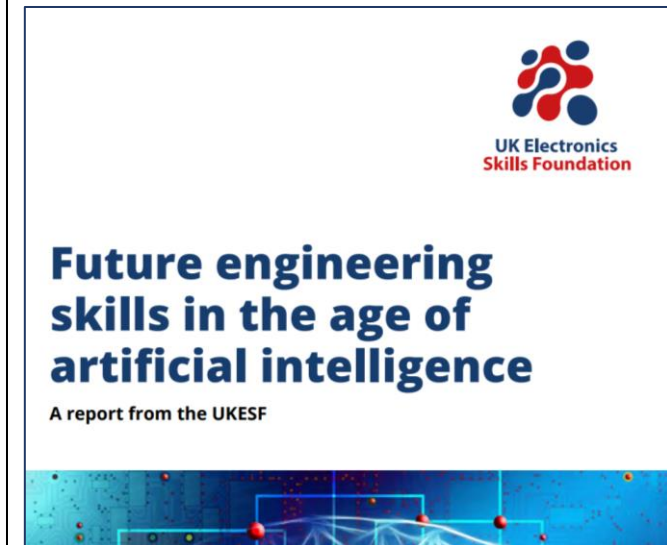
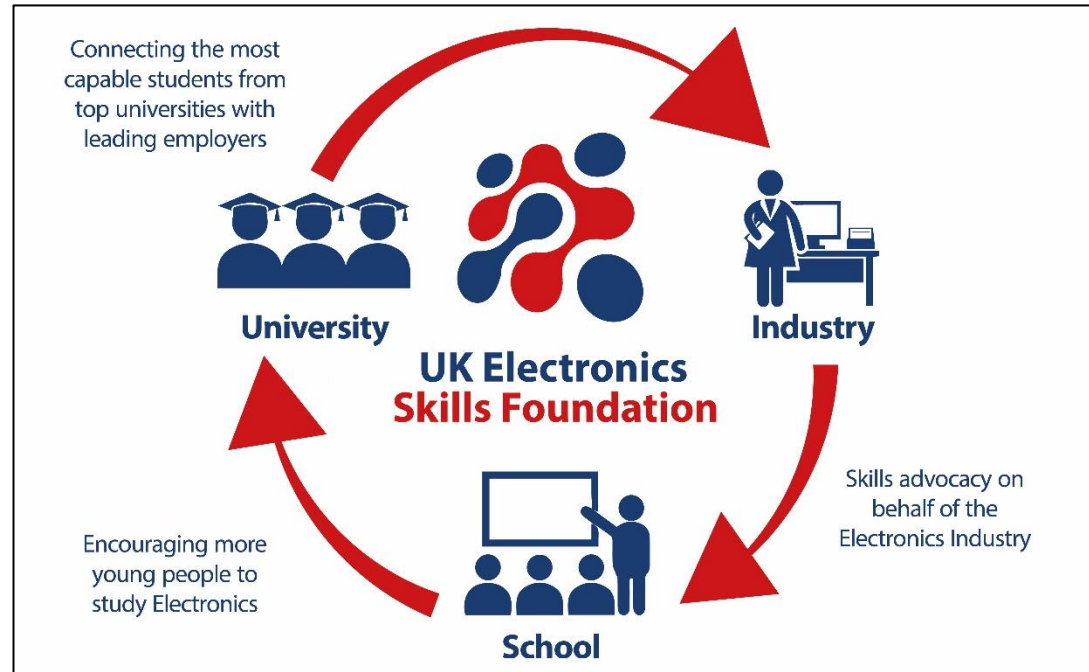
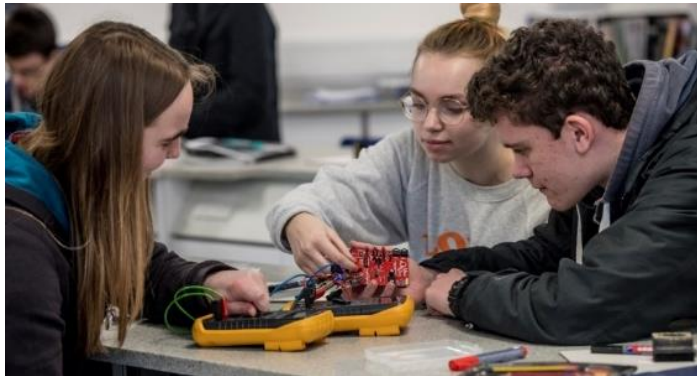
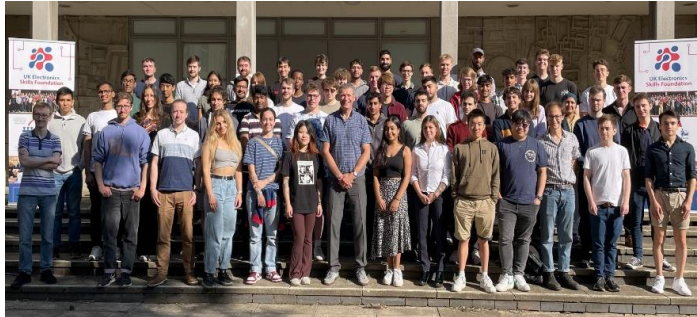
# The Techworks ecosystem







# Tackling the Skills Challenge in the UK's Electronics Industry



Founded in 2010, the UKESF is the only STEM organisation in the UK solely focused on Electronics. We are a charity, and our purpose is to promote Electronics and semiconductors to young people and to encourage them to pursue study and careers in the industry.

# Tackling the Skills Challenge in the UK's Electronics Industry

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- Schools Engagement & Outreach
  - Provided over 700 secondary schools with resources for teaching Electronics in Physics and Computer Science.
  - ED&I - Over 400 girls (aged 15-18) participated in “Girls into Electronics” events in 2023.
  - Recently obtained a grant from Innovate UK to deliver a programme for 40 schools in Wales to promote EEE.
- Support for Industry
  - Advocacy & Steering groups: Influencing UK Gov policies in Electronics and semiconductor skills, education & training.
  - Development of (degree) apprenticeship standards the Electronics sector: enabling work-based training programmes.
  - Graduate/research programmes with Academia and Industry to tackle specific skills and education gaps. Current focus: Chip design & Design Verification
  - Skills studies, consultations and surveys. Current focus: Technician skills
- Fab technician skills
  - UKESF is working with Paragraf as part of an InnovateUK project for manufacturing scale-up. The aim is to understand current gaps in technician training and develop a proof-of-concept programme. Ultimately, this will lead to some national occupational standards and thereafter new apprenticeship standards

# Major Network Events 2024



Semiconductor Manufacturing  
5th June - Liverpool

Annual industry networking and  
thought leadership events



Annual Awards & Dinner  
4th December - London



Automotive Electronics  
11th July - Gaydon



IoT Cybersecurity  
23rd October - London



Embedded System Design  
4Q 2024 venue tbc



# Empowering Deep Tech Innovation in the UK

Thankyou

[techworks.org.uk](https://techworks.org.uk)