



Welsh Economy  
Research Unit

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Yr Uned Ymchwil  
i Economi Cymru

CSconnected

**Annual Report: Compound Semiconductor Cluster in South  
Wales Draft**

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# Summary

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## *Introduction*

This report considers the economic activity supported in Wales by the cluster of firms and institutions that form part of CSconnected activity funded by the *Strength in Places Fund*. This report estimates the economic activity supported by the CS cluster in 2023 and includes contextual information through which to better understand the economic contribution of the cluster.

## *Context*

Whilst the Covid-19 pandemic had short term implications for global supply and demand of semiconductors, other factors, such as geopolitical developments, have had longer term consequences. The 2023 year was overwhelmingly conditioned by the August 2022 U.S. CHIPS and Science Act and resulting responses in the semiconductor global marketplace. Governments in Asia, Europe, and the Americas responded to the US initiative with their own 'versions' of the CHIPS Act, or other initiatives designed to shore up domestic semiconductor industries.

The UK government's national semiconductor strategy (published in May 2023) intends to offer British chip companies just £1bn over the next decade, focusing on existing areas such as chip design, as part of a 20-year plan.

The semiconductor market in the UK was valued at £1.8 billion in 2022, and its share of the global market is just 0.5%. The global semiconductor market is expected to experience 11.9% growth during 2024. The global semiconductor market size was valued at US\$592 billion in 2022 and is expected to reach around US\$1,884 billion by 2032. Global growth factors include: the extensive usage of semiconductors in a wide range of end use applications; the rising penetration of digital technologies and rising adoption of various consumer electronics; growing popularity of the latest technologies such as AI and the Internet of Things; significant increase in the work-from-home trend fostering the demand for PCs and laptops; rapid urbanization in the developing world; demand for semiconductors in the industrial equipment and automotive sector; and the growing demand for integrated circuits in developing nations as a result of smartphone demand.

## *Economic conditions*

UK economic data suggest that 2023 has been a challenging year for manufacturing activity, with confidence only slowly improving. In both Wales and the UK indices of production output remain around 5-6% below pre-Covid levels. Manufacturing employment in Wales in June 2023 is estimated to have been around 138,000 people, this being close to the 2020 level. Adding to problems have been uncertainties caused by high inflation and interest rates.

## *CS cluster activity in Wales*

Between 2021 and 2022 there was an 8.4% increase in CS cluster employment. The 2023 analysis estimates employment at 1,773 (an estimated 2% increase on 2022).

The analysis continues to support the conclusion that the CS cluster is characterised by relatively high levels of productivity. For example, data obtained from the most recent company accounts of cluster participants suggested that:

- Average sales per employee in the examined cluster firms was around £321,500 in 2022-2023.

- The weighted average sales per employee (allowing for the different levels of employment in firms) was higher at an estimated £377,300 in 2022-23.

The analysis of survey returns for 2023 suggested:

- Average salaries in the cluster are around £61,000 and with a range of £46,700 to £74,800.
- The earnings reflect high levels of skills being employed. For example, in 2023 the percentage of staff engaged in R&D activity in different parts of the cluster ranged from 6% to 100%. It is estimated that 35% of CS cluster employees are directly engaged in R&D activity.

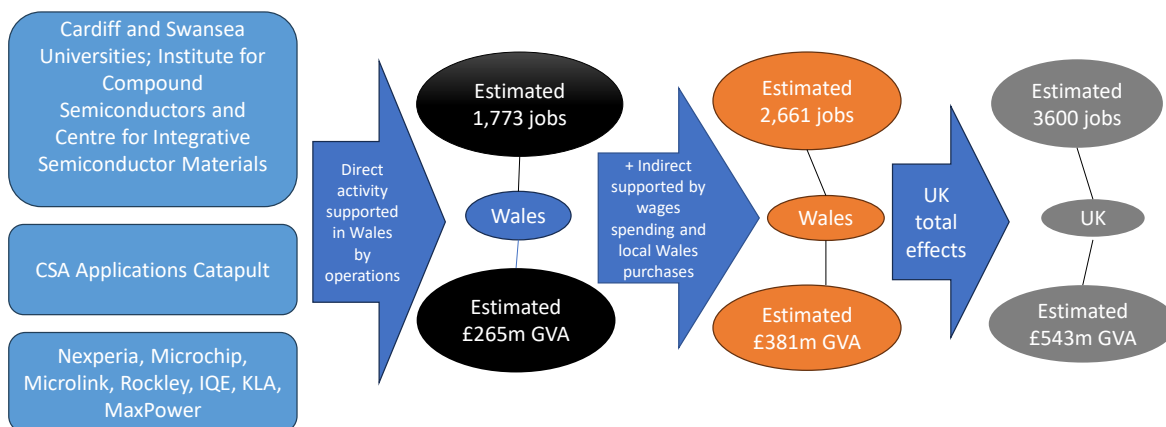
The analysis of the CS cluster for 2023 reveals that estimated GVA directly supported is £265m or around £150,000 per employee. The value of total exports from the cluster in 2023 are conservatively estimated to be in the order of £514m.

### CS cluster economic impact

The analysis in this report estimates that total manufacturing GVA in Wales in 2023 was £12.6bn and that the CS cluster contributes around 2.1% of the total.

CS cluster members directly support around £265.2m of Welsh GVA and 1,773 employees. Each £1m of GVA directly generated in the CS cluster supports an additional £0.44m of GVA elsewhere in the Welsh economy. Overall, this results in the cluster supporting directly and indirectly an estimated £381.3m of Welsh GVA. This is round 26% higher than the estimate for 2022 (£303m).

### CS Cluster Impact Summary



Every job in the cluster is connected to an estimated 0.5 of an employment elsewhere in the Welsh economy. In total, therefore, the cluster in 2023 could be associated with as many as 2,661 jobs in Wales.

The analysis also reveals that the CS cluster in Wales:

- Supports a total of £543m of gross value added in the UK economy.
- That every £1m directly supported by the CS cluster in Wales supports a further £1.05m of GVA in the wider UK economy.

Based on the current known investment intentions of CS cluster organisations, it is expected that the employment out-turn in terms of direct and indirect jobs supported in Wales will reach 4,000+ by 2025.

The level of, and targeting of, resources focused on the semiconductor sector in the UK case has not matched the intent shown in competing international locations. There is a very real concern that the level of interventions in other states might impact future investment into Wales by the CS cluster companies.

# 1. Introduction

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This report is the annual update which considers the economic activity supported in Wales by the cluster of firms and institutions that form part of CSconnected activity funded by the *Strength in Places Fund*, which is managed by UK Research and Innovation (UKRI). The consortium consists of partners including: Cardiff University (lead), Swansea University (Centre for Integrative Semiconductor Materials), Rockley Photonics, IQE, KLA, Microchip, Microlink Devices, the Compound Semiconductor Centre, the Compound Semiconductor Applications Catapult, the Cardiff Capital Region (CCR) City Deal, and Welsh Government.

An important element of the CSconnected activity is to explore the changing economic contribution of the CS cluster in Wales over time, and particularly the way in which the activities of the firms and institutions supported by the UKRI funding contribute in terms of meeting place-based needs in the Welsh economy.

This report estimates the economic activity supported by the CS cluster in 2023 and includes contextual information through which to better understand the economic contribution of the cluster.

Various data have been used to develop this report. During each year of the UKRI funded research it has been possible to send out a survey questionnaire to cluster members. This survey was sent out during October 2023 and was used to collect information in respect of the output, employment, wages and salaries, expenditure and exports of the private sector elements of the cluster and the independent research entities. The information gleaned from this survey allows the analysis of the amount of employment and output supported by the cluster and allows an analysis in terms of the comparative economic significance of the sector. The survey also collects data in respect of the spending patterns of cluster members in the Welsh economy. This helps the research team to estimate the indirect impacts of the cluster on the Welsh economy (see below).

In developing the annual report series, published company accounts data from the Bureau van Dijk FAME database are also used, with this providing additional insights into the spending and performance of the cluster firms. Finally, extensive use is made of published statistics from organisations such as the Office for National Statistics. This is largely in terms of regional economic data in respect of industry employment and gross value added (GVA).

This report presents estimates of the Welsh economic activity supported by the CS cluster. It is important to stress that this is an estimate up to the final quarter of the 2023 calendar year, as the companies involved in the cluster have different financial reporting year end dates. In addition, the analytical process requires assumptions to be made about the GVA directly and indirectly supported by CS cluster operations.

Part of the analysis comprises an economic modelling exercise to examine how the CS cluster supports activities in other parts of the Welsh economy. While this is a modelled assessment, part of the research work that commenced during 2023 is investigating the actual supply chain linkages of cluster members have with other firms in Wales and parts of England.

The annual review of economic activity supported by the cluster also serves to inform a series of KPIs for the UKRI funded Strength in Places CSconnected project. These KPIs include:

- KPI 1 Direct employment in core cluster firms and new inward investors.

- KPI 2 Exports of cluster firms.
- KPI 4 Total GVA supported by cluster activity directly and indirectly.

The next section provides an update on the international semiconductor context surrounding cluster development in 2023. The third section reviews the UK and regional economic context surrounding the cluster. The fourth section focuses on the economic contribution of the CS cluster in Wales, with the fifth section considering the wider economic impact of the cluster on the Welsh economy. The final section provides some conclusions. In particular, this report considers the needs of the cluster and its challenges. The expected development of CS cluster activity in Wales in 2024 is also outlined, together with the activity being carried out by the research and evaluation team during 2024-25.

## 2. Global semiconductor industry conditions

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### 2.1. Introduction

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The goods and services provided by private sector elements of the compound semiconductor cluster in Wales are largely exported, which may then return to the UK as key components in other consumer and industry products. For this reason, global progress in the semiconductor sector and trends in industry confidence affect output levels in Welsh operations and trade prospects. This section of the report focuses on the wider economic context surrounding the operations of the CS cluster firms in Wales.

### 2.2. International economic context for CS cluster activity

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*Geopolitical tensions continue to impact of global semiconductor markets.*

Whilst the Covid-19 pandemic had short term implications for the global supply and demand of semiconductors, other factors such as geopolitical developments have had longer term consequences. The 2023 year was overwhelmingly conditioned by the August 2022 U.S. CHIPS and Science Act and resulting responses in the semiconductor global marketplace. The semiconductor sector in the US accounted for US\$62.1 billion of exports in 2022<sup>1</sup>, and has become a key economic priority for the Biden administration. The geopolitical relationships between the US and China have been a particularly important dynamic in the resulting global tensions that have been, in part, fuelled by the CHIPS Act.

Since the enactment of the Act, the US Commerce Department has been issuing guidance that seeks to restrict expansions of semiconductor manufacturing in ‘countries of concern’, as well as engagement with ‘entities of concern’ over joint research and technology licensing<sup>2</sup>. Controls have, in particular, been placed on the sale of chips to China, but other countries such as Russia and Iran have been added to the list. Moreover, whereas the CHIPS Act has established a 25% advanced manufacturing investment tax credit, it has also introduced provisions to recapture such credits from companies that subsequently make investments or expansions in China.<sup>3</sup> In addition to the tax credit, the package of financial support is reported to amount to US\$39 billion of incentives for companies to invest in semiconductor projects in the US and US\$13 billion to support semiconductor research and development.<sup>4</sup>

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<sup>1</sup> Semiconductor Industry Association (2023) *State of the US Semiconductor Industry*. P. 23. Accessed November 2023: [https://www.semiconductors.org/wp-content/uploads/2023/07/SIA\\_State-of-Industry-Report\\_2023\\_Final\\_072723.pdf](https://www.semiconductors.org/wp-content/uploads/2023/07/SIA_State-of-Industry-Report_2023_Final_072723.pdf)

<sup>2</sup> Nikkei Asia (6.11.23) *China faces new U.S. chip rules: 5 things to know*. Accessed November 2023: [https://asia.nikkei.com/Business/Technology/China-faces-new-U.S.-chip-rules-5-things-to-know?utm\\_campaign=GL\\_techAsia&utm\\_medium=email&utm\\_source=NA\\_newsletter&utm\\_content=article\\_link&del\\_type=5&pub\\_date=20231109150000&seq\\_num=4&si=MERGE\\_user\\_id\\_MERGE](https://asia.nikkei.com/Business/Technology/China-faces-new-U.S.-chip-rules-5-things-to-know?utm_campaign=GL_techAsia&utm_medium=email&utm_source=NA_newsletter&utm_content=article_link&del_type=5&pub_date=20231109150000&seq_num=4&si=MERGE_user_id_MERGE)

<sup>3</sup> Ibid. P. 6.

<sup>4</sup> SIA (2023) *CHIPS Science Act Fact Sheet*. Accessed November 2023: <https://www.semiconductors.org/wp-content/uploads/2023/08/CHIPS-Science-Act-Fact-Sheet.pdf>



Governments in Asia, Europe, and the Americas have responded to the US initiative with their own ‘versions’ of the CHIPS Act or other initiatives designed to shore up domestic semiconductor industries. China has responded by restricting exports of key semiconductor materials such as gallium and germanium.<sup>5</sup> However US ‘allies’ have raised concerns about the protectionist direction of travel in the wake of the CHIPS Act.<sup>6</sup> The semiconductor industry in Wales is unlikely to be immune to such protectionist pressures.

Another supply side problem has been the risk posed by the concentration of semiconductor making capacity in Taiwan. Indeed, several members of the compound semiconductor cluster in Wales have manufacturing and/or sales activities in Taiwan. It has been estimated that if Taiwan were to lose its ability to supply chips around the world it would take three to four years for alternative supplies to be produced in the rest of the world.<sup>7</sup> Russia’s invasion of Ukraine has also been a significant geopolitical factor that has affected the supply of the rare earth metals needed by the semiconductor industry. Ukraine supplies around 70% of the world’s neon gas, whilst Russia exports around 40% of the world’s supply of palladium, both of which are used in the production of semiconductors.<sup>8</sup> Concerns about the fragility of supply have contributed, along with domestic initiatives to bolster economies, to the growing trend to strengthen semiconductor supply chains and to repatriate or diversify<sup>9</sup> the location of manufacturing facilities.

Ever-present fears of China’s stance toward Taiwan notwithstanding, in January the Taiwanese government passed amendments to its Statute for Industrial Innovation, which offers 25% tax reductions for research and development and 5% for new equipment purchases.<sup>10</sup> This has not, however, prevented Taiwanese firms from making investments elsewhere. TSMC, the Taiwanese semiconductor manufacturing giant, is investing US\$40 billion on two new fabs in Arizona (although the planned opening of the first of these has been delayed by a year to 2025 due to a shortage of sufficient skilled labour to operate these facilities).<sup>11</sup> There are emerging concerns that government interventions will force some parts of the semiconductor industry into places where the quality of the supply side of the economy might result in increasing costs.

The Chinese government has introduced new income tax exemptions for advanced technology process nodes, established import duty exemptions for integrated circuit manufacturers, and resumed operations of its US\$50 billion-plus state investment ‘Big Fund’ for chips.<sup>12</sup> The focus of the fund is on boosting its own indigenous supply chain, even though there are significant time and financial implications for doing so.<sup>13</sup>

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<sup>5</sup> Financial Times (1.8.23) *Tech cold war: South Korea pivots from China to US*. Accessed November 2023: <https://www.ft.com/content/c164c880-a832-422f-8fb4-29b2185d4982>

<sup>6</sup> Financial Times (13.7.23) *A global subsidy war? Keeping up with the Americans*. Accessed November 2023: <https://www.ft.com/content/4bc03d4b-6984-4b24-935d-6181253ee1e0>

<sup>7</sup> House of Commons Business, Energy and Industrial Strategy Committee (22 11 2022) *The semiconductor industry in the UK*. P. 15. Accessed November 2023: <https://committees.parliament.uk/publications/31752/documents/178214/default/>

<sup>8</sup> *Ibid.*

<sup>9</sup> Financial Times (14.7.23) *EU asks metals producers to explore making chip inputs after China export curbs*. Accessed November 2023: <https://www.ft.com/content/b08c11fe-8b09-4819-b8be-02e63b0bf2df>

<sup>10</sup> Semiconductor Industry Association (2023). *Op. cit.* pp. 11-12.

<sup>11</sup> *The Economist* (7.8.23). *Op. cit.*

<sup>12</sup> Semiconductor Industry Association (2023). *Op. cit.* pp. 11-12.

<sup>13</sup> Financial Times (9.11.23) *Squeezed chipmakers and China’s EV rise*. Accessed November 2023: <https://www.ft.com/content/c4f434ee-2200-4ac2-9d89-1461c8b3424b>

It has been reported that the latest (third) round of the Big Fund (focused on chip making equipment) has so far failed to raise sufficient funding from local governments and state-owned enterprises in China to support its operation as they continue to experience the nation’s economic downturn. Moreover, given the difficulties over deciding which initiatives to support, due to uncertainties caused by new US rules, the previous (second) round of the Big Fund (focused on manufacturing) remains underutilised.<sup>14</sup> Given US export controls, Chinese tech groups are expected to be left relying on more outdated and stockpiled chips. Chinese businesses are reported to have boosted orders from US chip companies in 2023, but many of these orders have not been fulfilled.<sup>15</sup>

Figure 2.1 summarises a selection of other developments which mark varying responses to the US CHIPS act and changing geopolitical pressures.

**Figure 2.1. Recent initiatives in global semiconductor markets**

| State       | Key recent events                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Japan       | In December 2022 the Japanese government announced US\$500 million of initial funding for its joint chip venture Rapidus (which includes eight domestic partners), which was followed by an additional US\$2.3 billion allocation in April 2023. This aims to achieve the commercial production of 2m chips in Japan by 2027. <sup>16</sup> TSMC has announced that it is now building a fab in Japan, as well as other similar moves elsewhere in the US and potentially the EU. <sup>17</sup>                                                                                                                                                                                                                                                                          |
| South Korea | In March 2023 the government passed K-Chips Act, providing 15% investment tax credits for large corporations and 25% for SMEs in key national strategic industries, including semiconductors. In April, new plans for an Industrial Transformation Super Project were announced, which allocates 70% of its research and development budget (around US\$4.7 billion) to core industrial sectors like semiconductors. <sup>18</sup> There is evidence that the US is successfully attracting Korean chipmakers such as Samsung (which is investing US\$17 billion in Texas <sup>19</sup> ) and SK Hynix with attractive subsidies, but their move is potentially being encouraged by fears that Korean companies could be targeted by Chinese restrictions. <sup>20</sup> |
| India       | In September 2022 the Indian government revamped its US\$10 billion Production Linked Incentive scheme, which now provides up to 50% co-funding for project costs of building semiconductor fabs and display fabs. <sup>21</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

<sup>14</sup> Financial Times (27.9.23) China’s economic malaise hits efforts to raise \$41bn chip fund. Accessed November 2023: <https://www.ft.com/content/521c8ac3-1933-4077-88b9-e9086a0196ca>  
<sup>15</sup> Financial Times (20.10.23) Tightened US rules throttle Alibaba and Baidu’s AI chip development. Accessed November 2023: <https://www.ft.com/content/ef157204-a204-4512-8c50-fe60e166b41e>  
<sup>16</sup> Semiconductor Industry Association (2023). Op. cit. pp. 11-12.  
<sup>17</sup> The Economist (6.3.23) Taiwan’s dominance of the chip industry makes it more important. Accessed November 2023: <https://www.economist.com/special-report/2023/03/06/taiwans-dominance-of-the-chip-industry-makes-it-more-important>  
<sup>18</sup> Semiconductor Industry Association (2023). Op. cit. pp. 11-12.  
<sup>19</sup> The Economist (7.8.23) How real is America’s chipmaking renaissance? Accessed November 2023: <https://www.economist.com/business/2023/08/07/how-real-is-americas-chipmaking-renaissance>  
<sup>20</sup> Financial Times (1.8.23) Tech cold war: South Korea pivots from China to US. Accessed November 2023: <https://www.ft.com/content/c164c880-a832-422f-8fb4-29b2185d4982>  
<sup>21</sup> Semiconductor Industry Association (2023). Op. cit. pp. 11-12.

| State   | Key recent events                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SE Asia | Malaysia, the Philippines, Singapore, Vietnam, and Thailand have all introduced incentive packages to attract foreign semiconductor industry investments. <sup>22</sup> Malaysia is already a major hub for the final steps of the chipmaking process with 13% of the global market for packaging, assembly, and testing services (it is also the sixth-biggest semiconductor exporter). Inflows of foreign direct investment into the country over the past few years have been at record levels, largely relating to global tech and chip companies. <sup>23</sup>                                                                                                                                                                                                                                                                                                                                                                                                     |
| Taiwan  | Suppliers to the Taiwanese semiconductor industry are now also reported to be considering entry into the EU, prompted by both China's stance toward Taiwan and EU Chips Act subsidies. <sup>24</sup> "Taiwan produces over 60% of the world's semiconductors and over 90% of the most advanced ones". <sup>25</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| EU      | In April 2023, the EU Chips Act, was supported by an estimated US\$47 billion in public and private investment. The aim is to double Europe's current 10% share of the global semiconductor market by 2030 and to help ensure EU supply, resilience, and technological leadership in semiconductors. The plan covers the entire semiconductor value chain including older chips and R&D facilities. <sup>26</sup> The EU initiative led to some new inward investment to develop chip capacity in Europe, even though some have suggested that Europe lacks the supply chain to support significant increases in capacity. <sup>27</sup> The EU is also seeking alternative sources of gallium and germanium, much of which is sourced in China. Efforts to avoid an EU-US 'subsidy race' were announced in 2022, but concerns continue to be voiced about the possible implications for relationships between these key allies because of their respective initiatives. |

### 2.3. UK Government responses

The above activity has conditioned the UK response to the changing geopolitical environment around semiconductors. The UK response has been more focused on chip design as opposed to manufacture. In comparison to the level of intervention occurring in some of the UK's main competitors, levels in the UK have been quite low. The UK government's national semiconductor strategy (published in May 2023) intends to offer British chip companies £1bn over the next decade and is focused on existing areas such as chip design. A report for the WTO28 suggested that the share of value-added in semiconductors can be broken down into eight categories: the design stage, which is divided between the design of logic chips (30% of semiconductor value added), memory chips (17%), and DAO chips (9%); wafer fabrication (19%) and manufacturing equipment (12%); APT (6%), materials (5%), and EDA and core IP (3%).

<sup>22</sup> Semiconductor Industry Association (2023). Op. cit. pp. 11-12.

<sup>23</sup> Financial Times (5.10.23) *Malaysia aims for chip comeback as Intel, Infineon and more pile in*. Accessed November 2023: <https://www.ft.com/content/56cd8f3d-acf6-4898-9895-bdb15da43f07>

<sup>24</sup> Financial Times (10.10.23) *Taiwanese semiconductor suppliers target Europe's next-generation factories*. Accessed November 2023: <https://www.ft.com/content/761b5b1b-c09b-463f-bc0c-73d682eddb33>

<sup>25</sup> The Economist (6.3.23). Op. cit.

<sup>26</sup> House of Commons Business, Energy, and Industrial Strategy Committee (22 11 2022) Op. cit. pp. 17.

<sup>27</sup> Financial Times (10 10 23) *Taiwanese semiconductor suppliers target Europe's next-generation factories*. Accessed November 2023: <https://www.ft.com/content/761b5b1b-c09b-463f-bc0c-73d682eddb33>

<sup>28</sup> Henry Wai-chung Yeung (2023) 'From Fabless to Fabs Everywhere? Semiconductor Global Value Chains in Transition', 132-187 in: WTO Global Value Chain Development Report 2023. Accessed January 2024: [https://www.wto.org/english/res\\_e/booksp\\_e/07\\_gvc23\\_ch4\\_dev\\_report\\_e.pdf](https://www.wto.org/english/res_e/booksp_e/07_gvc23_ch4_dev_report_e.pdf)

Focus on compound semiconductors has been welcomed in Wales given the significant activity within the regional cluster. The summer of 2023 also saw the launch of the UK's semiconductor advisory panel, which will oversee the *National Semiconductor Strategy*. The strategy has three central goals:

- Growing the domestic sector by building on UK strengths in IP and design, compound semiconductors and R&D.
- Mitigating the risk of supply chain disruptions by increasing the resilience of semiconductor-dependent critical sectors through domestic and international action.
- Protecting UK national security by using '...the levers we [the UK] have available to us to protect the technology we need secured, while recognising the international nature of markets and the need for the sector to grow'.<sup>29</sup>

The semiconductor market in the UK was valued at £1.8 billion in 2022<sup>30</sup>, and its share of the global market is just 0.5%. It does, however, have strengths in certain fields, notably in core intellectual property, research and development, fabrication of compound and advanced material semiconductors, and packaging design and development.<sup>31</sup>

## 2.4. Looking forward

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The global semiconductor market is expected to have seen a downturn of 10.3% during 2023, but in June 2023 forecasts predicted the market to experience 11.9% growth during 2024. The global semiconductor market size was valued at US\$592 billion in 2022 and is expected to reach around \$1,884 billion by 2032.<sup>32</sup> Weakening end markets reliant on consumer spending were expected to be the biggest factor in the expected downturn in 2023.<sup>33</sup> Fears have been reported that growing geopolitical tensions risk created a 'global glut' in semiconductor supplies<sup>34</sup>, whilst other reports suggest such fears are exaggerated with demand rising and semiconductor prices expected to rise during 2024<sup>35</sup>. Technological advances are expected to stimulate demand for more advanced semiconductors, even as supply gluts may continue to affect products such as memory chips (mainly used in consumer electronics).<sup>36</sup> Overall, growth is expected to return in 2024. These factors impact upon the market value of semiconductor industry shares, which are an indicator of confidence in the industry. The PHLX Semiconductor<sup>37</sup> Index (see Figure 2.2) reveals some growth in market capitalisation through 2023, and with an index value in December 2023 well above the value at the beginning of the year.

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<sup>29</sup> Department for Science, Innovation and Technology (DSIT) (2023) *National Semiconductor Strategy*. Accessed November 2023: <https://www.gov.uk/government/publications/national-semiconductor-strategy/national-semiconductor-strategy>

<sup>30</sup> Alsop T (2023) 'Semiconductors in the United Kingdom - statistics & facts', Statista. Accessed November 2023: <https://www.statista.com/topics/10981/semiconductors-in-the-uk/#topicOverview>

<sup>31</sup> House of Commons Business, Energy and Industrial Strategy Committee (22 11 2022). P. 12. Op. cit.

<sup>32</sup> Precedence Research (2023) *Semiconductor Market: Global Industry Analysis, Size, Share, Growth, Trends, Regional Outlook, and Forecast 2023 - 2032*. Accessed November 2023: <https://www.precedenceresearch.com/semiconductor-market>

<sup>33</sup> European Semiconductor Industry Association (6.6.2023) *Press Release: Worldwide semiconductor market expected to hit \$515 billion in 2023, rebound in 2024*. Accessed November 2023: [https://www.eusemiconductors.eu/sites/default/files/uploads/ESIA\\_WSTS\\_SpringForecast2023\\_1.pdf](https://www.eusemiconductors.eu/sites/default/files/uploads/ESIA_WSTS_SpringForecast2023_1.pdf)

<sup>34</sup> Financial Times (10.11.23) *China's biggest chipmaker warns geopolitics is stoking global glut*. Accessed November 2023: <https://www.ft.com/content/30e61fb3-ac48-4ece-94fb-af0c3763d99c>

<sup>35</sup> Financial Times (31.10.23) *Samsung foresees end of punishing memory chip slump in 2024*. Accessed November 2023: <https://www.ft.com/content/27ae2cf3-9671-46bf-b84f-a2bf634c534d>

<sup>36</sup> The Economist (13.11.23) *Ten business trends for 2024, and forecasts for 15 industries*. Accessed November 2023: <https://www.economist.com/the-world-ahead/2023/11/13/ten-business-trends-for-2024-and-forecasts-for-15-industries>

<sup>37</sup> The PHLX Semiconductor Sector Index<sup>SM</sup> (SOX<sup>SM</sup>) is a modified market capitalization-weighted index composed of companies primarily involved in the design, distribution, manufacture, and sale of semiconductors.

Global growth factors identified include: the extensive usage of semiconductors in a wide range of end use applications; the rising penetration of digital technologies and rising adoption of various consumer electronics; growing popularity of technologies such as AI and the Internet of Things; significant increases in the work-from-home trend fostering the demand for PCs and laptops; rapid urbanization in the developing world; demand for semiconductors in the industrial equipment and automotive sector; and the growing demand for integrated circuits in developing nations as a result of smartphone demand.<sup>38</sup>

**Figure 2.2 Movements in the PHLX Semiconductor Index Year to December 2023**



Source: [https://www.marketwatch.com/investing/index/sox?mod=mw\\_quote\\_tab](https://www.marketwatch.com/investing/index/sox?mod=mw_quote_tab)

Over the longer-term, a report for the U.S. Semiconductor Industry Association projected that the US chip industry will grow by around 115,000 jobs by 2030, a 33% growth on current numbers. The same report concluded, however, that around 67,000 jobs risk going unfilled based on current degree completion rates in the US.<sup>39</sup> This has been linked to delays to the opening of the new TSMC fab in Arizona. Despite over 50 new semiconductor projects being announced in the US by as early as June 2023<sup>40</sup>, significant obstacles remain. Such factors are expected to impact on the growth plans of other countries and on the various moves to repatriate or restructure and relocate semiconductor production processes.

<sup>38</sup> Precedence Research (2023). Op. cit.  
<sup>39</sup> Semiconductor Industry Association (2023). Op. cit. P. 7.  
<sup>40</sup> SIA (2023) CHIPS Science Act Fact Sheet. Op. cit.

## 3. Local economic conditions around the CS cluster

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### 3.1. Introduction

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While much of the output from the CSconnected cluster of businesses is produced for export markets, economic conditions in the UK and Wales are still important in terms of the strength of labour markets and more general conditions for business investment.

### 3.2. UK and Wales economic headlines

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Important for all UK business as whole has been information from the ONS highlighting that inflation rates have generally been falling, with the trend expected to be downwards through 2024. This impacts on the prices that businesses pay for goods and services, with the generally falling inflation rate being good news for longer term confidence.

UK economic growth during 2023 has been more hesitant. Following an increase of 0.3% in 2023Q1, and no growth in 2023Q2, the estimate of UK real gross domestic product (GDP) from the ONS shows that the economy contracted by 0.1% in 2023Q3 (July to September 2023)<sup>41</sup>. Following a decline in manufacturing output during 2022, there has been some growth in UK manufacturing output during 2023. By 2023Q3 the index of manufacturing output was 2.2% above 2019 levels<sup>42</sup> The ONS have noted that this may reflect falling input prices across the period taking some of the financial pressures off manufacturing.

According to the ONS, UK business investment fell by 3.2% in 2023Q3, although business investment 2.3% higher when compared with 2022Q3.<sup>43</sup>

Initial estimates from Pay as You Earn Real Time Information<sup>44</sup> showed a rise in the number of payroll employees in the UK for November 2023 to 30.2m, an increase of 333,000 employees (or 1.1%) over the figure for November 2022.

For the period to 2023Q3 the trade in goods data<sup>45</sup> show that there had been an increase in the value of exports from all UK countries in the year to September 2023 compared with the previous twelve months.<sup>46</sup> The value of goods exported from Wales increased by 2.0% to £19.9bn over the year to September 2023. The activity of the private sector firms in the CS cluster makes a significant contribution to Welsh exports, and this contribution is expected to grow due to the gradual demise of some of Wales' largest firms which have historically maintained regional exports.

Some Welsh sectors experienced a relatively high growth rate in the value of their exports over the year to June 2023.<sup>47</sup> Machinery and Transport exports increased to £8.2bn in the year to 2023Q3, from £7.2bn in the year to 2022Q3, an increase of over 15%.

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<sup>41</sup> <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpfirstquarterlyestimateuk/julytoseptember2023>

<sup>42</sup> <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/datasets/indexofproduction>

<sup>43</sup> <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/businessinvestment/julytoseptember2023revisedresults>

<sup>44</sup> <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/bulletins/earningsandemploymentfrompayasyouearnrealtimeinformationuk/december2023>

<sup>45</sup> ONS suggest caution in using this data. Data is typically published in current or nominal prices which means it has not been adjusted to remove the effects of inflation.

<sup>46</sup> <https://www.uktradeinfo.com/trade-data/regional/2023/uk-regional-trade-in-goods-statistics-third-quarter-2023>

<sup>47</sup> <https://www.uktradeinfo.com/trade-data/regional/2023/uk-regional-trade-in-goods-statistics-third-quarter-2023#datasets>

The ONS *Business Impacts and Conditions Survey (BICS)* for 27<sup>th</sup> November to 10<sup>th</sup> December 2023<sup>48</sup> reported that 19.9% of Welsh businesses surveyed experienced a sales increase compared to the previous month, with 21% reporting a decrease on the previous month. Some 24.1% of surveyed businesses in Wales expected sales to increase in January 2024 against a UK average of 16.8%. The BICS also revealed some reduction in costs and price pressures compared with the previous month.

The NIESR Summer 2023 *Economic Outlook*<sup>49</sup> noted that the Welsh economy had “suffered severely” from the pandemic, followed by the cost-of-living crisis, and was facing sluggish employment and output growth. The report revised downwards the NIESR projected employment level for Wales, but indicated there are some grounds for optimism with manufacturing orders increasing (albeit constrained by a lack of skilled labour and access to finance for investment).

### **3.3. Local economics need and priorities.**

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The summary review above points to the immediate economic environment facing the CS cluster firms. The UK economic numbers suggest that 2023 has been a challenging year for manufacturing activity with confidence only slowly improving. In both Wales and the UK, indices of production output remain around 5-6% below pre-Covid levels. Manufacturing employment in Wales in June 2023 is estimated to have been around 138,000 people, which is almost the same level that prevailed in 2020. Adding to problems have been uncertainties caused by inflation rates.

In the above context it is then important to consider the contribution of the cluster in terms of the maintenance of manufacturing employment, the maintenance of high productivity industry activity, the contribution to manufacturing output and trade, and the contribution to Welsh R&D spending. The next section addresses these issues.

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<sup>48</sup> <https://www.ons.gov.uk/economy/economicoutputandproductivity/output/datasets/businessinsightsandimpactontheeconomy>

<sup>49</sup> <https://www.niesr.ac.uk/wp-content/uploads/2023/08/JC737-NIESR-Outlook-Summer-2023-UK-v10-AC.pdf?ver=0ADNZdrTPaHhGBka6Jf>

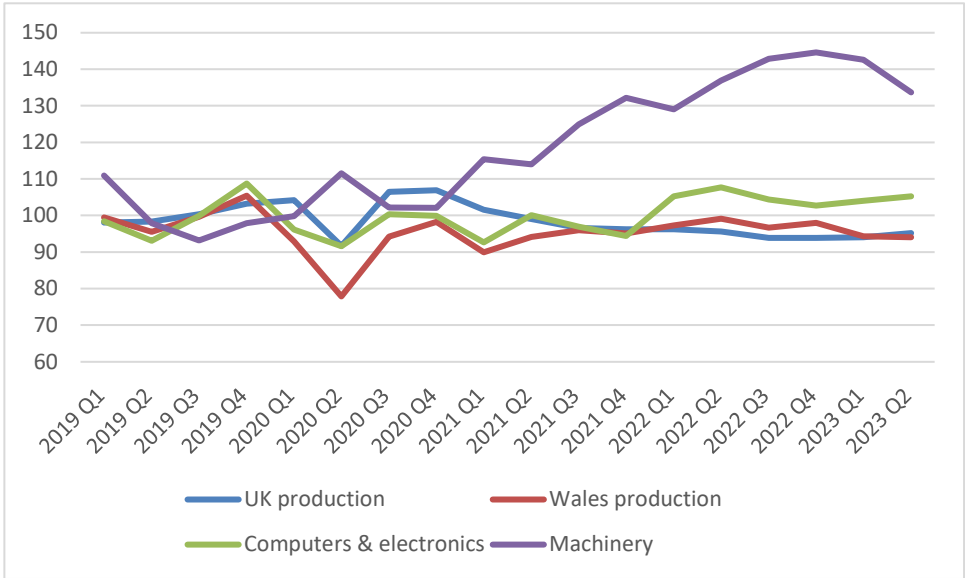
# 4. The economic role of the CS cluster

## 4.1. CS cluster and Welsh output

Much of the activity in the CS cluster sits within the broad computer and electronics products sector, and the machinery sector. Figure 4.1 reveals recent trends in the index of output in these sectors for Wales. There is every indication here that the index of output in both of these sectors outperformed UK and Welsh production in the period after 2021 Q4.

For example, the Welsh index of computer and electronics production in 2023Q2 was just over 5% above levels in 2019 (prior to the Covid-19 pandemic). In the case of machinery and equipment, the index value in 2023Q2 was over 30% above 2019 levels. In comparison the all-Wales production index was 6% below 2019 levels in 2023Q2. As indicated earlier, manufacturing industries in Wales had experienced a tough year and Figure 4.1 reveals that the index of output in computer and electronics production and machinery and equipment in Wales fell by around 2.3% in the year to 2023Q2.

**Figure 4.1 Index of production output Wales 2019-2023Q2 (2019=100)**



Source: Statswales



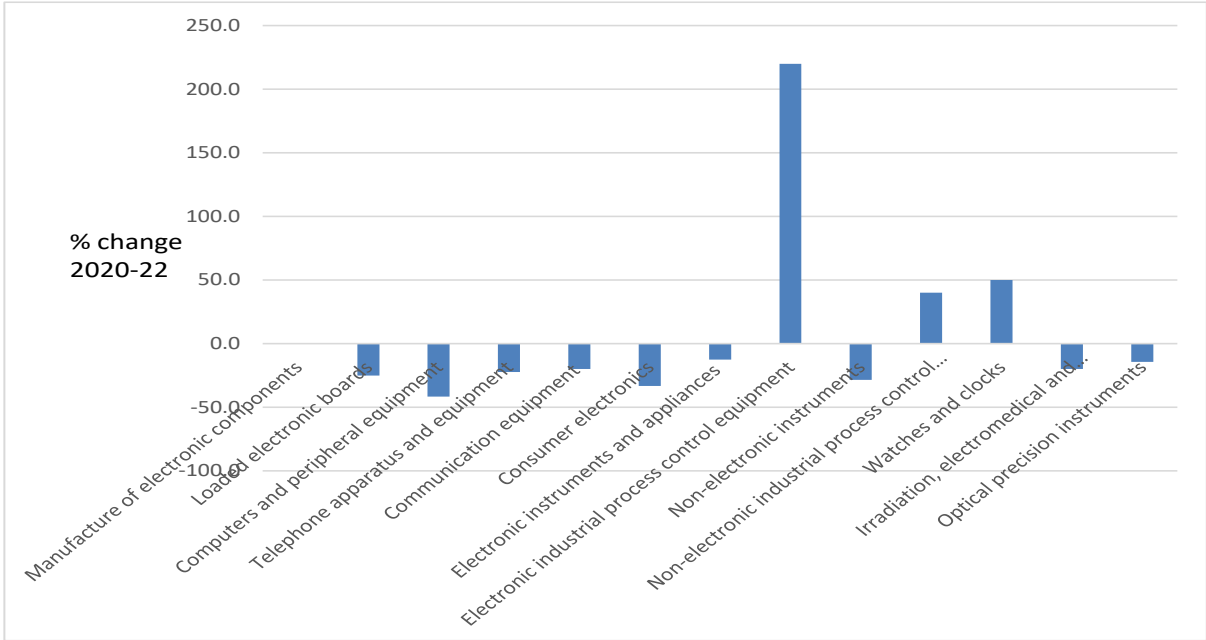
## 4.2. Employment

The previous analyses of the CS cluster suggests that between 2021 and 2022 there was an 8.4% increase in employment (i.e. from 1,602 to an estimated 1,737 employees in 2022). The analysis for 2023 estimates employment at 1,773 (an estimated 2% increase on 2022), and with around 80% of this employment in the private sector companies that make up the CS cluster, with the remainder employed by Universities and research institutes. The fact that employment in the cluster has been maintained is encouraging, particularly as This employment total takes account of redundancies announced at Nexperia during 2023.

The majority of the compound semiconductor manufacturing activity in South Wales is within standard industrial classifications (SIC 2007) 26 and 27. SIC 26 and 27 together make-up the Electrical engineering and equipment sector in Wales (defined as SIC 26 - Manufacture of computer, electronic and optical products, and SIC 27 - Manufacture of electrical equipment).

The figures in respect of the CS cluster are particularly encouraging given employment in other parts of SIC 26 have been falling in Wales. For example, employment in SIC 26 has fallen from 9,750 to 8,897 between 2020 and 2022 (latest available estimate from ONS *Business Register and Employment Survey*). Figure 4.2 actually reveals that in most subsectors of SIC 26 employment had fallen between 2020 and 2022 and with much of growth focused in electronic industrial process control equipment. In this context, activity in those parts of CS Cluster in SIC 26 is working to maintain Welsh activity in this manufacturing area.

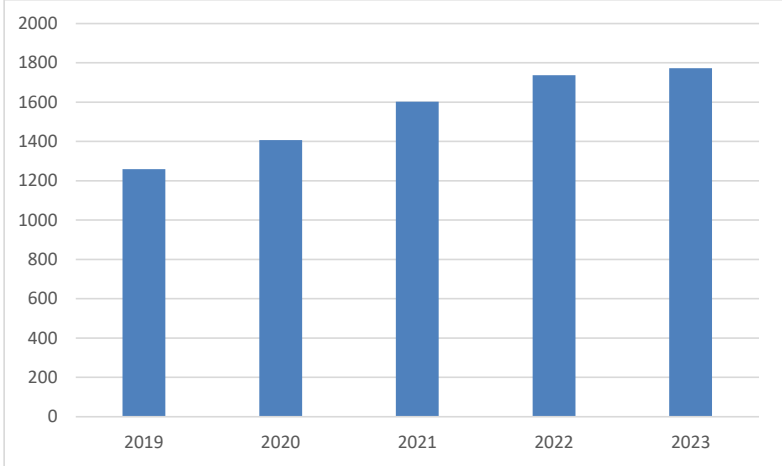
**Figure 4.2 Recent % changes in Manufacture of computer, electronic and optical products employment in Wales 2020-2022. (Source: ONS, BRES)**



Much of the CS cluster employment is in just a few elements of SIC 26 and SIC 27 (i.e. SIC 261 manufacturer of electronic components and SIC 279 manufacture of other electric equipment). Here estimated employees in 2022 were 2,850 people, with the CS cluster taking an increasing share of this total over time.

The current estimate is that the cluster accounts for around one half of the total employment in these sectors. There are expectations for this percentage to increase, not least because of the completion of KLA headquarters investment into the sector during 2023-2024 boosting employment, with this being expected to counteract the employment losses that were announced in Nexperia<sup>50</sup> in the final quarter of 2023.

**Figure 4.3 Time trend of estimated employment in the Welsh CS Cluster 2019-23**



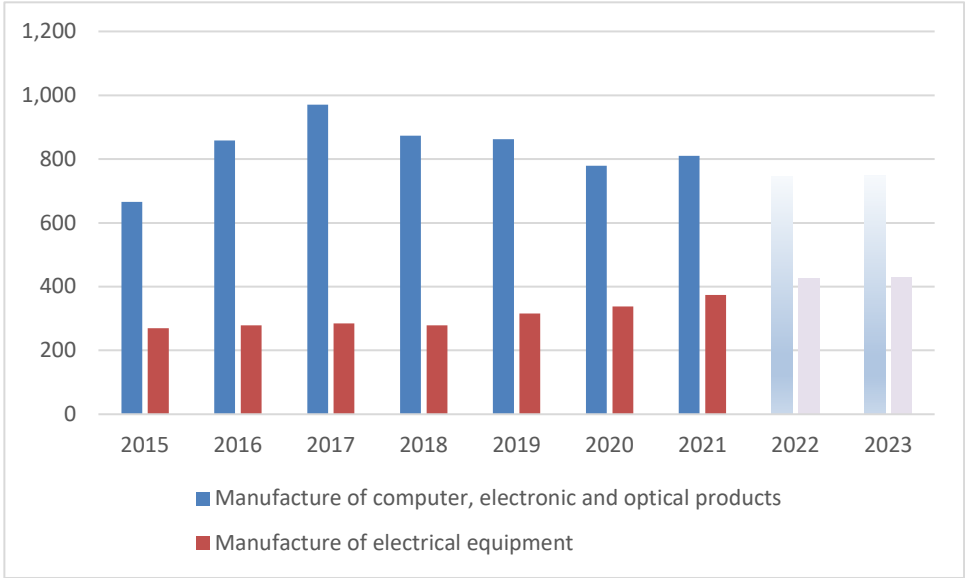
### 4.3. CS cluster and Welsh productivity

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An important element of the economic contribution of the private sector businesses in the CS cluster relates to their productivity. Figure 4.4 reveals the estimated GVA in Wales supported in SIC 26 - Manufacture of computer, electronic and optical products, and SIC 27 - Manufacture of electrical equipment. Note here that figures for 2022 and 2023 are estimated based on trends in employment growth. Figure 4.4. reveals the maintenance of activity in SIC 26 but with SIC 27 seeing a firmer recent trend on growth up until 2022.

<sup>50</sup> See [Technology: Hundreds of jobs saved after Nexperia forced to sell - BBC News](#)

**Figure 4.4 Trends in GVA in SIC 26 and SIC 27 Wales £m 2015-2021 (2022-23 estimated)**



Source: ONS Current price estimates of GVA.

The evidence continues to support the conclusion that the CS cluster as a whole is characterised by relatively high levels of productivity. For example, analysis of the most recent accounts of cluster participants (available for 8 participants at the time of a search on the FAME Companies House database) suggests that:

- Average sales per employee in the examined cluster firms was around £321,500 in 2022-2023.
- The weighted average sales per employee (allowing for the different levels of employment in firms) was higher at an estimated £377,300 in 2022-23.
- Average levels of sales per employee in Wales in 2021 (latest available) were around £256,400<sup>51</sup>.

It is accepted that sales per employee is far from the most ideal measure of productivity, but the data does hint at the high levels of productivity, whilst also revealing the relative capital intensity of elements of the sector.

The productivity characteristics of the CS cluster also link to the types of activity being undertaken and the high skills levels of staff. The CS cluster manufacturing firms also feature relatively high levels of earnings. The analysis of survey returns for 2023 suggests:

- Average salaries in the cluster were around £61,000 and with a range of £46,700 to £74,800.
- The earnings reflect high levels of skills being employed. For example, in 2023 the percentage of staff engaged in R&D activity in different parts of the cluster ranged from 6% to 100%. It is estimated that of the 1,773 people engaged in the cluster in 2023 35% are directly engaged in R&D activity.

<sup>51</sup> Estimated from data in the *Annual Business Survey* on manufacturing turnover for Wales combined with employment information from the *Annual Population Survey*.

Some information is available from the Office for National Statistics on levels of gross value added in Wales for sectors SIC 26 (Computer, electronic and optical products) and SIC 27 (electrical equipment). However, these sectors cover very different types of manufacturing activity, with SIC 26 including basic electronic components as well as complex semiconductor manufacture and epitaxy. Figure 4.5 shows estimates of GVA in current prices for these two sectors for 2023 together with estimated employment levels from the ONS *Business Register and Employment Survey*. Comparative estimated figures are also shown for the CS Cluster of organisations and for Wales manufacturing as a whole.

**Figure 4.5 Estimated GVA per Employee in SIC 26 & SIC 27 2023**

| Sector                                           | Gross value added 2023 estimated | Employees estimate 2022/23 | Estimated GVA per employee |
|--------------------------------------------------|----------------------------------|----------------------------|----------------------------|
| CS Cluster 2023                                  | £265m                            | 1,773                      | £149,500                   |
| SIC 26 Computer, electronic and optical products | £750m                            | 7,000                      | £107,000                   |
| SIC 27 Electrical equipment                      | £430m                            | 4,500                      | £95,500                    |
| All Welsh manufacturing                          | £12,573                          | 138,000                    | £91,100                    |

Source: Final 3 rows estimated for 2023 from ONS Regional Accounts GVA at Current Prices by Industry and BRES (from Nomisweb).

The analysis of the CS cluster for 2023 reveals that estimated GVA directly supported is £265m or around £150,000 per employee (noting that this includes elements of non-manufacturing activity, which works to bring down the average for the CS cluster because GVA per employment in sectors such as education, research and related services is lower than that in the manufacturing elements of the cluster). This estimate is likely to be conservative, and it is particularly difficult to estimate some of the non-wage components of value added for the cluster.

**4.4. CS cluster and Welsh trade**

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The CS cluster made a further important contribution to Welsh exports in 2022/2023. The survey revealed that the proportion of output exported by the industrial parts of the cluster remains well in excess of 90%. The total value of exports from the cluster in 2023 are conservatively estimated to be in the order of £514m and with total sales a little over £560m. For comparative purposes total Welsh exports in the year to 2023Q3 were around £19.9bn<sup>52</sup>, and with total exports of manufactured goods and machinery of around £11bn. On this basis, exports from the cluster made up around 4.7% of Welsh manufactured goods and machinery exports in 2022-23.

<sup>52</sup> Estimated from HMCE data for 2022-23. Value of Welsh Exports by Quarter and Product. Available from StatsWales. [Value of Welsh exports by quarter and product \(£m\) \(gov.wales\)](https://gov.wales/value-of-welsh-exports-by-quarter-and-product)

## 5. CS Cluster – Wider economic impact in Wales 2023

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### 5.1. Introduction

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This section of the report updates the analyses undertaken for 2019-2022 and develops a current estimate of the economic activity of Wales supported by the CS cluster. As in each of the annual reports, the GVA supported numbers are estimates. While data was available from some of the industrial partners in respect of employment and output, direct GVA associated with this employment and output is estimated using a variety of sources including the ONS *Annual Business Survey*, ONS *Regional gross value added (balanced) by industry*<sup>53</sup> and the *Business Register and Employment Survey* (accessed through NOMIS). The derived estimates take into account that GVA per employee in the consortium will vary by industry, for example with developed GVA per employee estimates varying between SIC 26 and 27 (SIC 26 Manufacture of computer, electronic and optical products, and SIC 27 - Manufacture of electrical equipment), and varying again in the case of any activity supported in the higher education sector.

This part of the report also estimates how far the purchasing behaviour of the cluster firms and organisations supports activity in the Welsh supply chain. As part of the annual survey the CS cluster, firms and organisations provide information in respect of their local purchasing of goods and services. Moreover, the annual survey provided information in respect of the wages and salary spending of the firms. Importantly, a large proportion of the CS cluster employees live in Wales, and then purchase goods and services within the Welsh economy.

A key part of the recent development of the cluster has been progress to add value in the Welsh and UK economies. For example, in some parts of the cluster there has been progress to develop stronger ties to local suppliers so that they can take on higher value-added elements of activity, thereby freeing up cluster firms to focus more on their specific expertise. This has meant that there are cases where activity previously undertaken within cluster firms has been subcontracted to suppliers. This type of activity is important because it is through these types of closer buyer-supplier partnerships that knowledge is transferred from the cluster to other local firms. Moreover, the local firms may gain new knowledge that may put them in a stronger position to win additional business by virtue of the linkages formed with the CS cluster. This is noted since the analysis that follows, the focus is on estimated quantitative supplier effects in terms of the activity supported, and not on these less measurable impacts. These impacts will be examined through a case study which is being developed at the time of writing.

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<sup>53</sup> See [Regional gross value added \(balanced\) by industry: all ITL regions - Office for National Statistics](#)

To estimate the indirect (or multiplier) impacts of the compound semiconductor cluster activity it is necessary to have a picture of the local economy that specifies how various industry sectors ‘fit together’ in terms of their trading relationships. This allows the effects of activity in one sector to be traced through the entire local economy. The most comprehensive picture available of the Welsh economy is an Input-Output table. Further description of the Welsh Input-Output project, its strengths and limitations, can be found in Jones (2022).<sup>54</sup> The latest set of tables refer to 2019.

The approach adopted here involves estimating direct employment, output and gross value added connected with current cluster operations. The indirect (supply chain) and induced (household spending) effects connected with this activity are estimated through the use of employment and GVA multipliers derived from the Welsh Input-Output frameworks. Multipliers used were adjusted to take account of features of the specific firms in the cluster with the analysis also incorporating information from the firms showing their local purchasing linkages (and the direction of their sales).

## 5.2. Impact headlines: Direct effects

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**In 2023 the compound semiconductor cluster employed an estimated 1,773 employees.** As highlighted earlier in this report, the 2023 employment estimate marks a 2% increase on 2022 estimates.

**The GVA directly supported by the cluster of firms and institutions in 2023 is estimated at £265.2m.** This represents a 25% increase on the figure for direct GVA reported in 2022. Recall that important components of GVA are profits and wages and salaries. While some parts of CS cluster saw challenging economic conditions in 2023 and a squeeze on profits, some elements saw an increase in activity and profits. Moreover, where parts of the cluster either maintained or grew employment this feeds through to an increase in the total wages and salaries that also contributes to gross value added. It is also important to point out that inflation rates were relatively high through 2023 which would have also inflated some of the wages, salaries and profits that contribute to the estimated GVA. On the basis of the above numbers, the estimated GVA per employee in the cluster is close to £150,000. Total manufacturing GVA in Wales in 2023 was an estimated £12.6bn meaning that the CS cluster contributed around 2.1% of the total.

## 5.3. Impact headlines: Indirect effects in Wales

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In what follows, the ‘local economy’ is taken to mean Wales. While the Welsh economy marks the strictly regional context for the cluster firms and organisations, the purchasing behaviour of the cluster firms also supports businesses in the wider UK economy (see later). However, much of the indirect impact of the cluster is expected to occur in Wales because of the spending of wages and salaries.

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<sup>54</sup> [Project Report Input Output Tables Wales 2019.pdf \(cardiff.ac.uk\)](#)

As the above analysis suggests, CS cluster members directly support around £265.2m of GVA and 1,773 employees. Using the Welsh Input-Output framework it is estimated that the cluster, through its purchasing of regional goods and services, and its payment of wage incomes, supports a further £116.1m of GVA in the Welsh economy. Then each £1m of GVA directly generated in the CS cluster supports an additional £0.44m of GVA elsewhere in the Welsh economy. Overall, this results in the cluster supporting directly and indirectly an estimated £381.3m of Welsh GVA. This is around 26% higher than the estimate for 2022 (£303m).

Similarly, while the cluster directly supports around 1,773 jobs, it supports an estimated further 888 jobs through its purchasing and payment of wages and salaries i.e. every employment in the cluster is connected to an estimated 0.5 of employment elsewhere in the Welsh economy. In total, therefore, the cluster in 2023 could be considered to be associated with as many as 2,661 jobs in Wales.

Figure 5.1 Impact summary



Note: Activities of the main manufacturing firms and other CS Connected members are combined for commercial confidentiality reasons. While direct employment and turnover information was provided by cluster firms, the estimates of GVA/employee were informed by Regional Accounts Current Price estimates of Industry GVA for Wales (SIC 26, 27) and overall Welsh employment estimates in these same industries. Indirect and household effects were estimated using multipliers developed from the Welsh Input–Output tables for SIC 26 and SIC 27, but with some adjustment to multiplier values to allow for some purchases and sales between firms. It is noted that the firms mentioned in this Figure do not share all the characteristics of the wider sector – particularly in the case of SIC 26. Multiplier estimates are therefore indicative. For the cluster firms, multiplier effects through supply chains in Wales are currently quite limited because of low local purchasing. However, the multiplier effects through wage spending are higher because of the relatively high wages and salaries paid in firms in the cluster.

## 5.4. UK-wide effects

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As reported above, the focus of the annual report series has been upon impacts in the Welsh economy. However, in what follows some tentative steps have been made towards estimating the whole UK effects linked to the activities of firms and organisations in the CS cluster. This exercise was challenging because of the limited information in respect of multiplier effects from UK Input-Output tables.<sup>55</sup> This exercise also assumes that the firms and organisations within the CS cluster share the broad characteristics of the larger industry group in the UK; for example, the whole of SIC 26 (Computer, electronic and optical products) and SIC 27 (electrical equipment). Note here that the UK wide effects embrace the Welsh effects.

The estimates here are that the CS cluster in Wales:

- Supports a total of £543m of GVA in the UK economy.
- That every £1m directly supported by the CS cluster in Wales supports a further £1.05m of GVA in the wider UK economy.
- That every full-time equivalent job in the CS cluster in Wales supports a further job in the wider UK economy.
- In both the GVA and employment impact cases, comparison with the earlier analysis in this section reveals that around 70% of the total UK impact would be in Wales.

## 5.5. Comparison with other studies: a note

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It is difficult to compare findings on the significance of the semiconductor sector in general on supporting wider economy activity. For example, the 2021 Oxford Economics study for the Semiconductor Industry Association<sup>56</sup> using the US IMPLAN modelling framework estimated that each job in the semiconductor manufacturing sector supported an additional 5.7 jobs in other parts of the US economy through supply chain and induced income effects.<sup>57</sup> The research in this annual report suggests a much more conservative number. Using the Oxford Economics numbers as a guide to both the employment and multiplier effects in the UK economy linked to the semiconductor industry would be problematic because:

- The US economy is far larger than the UK economy and with an expectation that multiplier effects are linked to the size of the economy.
- The US has a much larger and integrated semiconductor sector and with some very large semiconductor manufacturing firms.

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<sup>55</sup> See [UK input-output analytical tables, industry by industry - Swyddfa Ystadegau Gwladol \(ons.gov.uk\)](#) These analytical tables provide information on Type 1 GVA multipliers. However, this does not include the impacts of induced household spending i.e. Type 2 effects. The approach here was to use the UK Type 1 GVA multipliers as a baseline to estimate Type 2 GVA effects (i.e. including household spending) and with use also made of the relationship between Type 1 and Type 2 GVA multipliers in the Scotland 2020 Input-Output tables case. There were no employment multipliers available for the UK for 2019. So Type 1 employment multiplier estimates are based on 2015 data for the UK (see [Type 1 UK employment multipliers and effects, reference year 2015 - Office for National Statistics \(ons.gov.uk\)](#)) and with Type 2 employment multipliers estimated in a similar way to GVA multipliers above.

<sup>56</sup> [SIA-Webinar-May-2021-hg-fy.pdf \(semiconductors.org\)](#)

<sup>57</sup> A series of factors determine the size of employment multipliers: 1) indirect effects on local supplier industries; then the bigger the economy the bigger the supply side, the bigger the multiplier effect, 2) induced effects of higher wages and salaries on demand for locally produced goods and services; again as the reference economy gets larger, multiplier effects increase because import ratios fall as the reference economy gets larger. The large US economy would therefore capture more supplier and income effects than smaller more open economies.



- The US industry has more developed domestic supply chains to the semiconductor sector. We note in the UK that some elements of the supply chain to the UK sector are overseas.
- Employment multipliers tend to be much higher the more capital intensive the sector in question.

There is also an issue in comparing studies such as Oxford Economics with the analytical series in the CSconnected annual reports because the cluster does not just include capital intensive manufacturing firms, but also elements of the private and public sector. In any case employment multipliers (6.7) and GDP multipliers close to 5 (in the Oxford Economics 2021 case) would not be defensible in the UK case. For example, the UK Input-Output tables for 2019 show that Type 1 GVA multipliers for non-food manufacturing are typically in range from 1.4 to 2.4, and at the lower end of this range for Computer, Electronics and Optics (SIC 26)<sup>58</sup>. Even if type 2 household effects were to be added, it is very unlikely the multiplier numbers would get anywhere close to 5. Similarly, in the UK regional case it is unlikely that estimates of GVA multiplier effects for this industry far in excess of 2 are defensible. For example, in the Scotland Input-Output tables for 2020 GVA Type 2 multipliers for the Computer, electronics and optical sector as a whole are cited at 1.8<sup>59</sup>, with the Scottish economy being almost twice the size of the Welsh economy and with a stronger supply side by virtue of its greater size.

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<sup>58</sup> [UK input-output analytical tables, industry by industry - Swyddfa Ystadegau Gwladol \(ons.gov.uk\)](https://ons.gov.uk/methodology/input-output-tables/industry-by-industry)

<sup>59</sup> [SUT-2020.xlsx \(live.com\)](https://live.com/SUT-2020.xlsx)

## 6. Conclusions

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### 6.1. The overall picture

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This annual report suggests that activity among the CS cluster of firms and organisations in Wales has been maintained at levels similar to those in 2022 based on employment directly and indirectly supported in the Welsh economy. Estimates of the direct GVA supported in Wales by the cluster have increased, but with the increase supported in large measure being by a few parts of the cluster. The overall picture at the close of 2023 was encouraging. At one level, KLA continues its expansion plans in Newport at its new headquarters. At another level it is hoped that 2024 will see some stability occurring at the Nexperia facility at Newport. While Vishay International are on record as wishing to invest heavily in the facility in the medium term, the final takeover of the plant is still subject to a UK government review and the purchase rights of a third party. It is hoped that this will be accomplished in early 2024. It is important to remember that much of the vision for CSconnected was for there to be a foundry facility available to better integrate the value adding operations of the CS cluster in Wales.

There was some encouragement for the Welsh CS sector in the Autumn Statement in 2023 where it was announced that there would be £160m available for an investment zone for semiconductors in South Wales.

Based on the current known investment intentions of CS cluster organisations, it is expected that the employment out-turn in terms of direct and indirect jobs supported in Wales will reach 4,000+ by 2025.

### 6.2. Issues impacting cluster development

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A series of factors will shape the development of the CS cluster in Wales. Critical here is the growth in government support for the semiconductor sector in other parts of the world. Section 2 of this report has outlined the high level of financial resources being focused on semiconductor manufacturing in other parts of the world. Unfortunately, the level, and targeting, of resources in the UK case has not matched the intent shown in competing locations. Active interventions in competing locations may lead new semiconductor inward investment to places where the local labour and resources supply side is insufficient to support the largest manufacturing firms. There is some emerging evidence to support this such as the problems facing TSMC as it attempts to expand operations into the US. In short, there is a very real concern that the level of interventions in other states might impact future investment into Wales by the CS cluster companies. Indeed, there are already warnings of restructuring in some firms based in the UK, with, for example, Coherent in the North East of England announcing job losses in the Spring of 2023.<sup>60</sup> An important further issue is how far the various “CHIPS acts” around the world could contribute to a reshoring of foreign direct investments previously made in the UK by semiconductor technology companies.

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<sup>60</sup> [Coherent cutting over 100 jobs at Newton Aycliffe UK plant by end-May \(semiconductor-today.com\)](https://www.semiconductor-today.com/news/2023/05/coherent-cutting-over-100-jobs-at-newton-aycliffe-uk-plant-by-end-may)

The UK Government's focus has tended to be in terms of greater levels of support for semiconductor design. However, this leaves the greatest value adding manufacturing elements of the process in overseas locations, at the same time leaving the UK with limited sovereign capability in this key technology sector.

There is still much to do to further embed parts of the sector. CSconnected has led interventions in terms of short courses to improve the skills supply side in Wales. It is also noted that there are general challenges in Wales around STEM skills at foundation stages, with for example the PISA results for 2022 for Wales showing that average scores for mathematics among 15 years olds were significantly lower than the OECD average.<sup>61</sup> However, there are also concerns that infrastructure will inhibit prospects for some existing investors, as well as hinder the marketing case for new inward investment into the cluster. This is particularly acute in terms of electricity supply to strategic sites and the delays inherent in improving grid infrastructure. Problems of electrical supply have arisen at Imperial Park in Newport where several inward investors require more capacity. Similarly, at Swansea University there have been problems gaining grid connections for the new Centre for Integrated Semiconductor Materials. There are selected inward investments in Wales which place huge demands on the electricity grid but do not necessarily create similarly high levels of employment and value added.

Furthermore, the CS cluster fundamentals (as show in section 3) in Wales still focus almost entirely on overseas exports. While this is welcome in the context of falling exports in some of Wales' more traditional manufacturing sectors, it is still the case that products from the cluster are integrated into products made overseas, some of which are consequentially imported back into the UK. While there is justified interest in improving the backward value chain to local suppliers of goods and services, there is also a need to consider the forward linkage model and how far domestic demand can be grown for the goods produced by the CS cluster in Wales, and in the future buyer-supplier linkages between the cluster firms themselves in the region.

Finally, in terms of the future research and evaluation programme around CSconnected this will focus during 2024 on the following:

- Finalising a case study examining the value of supply chain development around the cluster.
- A case study examining the role of short education courses in improving the supply side of the sector in Wales.
- A piece of research examining how far Wales and the UK can benefit from the lessons of Taiwan in developing the semiconductor sector and the role of government and research institute interventions.

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<sup>61</sup> [Achievement of 15 year olds \(Program for International Student Assessment\) PISA national report: 2022 | GOV.WALES](#)



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