



Welsh Economy
Research Unit

Yr Uned Ymchwil
i Economi Cymru

CSconnected

**Revised economic baseline: Compound Semiconductor
Cluster in South Wales**

18th February 2021

Contents

Summary:	3
1. Introduction	4
2. Regional Economic Context	5
2.1. Introduction	5
2.2. General economic context in Wales in 2020Q4	5
2.3. Recent sector performance in Wales and trade activity.....	7
3. CS Connected- Economic contribution of the consortia in 2020	9
3.1. Introduction	9
3.2. Impact headlines: direct effects	10
4. Better understanding the impact of the CSconnected cluster	12

This report was written by Professor Max Munday, Dr Annette Roberts and Professor Robert Huggins, Cardiff University.

Summary:

In the final quarter of 2020 the firms and organisations forming part of CSconnected membership accounted for around 1,400 jobs, and private sector members accounted for around £440m of annual sales, much of this (over 90%) relating to overseas exports, mostly destined for markets outside of the EU. The analysis reveals that the CSconnected members directly supported close to £121m of Welsh GVA in the year ending 2020Q4.

The GVA directly supported by the cluster of firms and institutions is estimated in the year to 2020Q4 at £121.3m. This means that average GVA per FTE within the cluster is around £86,200 (the Welsh industry average being around £32,000).

In the context of the economic contribution of the CSconnected members this analysis reveals that:

- Where economic activity is created and supported in compound semiconductor cluster activity, it continues to create relatively high levels of GVA per employee.
- The sector already supports a regional supply chain but with scope to increase the regional supply of goods and services to the sector.
- Relatively high GVA per employee reflects relatively high earnings in the sector.
- The strengthening of this cluster with additional firms with productivity characteristics that are similar to the current membership would provide a further uplift to average regional productivity.

Once account is taken of the supply chain and household effects indirectly linked to the cluster, the total of Welsh GVA supported rises to £172m and the total Welsh employment supported rises to 2,085 FTE jobs.

The current contribution of the cluster needs to be understood in terms of poor economic conditions prevailing across Wales and the UK in 2020 due to uncertainty from Brexit and the Covid-19 pandemic. The resilience of cluster activity through the 2019-2020 period is very marked and already with prospects for further employment and GVA growth in 2021.

There are still some challenges in more accurately gauging how cluster purchasing activity supports employment and output in other parts of the Welsh economy, and to better elucidate: the types of employment supported in the cluster in terms of occupations; the numbers engaged in higher order functions such as R&D; the types of activity being supported in the higher education sector; and how far graduates from Welsh universities are finding opportunities in the cluster.

1. Introduction

This short report seeks to examine 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* managed by UK Research and Innovation (UKRI). The consortium consists of partners including: Cardiff University (lead), Swansea University, IQE, SPTS, Newport Wafer Fab, Microchip, the Compound Semiconductor Centre, the Compound Semiconductor Applications Catapult, the Cardiff Capital Region (CCR) City Deal and Welsh Government.

In the Strength in Places (SIP) Fund application process Professors Max Munday and Robert Huggins, and Dr Annette Roberts were commissioned in May 2019 to analyse the evolution of the cluster since its genesis in 2015, and then to analyse how far the further development of the cluster, as supported by the CS Connected SIP funding application, would support activity in the regional economy, and meet the more persistent economic challenges facing the regional economy. As part of this work, the research team provided an estimate of the economic activity supported by the consortium partners in 2019.

To build on this earlier work, there is now a need to revise the economic baseline that was originally developed in 2019 and to update as far as possible to the fourth quarter of 2020. There is also a need here to update key contextual information in relation to the economic contribution of the sector, particularly in terms of output trends in the Welsh economy and overall export trends. Clearly the latter part of 2020 was suffused with uncertainty resulting from BREXIT, and then the impacts of the Covid 19 pandemic. As such a watching brief on regional economic conditions is critical to understanding the changing contribution of CSconnected participants. Moreover, the update to the contribution of the CSconnected consortium is needed because a series of KPIs for the project link closely to the economic fundamentals of consortium economic activity. These include:

- KPI 1 Direct employment in core cluster firms and new inward investors
- KPI 2 Exports of cluster firms
- KPI 4 Total gross value added supported by cluster activity directly and indirectly

In what follows the key economic contextual characteristics for the CSconnected cluster are updated to provide an estimation of the direct and indirect economic contribution of the cluster partners for the final quarter of 2020. It is important to stress that the report is in some cases based on estimated data, with employment in the cluster partners changing quickly, and with some related economic information from published sources lagging current events by around one year. Any assumptions needed for the analysis are made clear within the report.

The next section provides an update on the regional economic context surrounding cluster development in 2019 and 2020, with the third section providing a revised estimate of the direct and indirect economic activity in Wales supported by cluster activity. The final section concludes with some potential avenues for deepening the impact reporting in future periods.

2. Regional Economic Context

2.1. Introduction

This section of the report focuses on changes occurring in the Welsh economy during 2020, in the period running up to the award of the funding. The second part of this section examines the economic information appertaining to the broad economic sectors in which CSconnected activity occurs i.e. standard industrial classifications (SIC) 26 and 27, manufacture of computer, optical and electronic products, and manufacture of electrical equipment.

2.2. General economic context in Wales in 2020Q4

This section develops some basic regional economic context for the period during which the SIP funding was awarded. This is necessary because economic conditions during 2020 are likely to have some impact upon the future achievement of KPIs for the CSconnected project.

The damage done to UK and Welsh economic activity during 2020 was unparalleled with heavy reductions in national and regional household and business consumption. There is some variation in the scale of economic contractions expected by many of the national and international forecasting groups. For example, the IMF forecast by the end of 2020 a 4.4% contraction in the UK economy¹ and with the OECD predicting a 4.2% 2020 contraction of global GDP and an increase of the unemployment rate in the 37 OECD countries from an average of 5.3% in 2019 to 7.2% in 2020.²

In spite of some improvements to the UK economy in the third quarter of 2020, UK GDP was still down by almost 10% in the year to 2020Q3 with very few industries being unaffected. Unfortunately at the time the SIP grant was awarded a set of new lockdown restrictions were being put into place in 2020Q4 which would mean a slow economic start to 2021.

Strong government intervention via, for example, the Coronavirus Job Retention Scheme, and in Wales through the Economic Resilience Fund, helped to stem some of the worst impacts of the crisis. However, in Wales, unemployment in 2020Q3 grew to 4.6%. In October 2020 around 114,000 people in Wales claimed unemployment-related benefits (7.5% of the workforce)³, down from 120,000 in July 2020. On 1st October 2020, the Welsh areas with the highest proportion of working age people claiming either job seeker's allowance or universal credit were Newport (7.6%); critically this being an area where much of the CSconnected industrial activity is based.

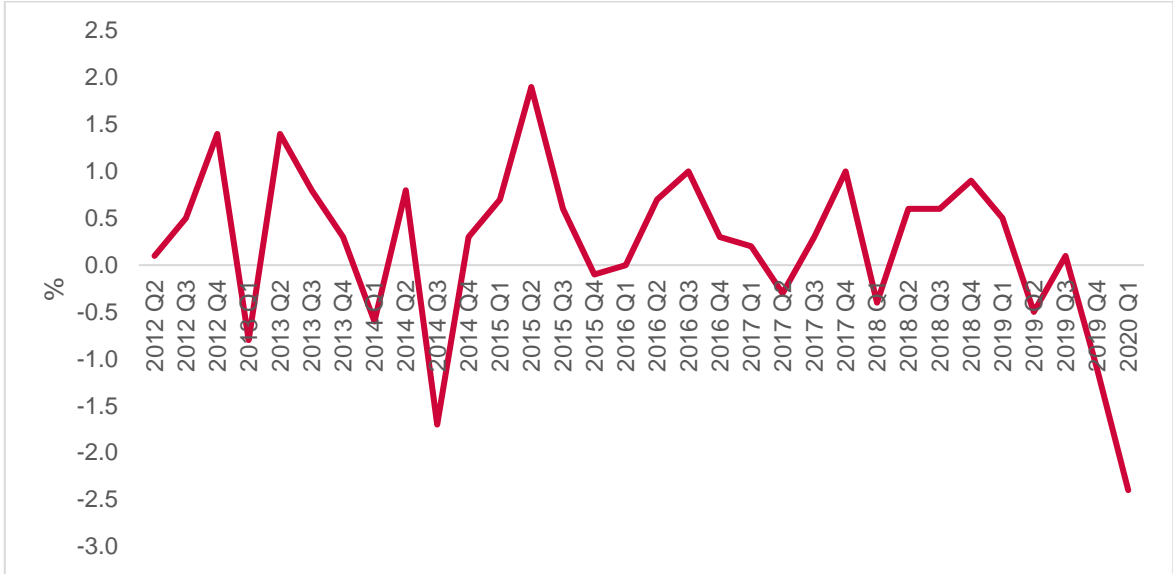
¹ IMF (2020) World Economic Outlook, October 2020: A Long and Difficult Ascent <https://www.imf.org/-/media/Files/Publications/WEO/2020/October/English/ExecSum.ashx>

² <http://www.oecd.org/economic-outlook/>

³ Experimental statistics. Data for October 2020 is provisional.

The very early impacts of the pandemic were captured by the quarterly (experimental) GDP estimates for Wales. The latest available figures, for 2020Q1 (Figure 1), showed a quarterly decline of 2.4% (similar to England and Scotland)⁴, capturing the initial effects of the lockdown in March 2020. However, there was strong evidence that Wales was already entering a period of slower growth prior to Covid-19. For example, Welsh GDP is estimated to have contracted by 1.1% in the quarter to 2019Q4 following a 0.1% increase in the quarter to 2019Q3. Overall GDP in Wales fell by 3.8% in the year to 2020Q1. These GDP figures, however, should be treated with caution, due to the volatility in these data. Moreover, further evidence of poorer conditions prior to the epidemic is found in the Welsh index of production which fell by around 5% in the year to 2020Q1.⁵

Figure 1. % quarterly change of GDP, Wales



Source: ONS

A key point of context from the above brief overview is that the CSconnected activity was starting during a period of real economic difficulty for Wales, with some evidence that the regional economy was slowing down even prior to the Covid 19 pandemic. However, as is shown later in this report (in Section 3), there is some evidence that the participants in the CSconnected activity were able to weather the economic storm comparatively well, maintaining employment and output through much of 2020, in spite of difficult economic conditions.

⁴ <https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/gdpukregionsandcountries/januarytomarch2020>

⁵ [Welsh Indices of Production and Construction \(2018=100\) by section and year \(gov.wales\)](https://gov.wales/welsh-indices-of-production-and-construction-2018=100-by-section-and-year)

2.3. Recent sector performance in Wales and trade activity

The majority of the compound semiconductor manufacturing activity in South Wales is within standard industrial classifications (SIC) 26 and 27. The prior report supporting the SIP bid revealed that there were around 10,500 employees in the Electrical engineering and equipment sector in Wales in 2017 (defined as SIC 26 - Manufacture of computer, electronic and optical products (around 6,000 employees), and SIC 27 - Manufacture of electrical equipment (around 4,500 employees)).

The most recent figures available for employment in these two sectors are from the ONS *Business Register and Employment Survey* and reveal that employment grew from 10,500 in 2017, to an estimated 13,000 in 2019. This represented employment growth of 24% across the sector at a time when manufacturing in Wales was under pressure as a result of uncertainty over Brexit. It is too early to come to conclusions about how far these employment levels were maintained in 2020, but there is some evidence that up until the end of the second quarter in 2020, output in Computer and Electronic Products in Wales was being maintained at a level close to that existing before the Covid-19 pandemic.

It is acknowledged that the sectors SIC 26-27 Manufacture of computer, electronic and optical products, and SIC 27 - Manufacture of electrical equipment are quite broad. However, it is important to note that the elements of SIC 26 in which firms such as Newport Wafer Fab, IQE and Microchip operate (i.e. SIC 261 Manufacture of electronic components and 262 - Manufacture of loaded electronic boards) saw employee growth of 34% 2018-2019 from 1,750 to 2,350 people.

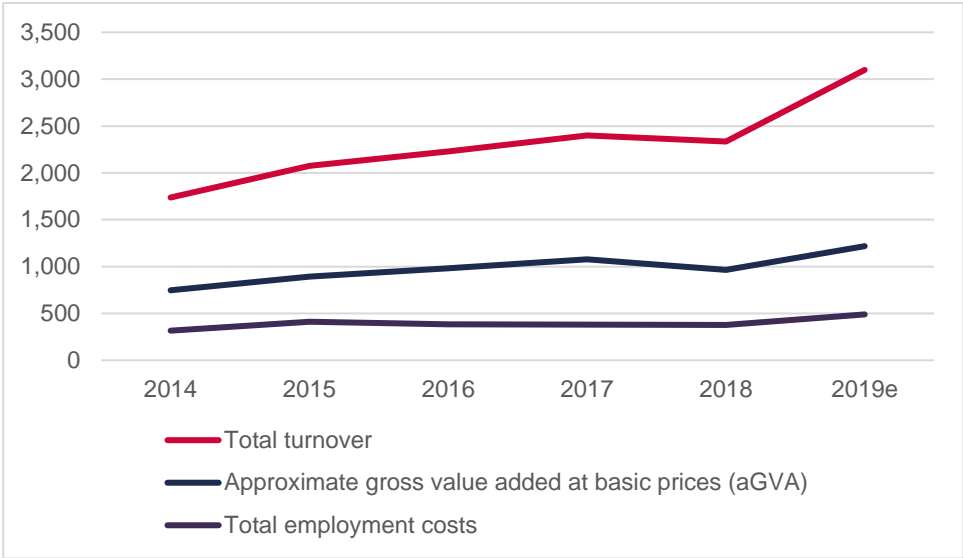
Further updates of economic activity in SIC 26-27 reveals that:

- GVA for the sector (SIC 26-27) as a whole in Wales (see Figure 2) was around £1.1bn in 2017, falling to 0.97bn in 2018, but then an estimated £1.2bn in 2019.
- The Electrical machinery, apparatus etc. sector⁶ (that includes IQE and Newport Wafer Fab) exported goods to the value of around £960m in 2019, and with the value of exports in this sector up from around £918m in 2017.⁷
- Output in the broad Electronic products sector has been maintained over the period 2018 to mid-2020 excepting a hike in output in the quarter immediately preceding Brexit (see Figure 3) but with output in Wales maintained at a higher level than for the UK as a whole, and evidence in Wales of a good recovery in sector output in 2020Q3.

⁶ Here defined as Standard Industrial Trade Classification (SITC) 76-77.

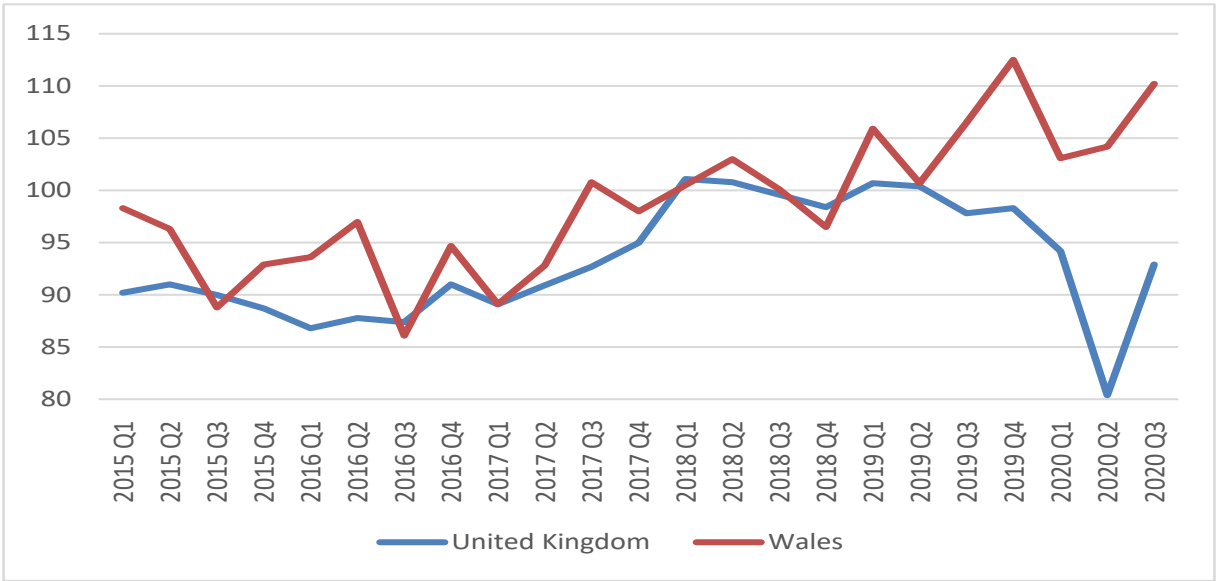
⁷ Derived from [Regional trade data table - UK Trade Info](#)

Figure 2 Recent trends in Sales, GVA and employment costs in SIC 26&27 Electronics, Computing and Optical Products, Electrical equipment in Wales (£m)



Note: 2019 figures are estimated, and 2014 figures for GVA.

Figure 3 Recent trends in Index of Welsh output in Computer and electronic products – 2018=100



Source: Derived from StatsWales

In summary the sectors in which CSconnected consortium operates appear to have, at the very least, maintained its base of economic activity in Wales at a time of great uncertainty.

3. CS Connected- Economic contribution of the consortia in 2020

3.1. Introduction

This section of the report provides an estimate of the economic activity of Wales supported by the consortium members as at the final quarter of 2020. For reasons of commercial confidentiality, data for individual consortium members is not reported, but rather information is presented for the group as a whole which includes: SPTS Technologies, Newport Waferfab, IQE, Rockley Photonics, Microchip, CSA Catapult, and CS Centre. The estimates also take account of higher education sector employment in Swansea and Cardiff Universities that are linked to the consortium activity.

It is important to note, in respect of this section, that figures for gross value added supported are estimates. While data was available from the industrial partners in respect of employment and output, direct GVA in this report has been estimated using Welsh average GVA per full time equivalent employee for specific sectors derived from sources including the ONS *Annual Business Survey* and the *Business Register and Employment Survey*. The derived estimates take into account that GVA per full time employee in the consortium will vary by industry, for example with developed GVA per FT 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.

Finally, this section also provides an estimate of how far the activity of the consortium members supports other activity in the Welsh economy through their supply-chains. This analysis was assisted by information provided by consortium members in respect of their purchasing patterns, in particular information in respect of which firms are able to purchase in the region. Clearly, the most important aspect of local purchasing is labour inputs, with the consortium activity providing wages and salaries that are spent in the local economy, and which themselves support economic activity indirectly.

To estimate the indirect (or multiplier) consequences 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 then 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 et al., 2010).⁸

⁸ https://www.cardiff.ac.uk/__data/assets/pdf_file/0010/698869/input-output-tables-2007-final-30-6.pdf

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 tables. Multipliers used were adjusted to take account of features of the specific firms in the cluster and with analysis also incorporating information from the firms showing their local purchasing linkages (and the direction of their sales).

3.2. Impact headlines: direct effects

In the final quarter of 2020 the compound semiconductor cluster employed an estimated 1,407 full-time equivalent employees. Importantly, the vast majority of employment provided by the cluster is full-time as opposed to part-time. Indeed, it is estimated that less than 100 of the employment opportunities offered by the cluster were part-time in nature.

Importantly, total cluster employment has been maintained during a period of real economic difficulty for Wales, particularly in the manufacturing sector which has seen some large closures and rationalisation announcements. In this respect, cluster employment was estimated at 1,347 in 2018 and 1,483 in 2019. The 1,407 estimated for 2020Q4 is expected to rise in 2021 in connection with already announced plans at several of the consortium partners including Newport Waferfab.

The estimated gross value added per FTE within the compound semiconductor cluster firms ranges from around to £56,000 to £119,000. These estimates are likely to be conservative. The average GVA per FTE in Wales was estimated at around £32,000 in 2019, and for manufacturing as a whole in Wales around £74,000. Higher levels of GVA per employee in the compound semiconductor cluster are linked to relatively high earnings. For example, an analysis of Companies House data for six members of the consortium revealed that there were wages and salaries (excluding social security and pension costs) **of £50.4m for their last financial year, being paid to around 1,100 employees and with an average of close to £45,500.** The *Annual Survey of Hours and Earnings* for Wales in 2020 reported that average Welsh yearly earnings were around £28,000.⁹ Then average earnings in the cluster are around 60% higher than the Welsh average.

The GVA directly supported by the cluster of firms and institutions is estimated in the year to 2020Q4 at £121.3m. This means that average GVA per FTE within the cluster is around £86,200.

It is useful to contextualise these numbers in terms of the GVA generated by all Welsh manufacturing. The latest available data for 2018¹⁰ reveals that Welsh manufacturing generated some £11bn of GVA and the Computer, electronic, optical and electrical engineering parts of Welsh manufacturing generated £1.46bn of GVA. **In this context the compound semiconductor cluster is likely to account for around 1% of Welsh manufacturing GVA and around 8% of GVA in the more tightly defined electronic and engineering sector.**

Total sales of the CSconnected industry partners in 2020 were an estimated £439m.

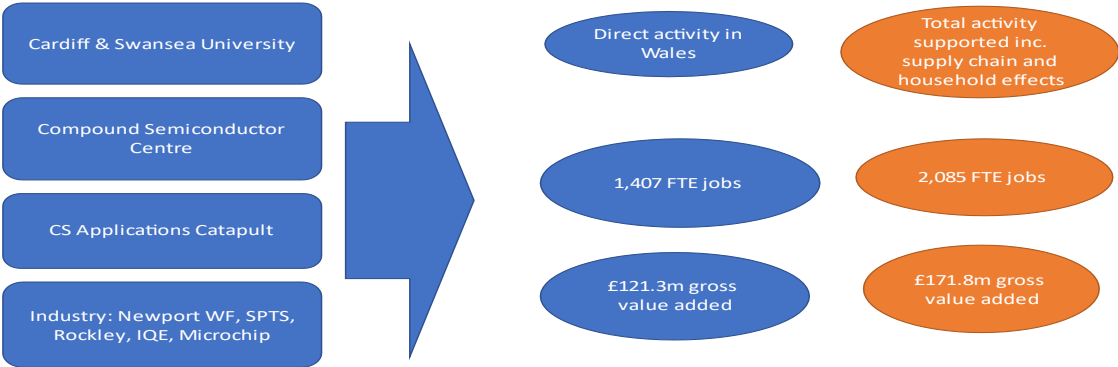
⁹ [Average \(median\) gross weekly earnings by Welsh local areas and year \(£\) \(gov.wales\)](https://gov.wales/average-median-gross-weekly-earnings-by-welsh-local-areas-and-year/)

¹⁰ [Gross Value Added in Wales by industry \(gov.wales\)](https://gov.wales/gross-value-added-in-wales-by-industry/)

Exporting activity dominates industrial partner sales, with limited sales of products in either Wales and or rest of UK markets, and with the strong export performance evidence of the competitive advantage of the cluster. It is estimated that over 90% of industrial partner sales are overseas exports.

The CSconnected project aims to increase the embeddedness of the compound semiconductor firms in the regional economy and, as the analysis above indicates, consortium members directly support around £121.3m of GVA and 1,407 full-time equivalent employees. Each cluster member varies in how far it supports activities in local providers of goods and services in Wales, and clearly an expansion of indirect economic effects caused by consortium member regional spending will work to reinforce the importance of the cluster.

Figure 4 Economic activity supported by the Compound Semiconductor Cluster (2020Q4)



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 the cluster firms, the estimates of GVA/employee were informed by GVA estimates for Wales in the industries to which the cluster firms belong (SIC 26, 27 – see <https://www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalandrealregionalgrossvalueaddedbalancedbyindustry>) and overall Welsh employment estimates in these same industries. Estimated from 2015-2018 data in the Annual Business Survey. 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, but with the multiplier effects through wage spending higher because of the relatively high wages and salaries paid in firms in the cluster.

Using the framework of Welsh Input-Output tables it is estimated that the cluster, through its purchasing of regional goods and services, and its payment of wage incomes, supports a further £50.5m of GVA in the Welsh economy. Put another way, for every £1m of GVA directly generated in the cluster, a further £0.42m of GVA is supported elsewhere in the regional economy. Overall this results in the cluster supporting directly and indirectly an estimated £171.8m of Welsh GVA.

Similarly, while the cluster directly supports 1,407 FTE jobs, it supports an estimated further 678 FTE jobs through its purchasing and payment of wages and salaries i.e. every 1 FTE job in the cluster is connected to an estimated 0.48 of an FTE job elsewhere in the Welsh economy. In total, therefore, the cluster in 2020 could be associated with as many as 2,085 FTE jobs in Wales.

The overall economic contribution is summarised in Figure 4 above.

4. Better understanding the impact of the CScconnected cluster

While this report provides elements of the economic baseline for the compound semiconductor cluster, this is also an opportunity to consider how the economic impact agenda for CScconnected might evolve further through 2021. Currently much of the economic impact analysis is focused on employment, gross value added and exports. While these are important indicators of progress of the cluster, elements of the impact research might be deepened in the following ways.

First, the analysis of supply chain effects linked to main industrial players is a modelled exercise with assumptions based upon materials provided by the firms about their local purchasing. In consequence the approach adopted is reporting on average supply chain effects in the whole of the industry, and this may not identify the richness of some of the supply chain linkages being developed. For example, some of the supply chain being developed may be providing particularly high productivity jobs or specific high value activity which is missed in the modelling exercise. The research will seek to explore more details of the purchasing linkages of the industrial partners in the coming year.

Second, the analysis in this report focuses on aggregate employment created directly and indirectly but with little indication of the quality of employment beyond the estimation of the gross value added connected with each job. Here there will be a challenge to examine the occupational diversity offered by the industrial partners, but also to understand more about the qualifications base and the numbers involved in different parts of the research, development and innovation process.

Third, and similarly, the economic evaluation team will need to understand more about the employment being supported in Cardiff and Swansea Universities (and perhaps others) in connection with the cluster development. The connections between different schools and the industrial partners will be mapped, to further to examine the distribution of higher education staff between senior academics, research associates and PhD staffs. It will also be useful to explore the extent to which graduates from the consortia's higher education colleges are finding employment opportunities within the industrial partners.

Finally, the economic evaluation package will be seeking to develop case studies of impact through 2021-22, and with this reflecting the fact that the value of the CScconnected activity cannot be understood in terms of quantitative analysis alone; particularly in relation to the development of new networks, skills development, international links, and the role of the cluster in the development of marketing Wales as an industry location for advanced high value added economic activity.



Cardiff Business School
Ysgol Busnes Caerdydd

Welsh Economy Research Unit

Cardiff Business School

Cardiff University,
Aberconway Building,
Colum Drive,
Cardiff CF10 3EU

For enquiries or to find out more please get in touch:

<https://www.linkedin.com/company/welsh-economy-research-unit/>

<https://twitter.com/CUWERU>