Welsh Economy Research Unit
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CSconnected
Strength In Places Fund

CSconnected: What are the supply chain development opportunities in the CS cluster?

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This case report was written by Max Munday, Rob Huggins, Mark Lang & Annette Roberts at Cardiff University.

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Case summary

This is the fourth in a series of case studies to support the CSconnected Strength in Places Fund (SIPF) project, funded by UK Research and Innovation.

One of the main ways through which the compound semiconductor (CS) cluster in Wales links through to local and national economic development opportunity is through its purchasing of goods and services in the economy. Buyer-supplier partnerships are a means of supporting employment and gross value added but have an equally important role in spreading new ideas and knowledge from high technology businesses in the semiconductor sector through to their suppliers. In this report we seek to answer the following questions:

- How might Welsh and UK suppliers benefit from linkages with the CS cluster in South Wales?
- What is the expected scale of the opportunity for Welsh and UK suppliers?
- How might recent shifts in policy at national and international level link through to new supply chain opportunities?
- What are the broad scenarios of future change in respect of the purchasing and sales behaviour of the CS cluster of firms?
- What types of interventions might encourage a higher degree of local buyer-supplier partnerships in the cluster?

We show in the report that there could be significant economic benefits for those local and UK firms that are able to work with the international firms in the CS cluster in South Wales, not least in terms of productivity uplift and their own integration into global value chains. We show that there is extremely strong competition in the current geo-political environment to retain as much value added in the semiconductor supply chain in the domestic economy. Changes in international trade patterns and policy towards the semiconductor sector could provide opportunities in the domestic supply chain.

While the CS cluster in South Wales makes a significant contribution in terms of employment, exports from Wales, locally focused R&D spending and Welsh productivity growth, there are limits to what these firms can buy in the local Welsh, or indeed wider UK, economy. Moreover, to date the businesses in the cluster do not tend to trade with one another although they do collaborate in terms of research and development projects. However, the case material considered suggests that there is an opportunity to increase local purchasing of goods and services, and with the prospect that as the cluster grows that there will be more investment in the supply chain resulting from the investment of existing firms through to the attraction of new inward investors. The case material in the report revealed the advantages for local and wider UK-based businesses of working with businesses in the cluster and beyond in terms of not just sales growth, but skills development and deepening of local manufacturing activity.

1.Introduction

This is the fourth in a series of case studies to support the CSconnected Strength in Places Fund (SIPF) project, funded by UK Research and Innovation.

One of the main ways through which the compound semiconductor (CS) cluster in Wales links through to local and national economic development opportunity is through its purchasing of goods and services in the economy. Buyer-supplier partnerships are a means of supporting employment and gross value added but have an equally important role in spreading new ideas and knowledge from high technology businesses in the semiconductor sector through to their suppliers. Similarly, businesses in the CS cluster also sell their goods and services to other firms in the domestic economy which is also a means of transfer of new ideas.

To date much of the output from the CS cluster is exported to foreign markets rather than other firms in Wales and the UK. However, the CS cluster does purchase significant amounts of goods and services in the Welsh and UK economy, and it is expected that the proportion of domestic purchases in total purchases will grow as the cluster grows. Opportunities will also develop because firms gain more knowledge of local opportunities, and with the prospect that suppliers, seeing the size of the CS cluster, might locate closer to serve its needs. This is the context for the fourth CSconnected case study with an emphasis on the potential supply chain benefits. Critical context here is that there has been quite limited attention given to the more general purchasing behaviour of semiconductor manufacturing activity in the UK and the potential for import displacement, and then the potential benefits of greater levels of local purchasing.

In what follows we seek to answer the following questions:

- How might Welsh and UK suppliers benefit from linkages with the CS cluster in South Wales?
- What is the expected scale of the opportunity for Welsh and UK suppliers?
- How might recent shifts in policy at national and international level link through to new supply chain opportunities?
- What are the broad scenarios of future change in respect of the purchasing and sales behaviour of the CS cluster of firms?
- What types of interventions might encourage a higher degree of local buyer-supplier partnerships in the cluster?

While our focus is on the CS cluster in South Wales, we are mindful that the conclusions here are relevant for the wider semiconductor industry in the UK. The remainder of this case is structured as follows.

First, we summarise literature that speaks to the structure and characteristics of the semiconductor value chain. We then connect this to a broader discussion around global value chains in terms of clusters of economic activity in regions, before turning to consider how we expect local and domestic suppliers to benefit from linkages with high technology businesses in the semiconductor sector.

Second, we consider recent changes in policy around the semiconductor sector in the UK and overseas and examine what this could mean in terms of opportunities in domestic supply chains around semiconductor businesses.

Third, we focus in on the CS case in Wales. Here we consider:

- The local and rest of UK purchasing patterns of the businesses in the cluster.

- The place of the CS cluster of firms in global value chains.
- The scale of the opportunity were businesses in the cluster to increase local purchasing of goods and services.
- Case material which reveals some of the benefits for local firms of working with high technology businesses in the CS cluster.

The final section of the report concludes with an evaluation of the expected CS cluster supply chain development future scenarios and implications for interventions in the space.

2. The Importance of Local Supply Chain Development

2.1 Introduction

The academic and policy research on global value chains (GVCs) has grown rapidly partly because of the strong growth of multinational enterprise activity over the last three decades. Research here tends to be multidimensional and inter-disciplinary (Kano et al., 2020). Studies have included the evolution of value chains, specific firm or industry studies, and impacts on firms and economies (see below). The policymaking interest includes concerns around value chain vulnerabilities, as well as how locations may capture a higher share of value chain activity and maximise the benefits of value chain participation (Miller, 2022; Yeung, 2022a, and see section 3). The general literature has been influenced by the recent history of the global semiconductor industry. This has increased as a result of the semiconductor shortages linked to the global economic shutdowns during the Covid pandemic and then the ongoing geo-political tensions and supply disruptions that have followed (Chandler, 2023).

In what follows the structure and characteristics of the semiconductor value chain are summarised. This is followed by an overview of some of the issues around global value chains, in terms of clusters and regions, as well as the related issues of multinational enterprises (MNEs), domestic firms and local economy impacts resulting from supply chain linkages.

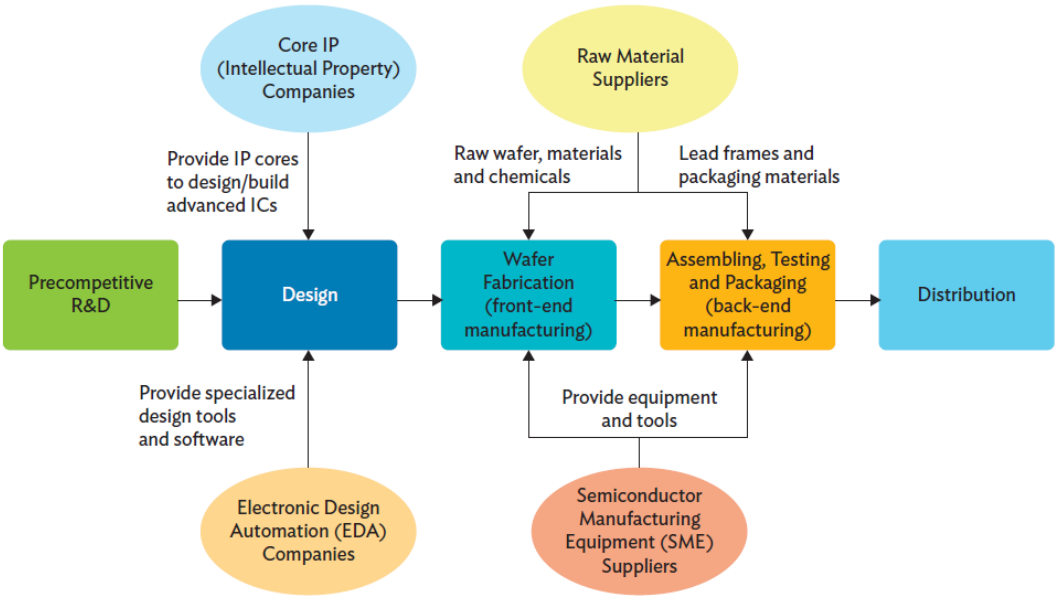
2.2 The semiconductor value chain

The value chain concept describes a set of activities, products and services linked together in a value-adding sequence. This concept, developed by Porter (1985), is based on a process view of organisational activity comprising sub-systems of activities which transform inputs into outputs. This concept has evolved considerably through time (Kaplinsky and Morris, 2020; Ricciotti, 2020).

Value chains have become increasingly globalised over recent decades and the value chains of different industries have been the subject of academic and policy interest, not least those involving the fast growth semiconductor sector[1]. The World Trade Organisation (WTO) note that ‘over the past two decades, the semiconductor value chain has evolved into one of the most global value chains’ (WTO, 2023, p141). Key elements of the semiconductor value chain are summarised in Figure 1. This structure separates the main activity stages in the central element of Figure 1 into R&D and design, and then wafer fabrication, assembling, testing and packaging, followed by distribution. Around these key stages are inputs of other activities, equipment, materials and services.

[1] The related concept of global production networks (GPN) is acknowledged, but not fully explored here. The GPN concept has however been explored in relation to semiconductors (see Yeung, 2022b, 2024). The developments within the CSconnected cluster are potentially too nascent to effectively operationalise this concept, but this is an ongoing consideration.

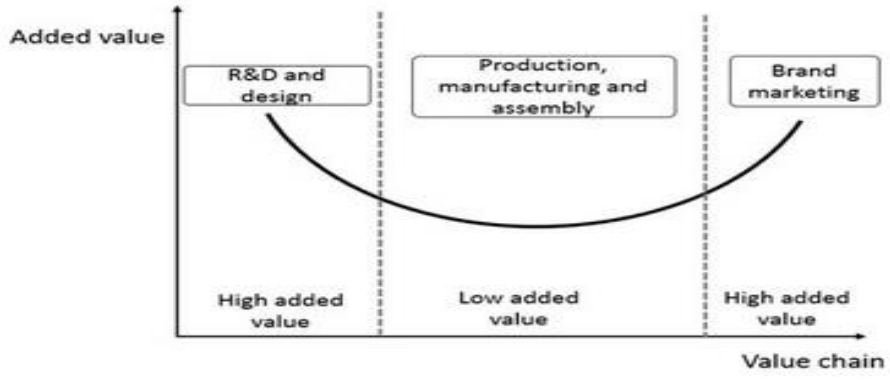
Figure 1: The basic structure of semiconductor value chains



Source: WTO, 2023, Chapter 4, p137, Figure 4.1 (Original Sources: Adapted from SIA (2016: Figures 1 and 2); Capri (2020: Graph IV); and BCG and SIA (2021: Exhibit 4).

Within the global value chain (GVC) literature has been a suggestion that value creation becomes concentrated at the upstream and downstream ends of the value chain. This leaves the 'middle' of the chain, comprising repetitive manufacturing and logistics with limited value creation and capture (see Figure 2). This pattern was reported to have been first recognised by Stan Shih of Acer in the early 1990s, in relation to the personal computer industry. Since then, the concept of the 'smile curve' of value creation has been investigated through empirical studies of industries and economies (e.g. Shin et al., 2012, Meng and Ye, 2020, Baldwin and Ito, 2021). The broad 'smile' concept is contested with the manufacturing element of the semiconductor industry seeing a larger share of the value added in the total process. For example, Holmström et al. (2021) suggest that due to the greater role of production intensive segments, and the re-investment of profits in this section of the semiconductor value chain, that the smile is potentially less evident in this sector, (a 'smirk' see Rehnberg and Ponte, 2018) and may also be similarly so in other technology industries.

Figure 2: Smile curve example



Source: You and Yang, 2022.

Ciani and Nardo (2022) show that within the semiconductor industry, the production chain is dominated by a small number of countries, but with no country having control over the entire chain. This research, which investigated the position of the EU in the value chain found that 'almost 80% of suppliers to European firms operating in the semiconductor industry are headquartered outside the EU'. In addition, the research found that EU companies in this industry have less than 40% of their customers in the EU. At the global level, when investigating vulnerabilities in the semiconductor supply chain, the industry was found to be 'geographically highly concentrated, with the top-5 semiconductor-producing economies accounting for around three-quarters of global value-added' (Haramboure, et al. 2023).

2.3 Clusters, regions and global value chains

Clusters have long been recognised as the source of regional and or national economic growth (Harris, 2021). This work, partly linking back to Porter (1998) explains how related and supporting industries co-locate within clusters, and how this stimulates knowledge spillovers and innovation for cluster firms, and benefits for the host economy in relation to entrepreneurship, innovation and job creation (Ryan and Giblin, 2012). When studying clusters in the US semiconductor industry, Ketelhöhn (2006) found results consistent with Porter's cluster theory. In particular, co-location between buyers and suppliers was linked to higher levels of industry innovation. This is an important issue for the development of the CS cluster in Wales in that within the clusters to date, while there has been technical and research collaboration, the firms do not trade with one another.

Other research has expanded the boundaries of the linkages studied, including investigation of the potential impacts of the connections outside of immediate buyer-supplier connections. For example, Villena et al. (2023) investigate the role of 'close ties to the partner's partners.' They found that connections to one's partner's partners could have both positive and negative impacts on the realisation of benefits, depending on factors such as buyer dependence.

Research has then established that firms 'increasingly set up formal linkages with firms outside of the geographical cluster to hook on to the global production and innovation system' (Hervás-Oliver et al., 2008; Turkina et al., 2016). A more integrated framework can connect industrial districts, clusters, and value chains (De Marchi et al., 2018). For example, research from the automotive industry suggests that GVCs are 'nested structures' with activities organised within clusters within national production systems which join together and constitute the industry at a global level (Sturgeon, 2008).

These types of considerations have also been generalised to consider a network view of industrial clusters (Bathelt and Li, 2014; Turkina et al., 2016), where networks of firm linkages within a cluster are embedded in a larger global cluster network. Linking to the smile curve concept, the impacts for firms and regions of participating in GVCs may then depend on that firm or region's position in the GVC. In addition, research examining the role of regions in GVC in the EU suggests that the role of an individual region in the global value chain is affected by the behaviour of their neighbours, i.e. the behaviour of those neighbours influences the production structure of a specific region as well as the globalization level of its production processes' (Bolea et al., 2022). This research then identifies a spatial dependence between regions that impacts their participation and position in GVCs.

Furthermore, European regional analysis by Capello and Dellisanti (2024) found that regions with abundant scarce skills and natural resources are able to benefit most from GVC participation. This research mapped the European regions into headquarters, factory, primary resource and other regions, 'which engage with GVCs in markedly distinct ways and consequently exhibit divergent growth trajectories'. Capello and Dellisanti (2024) also note that these varying growth outcomes can exacerbate spatial disparities, suggesting a need for further research into the potential connection between GVCs and regional inequalities.

2.4 Multinational enterprises (MNEs) and host economy impacts

One of the main transmission mechanisms for the impacts of value chain participation on local firms is through their collaborations with multinational enterprises (MNEs) that operate at various stages in the value chain. MNEs are assumed to possess ownership advantages, including knowledge, which may then 'spillover' into host economy firms through their various interactions, either directly or indirectly. These impacts on domestic firms have been measured in terms of firm performance, including productivity growth (for example, Haskel et al., 2007).

Recent evidence on the domestic firm effects of joining MNE supply chains in Costa Rica, using an event study methodology, has shown there to be 'strong and persistent gains in performance' in domestic firms after supplying to a first multinational corporation (Alfaro-Ureña et al., 2022). Costa Rica has changed its development model in recent decades towards the promotion of multinational investment (Gov.UK 2018; Chacon et al, 2023), this has included the development of a free trade zone regime. The research by Alfaro-Ureña et al. also found that in the year they started supplying the MNE buyer, sales to other buyers decreased, possibly due to supply constraints. However, over time sales to other buyers expand. In addition, through a survey approach, this research found a series of other impacts, including 'better managerial and organizational practices, expansions in product scope with higher-quality products, and improved reputation'.

The potential impacts from the activity of multinationals have been recognised in some research as being conditional on a range of 'complementary conditions' in the host economic environment that may enable benefits to be absorbed by firms, regions and countries (Joo et al., 2022, Alfaro, 2017). Although the extent to which these impacts are conditional has been contested (Bruno et al., 2018). The host economy conditions include the extent and nature of the political and institutional structures, as well as market and sectoral structures. In addition, the benefits for the domestic economy connect to foreign direct investment (FDI) motivations, with higher gains from FDI motivated by 'strong technology-based ownership advantages' (Driffield and Love, 2007). The extent and nature of impacts from MNEs on domestic firms arising through transaction linkages may further depend on whether domestic firms are suppliers to, or buyers from the MNE. For example, Driffield et al (2002) suggest that MNEs may appropriate some of the productivity gains within their domestic suppliers, hence limiting the flow of externalities to these supplier firms. This may result from the larger size and market power of the MNE (see also Bénétrix et al. 2023 below).

Bénétrix et al. (2023) provide a useful summary of the issues related to the 'elusive link between FDI and economic growth' and find that this relationship has varied over time and across empirical/measurement methodologies. One possible suggestion for this finding is the 'GVC revolution that completely changed the nature of FDIs and their potential effects on economic growth' (p.3). This revolution may have two potential opposing impacts. The global nature of value chains may enable nations and regions to access and participate in that chain.

However, any spillovers may be limited as the MNEs are further enabled to organise production to keep lower value-added activity in poorer countries whilst using their stronger bargaining power to squeeze the profits of the domestic firms (Baltagi et al., 2015). A review of the range of potential costs and benefits of MNEs on host economies is provided in Munday et al. (2024a) together with a consideration of the 'transformation potential' of inward investment. In particular foreign capital may be considered to have the potential to upgrade existing clusters as well to enhance the interconnections between different clusters. This latter impact is particularly important in relation to GVCs which can been seen as networks of industrial clusters (see earlier).

2.5 Conclusions

A number of conclusions arise from the above review in respect of the operations of the CS cluster in South Wales. First the review suggests that the position of the manufacturing firms within global value chains could be an important determinant of the local economic consequences of their operations. Second, the review flags up that there could be significant economic benefits for those local firms that are able to work with the international firms in the CS cluster in South Wales, not least in terms of productivity uplift and their own integration into global value chains. Third, the involvement of international firms in the CS cluster is a potential means of linking the whole of CS cluster activity (including that undertaken with the higher education sector) to other global clusters of expertise in the sector. Finally, and with this providing context for the next section of the case, there is likely to be extremely strong competition in the current geo-political environment to retain as much value added in the semiconductor supply chain in the domestic economy such that changes in international trade patterns could provide opportunities in the domestic supply chain to the semiconductor sector (Peters, 2022).

3. National Strategies and Semiconductor Supply Chains

3.1 Introduction

Building on the analysis in Section 2 of this report, we next consider the links between the fast moving policy agendas in respect of the semiconductor sector and links through to implications for supply chain development.

3.2 Context

There are two main perspectives emerging in policy and legislative agendas across the world regarding semiconductor supply chains. The first, and by far most prevalent, perspective is concerned with how to reduce supply chain vulnerability in the context of the highly globalised model of semiconductor production that has developed. Indeed the last five years has seen some significant shifts in investment flows in the sector, with for example, Taiwanese semiconductor makers investing in the USA, and then with issues arising for them because of an inadequate supply side to service large FABs (Taipei Times, 2021). The second, and less clearly articulated, perspective is concerned with how, and to what extent, can those locations with existing or proposed semiconductor industries capture a greater share of the upstream and downstream supply chain within their regional economies. These two perspectives are not mutually exclusive and may, indeed, be supportive.

Traditionally, semiconductor firms have tended to evolve in locations with pre-existing industrial ecosystems and complexes that fulfil certain basic requirements (for example, stable energy and water supplies, sufficiently skilled labour forces, and appropriate infrastructure and transportation networks) (Gordon and McCann, 2000). Increasingly, these basic needs are seen as essential but insufficient requirements, as firms are progressively looking toward sustainability concerns (for example, by ensuring their energy supplies are met through renewables), supply chain security, and more significant levels of subsidies (McKinsey and Company, 2023). Also relevant for semiconductor firms here is a stable and enforceable IP regime.

These considerations are important, particularly for regions looking to grow their appeal to semiconductor investments, as they have potentially significant economic impacts. These impacts expand well beyond direct employment within the semiconductor industry, to include wider regional supply chain employment, higher rates of regional R&D, and increased local gross value added generation. Indeed these types of considerations are at the heart of attempts in South Wales to encourage the development of the CS cluster. So in South Wales, for example, where there are some existing strengths in technology companies and/or ambitions to improve numbers of high technology companies, particularly where companies are likely to benefit from areas of future growth such as the Internet of Things and robotics, then a stronger regional presence in semiconductor industries might bring more significant regional economic benefits (Gordon and McCann, 2000).

The following sections highlight some of the various national semiconductor strategies and acts introduced over the last two years and, in particular, what actions have been proposed to support supply chain resilience. Although the US Chips Act has perhaps had the most significant global impact in this regard, other national and EU strategies have been launched, and these are also considered within this section. Alongside those considered here, a range of other countries - including Taiwan, Japan, South Korea, India, Malaysia, the Philippines, Singapore, Vietnam, and Thailand - have introduced their own chips acts, strategies, and incentive packages. Collectively, therefore, there has been a substantial global increase in legislative and other government initiatives focused on semiconductor supply chains over the last two years.

3.3 The UK National Semiconductor Strategy

The UK's strategic response to semiconductors is focused largely on chip design (see Figure 1 and Figure 2 in Section 2 on where such activities sit in the semiconductor value chain). In comparison with the level of financial intervention occurring elsewhere the UK's has been modest.[2] The UK government's national semiconductor strategy, published in May 2023, offers the UK semiconductor ecosystem (including higher education institutions) a share of up to £1bn over the course of the next decade.[3] In context the average cost of constructing and equipping a single new fab is estimated to be around US$10bn (McKinsey and Company, 2023); however, the costs associated with constructing a CS Fab are significantly less at around an estimated $300-$400m and with continued opportunities for the UK in the CS manufacturing space. The UK government is also seeking to target investment on chip design, where it believes the UK also has a particular strength. This might be perceived as a 'low hanging fruit' as interventions in design might be relatively cheap to implement.

At its core the UK National Semiconductor Strategy has three central goals, these are:

- 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'. (DSIT, 2023)

[2] The fragility of parts of the UK semiconductor sector were underlined in 2024 by problems at Coherent in the North of England caused by the loss of Apple as a client. See Apple changes leaves UK microchip plant facing bleak future | Euronews

[3] See DSIT (2023) National Semiconductor Strategy - CP 838 (publishing.service.gov.uk). Note 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%. It has strengths in core intellectual property, research and development, fabrication of compound and advanced material semiconductors, and packaging design and development. *See*: Alsop T (2023) and House of Commons Business, Energy and Industrial Strategy Committee (22 11 2022).

On the issue of supply chain resilience, the Strategy suggests that the UK '…will need to work domestically and internationally to improve resilience of [chip] supply'. The Strategy states '…the best way to build better resilience in supply chains will be through international action. Building international resilience will require a greater geographical spread of manufacturing across the range of semiconductor technologies…'. The UK's strategy does not, however, fully explore how the UK's national or regional economies might better integrate with, or benefit from, the semiconductor supply chain, although it is noted that research is being undertaken on this issue.[4] Instead, the focus appears to be on wider global resilience. Moreover, and important for this report, there is limited attention given to the more general purchasing behaviour of semiconductor manufacturing activity in the UK and the potential for import displacement, and then the potential benefits of greater levels of local purchasing.

3.4 The EU Chips Act

The aim of the EU Chips Act, introduced in April 2023, is to double Europe's current 10% share of the global semiconductor market by 2030 and to help ensure the EU's future supply resilience and technological leadership in semiconductors (European Chips Act, 2023). The plan covers the entire semiconductor value chain, and it is supported by an estimated $47 billion in public and private investment (House of Commons BEIS Committee, 22.11.2022, p. 17).

The EU Chips Act has five strategic objectives, these are:

- Strengthening research and technological leadership.
- Building and reinforcing Europe's capacity to innovate in the design, manufacture, and packaging of advanced chips.
- Putting in place an adequate framework to increase production by 2030.
- Addressing the skills shortage and attracting new talent.
- Developing an in-depth understanding of global semiconductor supply chains.

The EU's objectives, it anticipates, will be achieved through three pillars of action, including: the establishment of a European Semiconductor Board; a framework to ensure the security of supply and resilience by attracting investments and enhance production capacities; and a Chips for Europe Initiative. The initiative, in particular, aims to support large-scale technological capacity building and innovation within the EU and to enable the development and deployment of cutting-edge, next generation semiconductor and quantum technologies.

Even though some commentators have suggested that Europe lacks sufficient existing supply chains to support significant increases in capacity, in the period since the EU's initiative was first agreed there have been signs of new inward investment, and, consequently, the development of chip capacity in Europe appears to be proceeding (FT, 10.10.2023). The Chips for Europe Initiative also contains a Chips Fund, which is designed to support start-ups, scale-ups, SMEs, and small 'mid-caps' within the EU, and therefore help to maximise the regional economic impact of semiconductor supply chains. This, perhaps, signals the EU's desire to grow indigenous regional economies to help support its semiconductor ambitions.

[4] See Institute for Manufacturing IfM News and Features (cam.ac.uk)

3.5 The US Chips Act

The semiconductor sector accounted for US$62.1bn of US exports in 2022 (Semiconductor Industry Association, 2023, p. 23) and has become a key economic priority for the Biden administration. Since the enactment of the Chips and Science Act in 2022, the US Commerce Department has issued successive guidance that seeks to restrict expansions of semiconductor manufacturing in 'countries of concern' (including China, Russia, and Iran), as well as engagement with 'entities of concern' (for example, some Chinese owned companies) over joint research and technology licensing (Nikkei Asia, 6.11.2023).

One of the most significant initiatives resulting from the Chips Act has been the introduction of a 25% advanced manufacturing investment tax credit. There are clauses, however, that would seek to recapture such credits from companies that subsequently make investments in China (Nikkei Asia, 6.11.2023). In addition to the tax credit, the package of financial incentives is reported to amount to US$39bn for companies that invest in semiconductor projects in the US, as well as an additional US$13bn to support semiconductor research and development (Semiconductor Industry Association, 2023b).

A major impetus behind the Chips Act, and subsequent initiatives, has been to improve security of chip supply. This helps explain, in the context of growing geopolitical tensions, the implicit concerns relating to so called 'countries of concern'. There are, however, also more domestically grounded economic motivations that lie behind the Biden administration's focus on the semiconductor industry. The semiconductor industry has a significant economic footprint in the US, employing around 345,000 people across 49 states, and, in addition, the sector also supports a considerably higher number of US jobs (estimated at 2.3m in 2022) either through upstream and downstream supply chains in the semiconductor industry or through wage spending (Semiconductor Industry Association, 2023b).

Notwithstanding issues of supply chain security, the strategy of the US, particularly when seen alongside its other recent intervention, the Inflation Reduction Act, has been aimed squarely at mitigating the growing deindustrialisation in some of its most deprived communities. Since the introduction of the Chips Act, the total value of US-based semiconductor projects underway or announced has been estimated at between US$223bn and US$260bn by 2030. Much of this is centred on fab construction, including in areas that have not traditionally attracted high levels of semiconductor industry investment, such as Ohio and Indiana where Intel and Skywater are now expanding.

Currently, the US only manufactures around 12% of the global chip production, and none of the most advanced types (McKinsey and Company, 2023). The Chips Act allocation of over US$50bn seeks to redress this. Much of the US' incentives, it is suggested, are focused on businesses that already assemble products in the US, and which the Biden administration is thus seeking to incentivise the movement of production into the US as well (FT, 13.7.2023). This, it would appear, demonstrates the US strategy to localise (or at least domesticise) a far greater share of semiconductor supply chains, in order to bring regional economic benefit to some of its otherwise deindustrialising areas, as well as being concerned with wider geopolitical security concerns.

3.6 Conclusions

Our review of policy here has focused on Europe and the USA but with many countries setting their stalls to attract greater parts of the semiconductor value chain. The section highlights the role of different types of incentives to encourage international capital but with the associated danger that capital in the semiconductor industry could be lured to places with an inadequate supply side of skills and supply of goods and services.

Moreover, this section shows that there tends to be a focus on the value chain links in semiconductors from design to final consumption of products, but with rather less focus on who supplies what at discrete parts of the value chain. The existing focus tends to take a macro or holistic approach by addressing the value chain in full, rather than examining particular segments or relevance to certain clusters, regions, or nations. As discussed in section 2, this latter is important for the CS cluster in South Wales where we argue it is an identifiable part of global value chains but with to date limited linkages back into the Wales and rest of UK economy, but then with scope for development here.

4 CS Cluster in Wales

4.1 Context

This section of the report seeks to examine the scale of the opportunity in Wales from increasing local purchasing from the CS cluster. There are a series of points of context before progressing.

First, in a prior case developed for CSconnected, it was shown that inward investors in the CS cluster (see Figure 3) scored well on several indicators of regional embeddedness, not least in terms of their productivity, salary levels, R&D intensity, and the linkages they possess with regional institutions and higher/further education colleges (Munday et al, 2022). Notwithstanding, in terms of genuinely local buyer-supplier linkages the record is not as strong. This is not surprising given the small size of the Welsh economy set against the specific input requirements of firms in the CS cluster. Indeed, as shown later in this section, many of the firms in the cluster are unable to purchase high levels of inputs in the wider UK economy either. It is noted that developing the local supply side for the CS cluster (in terms of both goods, services and skills) is an important part of the UKRI CSconnected initiative.

Figure 3 CS Cluster Commercial Organisations

Organisation	*Area of production/services*	*Date of establishment in S.Wales*
KLA U.K. (SPTS Division)	The design, manufacture and distribution of specialised equipment used by the group's customers to produce semiconductor related devices.	1982
Microchip Technology Caldicot Limited (US)	Development, manufacture and marketing of semiconductor integrated circuits.	05/10/1961
IQE plc	The manufacture of advanced semiconductor materials. Research, development, manufacture and sale of advanced semiconductor materials and related proprietary technology.	09/03/1987
Vishay International (US) previously Nexperia Newport Limited (PRC)	The development, manufacture, marketing and sale of semiconductor devices for assembly.	14/08/1992
Rockley Photonics Limited (US)	Photonics supplier of integrated optical chips and modules across multiple markets. Key markets healthcare, wearables, and machine vision.	09/09/2013 in the UK
Microlink Devices (US)	Specializing in the design, development, and manufacture of advance solar arrays for spacecraft, aircraft, and terrestrial applications.	17/5/2019
Compound Semiconductor Applications Catapult Limited (UK)	Independent centre of expertise connecting researchers and the entire compound semiconductor supply chain within the UK with those business that can gain the most from using compound semiconductors in systems and devices in their end products.	28/06/2016
Compound Semiconductor Centre Limited (UK)	Builds on research undertaken at Cardiff University's Institute for Compound Semiconductors to develop innovative new materials technologies that will enable a wide range of new and emerging applications	9/9/2014

Second, the series of CSconnected *Annual Reports* on CS cluster developments and impacts[5] have identified the very limited trade between the CS cluster partners i.e. businesses in the CS cluster are not typically found within the direct supply chain of other cluster businesses. Once again, this situation might evolve quite quickly in the current geopolitical environment and is one of the objectives of the CSconnected initiative.

Third, in terms of local/Wales economic impacts from the activities of the CS cluster firms, the annual reports have also identified that a significant element of this relates to the local spending of staff, as much as it does to the spending of the cluster participants on goods and services. In this respect it is important to note that the Cluster is working to reinforce the labour supply side to the companies which could reinforce these spending effects. The cluster has a comprehensive workforce development strategy which embraces focussed post graduate training through to continuing professional development to school outreach. This type of focussed skills strategy has been seen by some as critical in expanding GVC participation (see Capello and Dellisanti, 2024).

Fourth, while the focus of this section is on the supply side to the CS cluster it is important not to ignore opportunities in terms of forward linkages i.e. who the CS cluster firms might sell to in the Welsh and UK economies, and hence how they may connect in with other clusters and value chains. Currently this opportunity is quite limited as the CS cluster firms typically export over 90% of their output (Munday et al, 2024b). This is not cited as an explicit weakness as the ability of the CS cluster to export internationally is a sign of competitive strength.

In what follows the nature of the opportunity in Wales and the wider UK economy from CS cluster firms growing their local purchasing of goods and services will be examined; then the local and UK spending patterns of firms in the CS cluster will be summarised before estimating the likely scale of the local purchasing opportunity. The section is then segued with some short cases which aim to exemplify the nature of opportunities for local and UK businesses.

4.2. The multiplier effects of increased local purchasing propensity

In each of the CSconnected *Annual Reports*[6] there is an estimate of the direct and indirect economic effects levered in Wales through the presence of the cluster. To estimate the indirect (or multiplier) consequences of CS cluster activity it is necessary to have a picture of the local or UK economy that specifies how the various industry sectors 'fit together' in terms of their trading relationships. This then allows the effects of activity in one sector (i.e. the CS cluster) to be traced through the entire local or UK economy.

Both Wales and the UK have Input-Output tables that provide a detailed financial map of the economy for a particular time period, typically one-year, and shows the flow of goods and services between industries, consumers and government. As well as being an important descriptive tool, the Input-Output tables can be used for economic modelling and for impact assessment. For example, in the 2023 Annual Report for CSconnected, the framework of Wales and UK Input-Output tables was used to show how each £1m of CS cluster GVA supported GVA in the wider Welsh and UK economies (Munday et al, 2024b).

[5] See Reports | CSconnected

[6] See Reports | CSconnected

However, the approach in the Annual Report series focuses on GVA and employment supported as a result of supply chain spending AND household spending (wages and salaries). The interest here is more in terms of what might be expected were there to be an improvement in local sourcing behaviour i.e. just supply chain leveraged effects.

Much of the activity in the CS Cluster in Wales is in Computer, electronic and optical products (SIC 26), and then Electrical equipment (SIC 27). A limited insight into how changes in the final demand for the products of these industries feeds through to input requirements from other UK industries in terms of their products can be derived from the UK Input-Output tables.[7]

Figure 4, for example, makes use of the UK Input-Output table framework and reveals that for the UK as a whole, for CPA 26, Computer, electronic and optical products, what the direct inputs per unit of output are on average for the sector. This shows that for this sector, 0.311 of inputs from the UK are required per 1 unit of output, of this 0.032 is from itself, 0.048 from computer programming and 0.11 of imports - it also shows 0.578 GVA (largely 0.426 of compensation of employees).

Figure 4 Direct UK and Other Input requirements per unit of output UK, 2020 for Computer, electronic and optical products (CPA 26)

Total SIC 26 direct inputs	1.000
Of which	
Computer programming, consultancy	*0.048*
Wholesale trade services	*0.041*
Computer, electronic and optical products	*0.032*
Other transport equipment	*0.015*
Electrical equipment	*0.013*
Legal services	*0.013*
Fabricated metal products	*0.012*
Retail trade services	*0.011*
Accounting	*0.010*
Other professional, scientific and technical services	*0.010*
Rubber and plastic products	*0.009*
Real estate services	*0.008*
Advertising and market research services	*0.007*
Warehousing and transportation	*0.007*
Other	*0.075*
Total direct inputs	0.311
Imports	0.110
GVA	0.578

[7] See UK input-output analytical tables: product by product - Office for National Statistics (ons.gov.uk)

Total SIC 26 direct inputs	1.000
Total	1.000

Derived from UK Input-Output Tables, 2020

Moreover in terms of variables such as total output and then gross value added, the UK Input-Output tables (Figure 5) suggest that each unit increase in UK total output of Computer, electronics and optical products results in an increase of 1.5 in the outputs of other UK products, and then each one unit of GVA associated with these products, supports 0.44 of a unit increase in GVA associated with other products. Figure 5 also shows comparable numbers for the Electrical equipment products group.

Figure 5 Multiplier Values (Type 1 Direct and Indirect effects divided by Direct Effects)

	Output	*Gross value added*
Computer, electronic and optical products	1.50	1.44
Electrical equipment	1.60	1.67

Derived from UK Input-Output tables 2020

The material in Figures 4 and 5 presents averages for the product groups concerned. There will be variations within each product group i.e. the manufacture of semiconductor products might vary in terms of direct and indirect product requirements from the average for Computer electronics and optical products. This noted, however, the material above reveals that the CS cluster of businesses could support the development of a wide array of products and services in the UK economy through their local purchasing. This would be separate from any impacts associated with the spending of the wages and salaries of employees.

4.3 CS cluster in Wales and UK Purchasing

As part of the Annual Survey undertaken with the Welsh firms and institutions that make up the CS cluster, the businesses are requested to list their main items of spending, and then the extent to which purchases are made in Wales, the rest of UK and then overseas. The quality of returns from the cluster members does vary somewhat and with a difficulty that some firms may purchase goods in Wales, for example through local wholesalers, but these same goods are made elsewhere in the UK or overseas (see also below).

The analysis of the annual survey returns for 2023 suggests that the total level of sales of the cluster firms is around £560m, and with gross value added supported of around £265m. A corollary here is that the total value of goods and services purchased is in the order of £300m. The company returns suggest that:

- There is no overall pattern to local purchasing, with the average local sourcing propensity for the cluster disguising very diverse activity, even amongst some seemingly similar product groups. For example, in terms of silicon and epitaxy some of the businesses source the majority of goods in Wales, in some it is divided between Wales and overseas, and then in one case the source is 100% overseas. Similarly with products such as industrial gases some businesses source 100% in Wales while some source 100% overseas.
- For larger multinational cluster members, their direct materials and components requirements are served through result of intra-company transfers, which adds to the challenge of identifying the values of such 'purchases'.
- The majority of cluster members purchase in what might broadly be considered 'catalogue items'. In these cases products might be bought from wholesalers based in Wales or the UK, but with these same goods being produced overseas. In these cases, only a 'retail/wholesale margin' is 'captured' within the local economy.
- In most financial and business services there is a much greater propensity to purchase in Wales, but these same services typically represent a lower percentage of the overall value of domestic economy purchases.
- Cost categories such as business rates represent almost wholly Welsh spend, although in this example, the impact of this 'tax' on the local economy is difficult to estimate.

Figure 6 seeks to summarise the situation in relation to CS cluster sourcing patterns and product value characteristics (in terms of their significance in overall total purchases). In terms of materials and components used directly in the production processes of firms, UK sourcing is varied in terms of the purchasing propensity, but some of these types of goods typically make up a high proportion of total purchases. Across the manufacturing firms in the CS cluster the proportion of total purchasing estimated to be made up of materials such as silicon, EPI, gases and chemicals etc lays between 50% and 95%. This is possibly where there are the greatest opportunities for import substitution.

In respect of the estimated total UK purchases of the CS cluster it will only be a small proportion of the total estimated £300m total. This noted the previous analysis in Figures 4 and 5 would suggest that every increase in local sourcing of goods and services associated with CS cluster growth would cause significant UK supply chain gains. For example, a £1m increase in demand for Computer, electronic and optical products would be associated with a further £0.5m of activity required in terms of UK products to service the demand.

Figure 6. Broad trends in UK sourcing in the CS Cluster in Wales

Commodity of service	UK sourcing	Value in terms of significance in total requirements
Silicon and EPI	Varied	High
Industrial gases	Varied	High
Chemicals	Varied	High
Reclaim wafers and other materials	Varied	High
Rent/lease of property	High	Low

Commodity of service	UK sourcing	Value in terms of significance in total requirements
Financial services	High	Low
Business rates	Very high	Low
Utilities	High	High
Telecomms	High	Low
Hire/lease of eqmt	High	Low
Transport services	High	Low
Hotel and catering	High	Low
Insurance, legal & accounting	High	Low
Other business services	High	Low
Training and development	High	Low
Repairs and maintenance	High	Low
Waste removal	High	Low
Marketing	High	Low

In the next sub-sections we provide some cases linked to the KLA company in Newport which seek to reveal the benefits of working with the CS cluster in Wales and the growth opportunities that result. The case that follows was supported by interviews with staff in KLA (and the provision of data) and two of its UK suppliers.

4.4 KLA and local suppliers

KLA U.K. (SPTS Division – hereafter KLA) is a multinational enterprise who acquired Newport-based SPTS Technologies Ltd in 2019. To meet the growing demand for its semiconductor processing equipment, from areas such as 5G/6G communications, electric vehicles, and datacentres, KLA is investing in its Welsh operations. It is currently developing a new manufacturing and R&D centre at Newport with the capacity to provide employment opportunities for up to 750 people. KLA has suggested that expanding in South Wales permits the firm to better utilise local pools of talent and to strengthen links with local higher education institutions. The new innovation centre at the Newport site is expected to provide up to 200,000 square feet of cleanrooms for R&D and bespoke manufacturing assembly space.

KLA represents a key part of the CS cluster in the South Wales economy. In 2023 the firm employed around 550 full time equivalent people which was a little over 30% of the total direct employment supported by the CS cluster in Wales. It is also one of the region's leading exporters with the vast majority of its sales from its Newport site (over 95%) being to overseas export markets.

As well as contributing strongly to household incomes in Wales through its payment of wages and salaries, the business also purchases significant amounts of goods and services in the Welsh and UK economies. Significant payments to businesses in the Welsh economy relate to sub-contracted services, utilities, transport services, business services, freight services and very importantly R&D materials.

There are areas where KLA believed there is scope for further supply chain development including:

- Large scale machining of metal with demands largely met from imports into the UK
- Complex mechanical assembly particularly linked to machine builds
- Ceramics supply with very little capacity in Wales and South West to serve KLA needs here.

There is the prospect that new investment in these technology areas could actually constitute a whole new manufacturing hub benefitting a wide range of manufacturers in Wales and the South West. KLA have actively encouraged firms in their Wales and South West supply chain to upskill. Critical in these evolving supply chain firms is that they have, for example, invested in clean room capability, including ultrasonic cleaning, clean packaging, and have manufacturing and design engineers on site.

In what follows are two examples of firms that have worked closely with KLA and have developed skills to add more value to the components they produce.

Company A. The business was established in 2005 within the garage of the owner but has now grown to around 100 staff. While the core business is metal fabrication, the business model has evolved to add more value to its sheet metal components and it serves businesses in aviation, defence, semiconductors, food processing and construction. Much of the firm's business is centred on the UK economy as opposed to exports. Business management showed that the post-Covid-19 environment held risks for them (not least given their rural location and challenges in gaining labour) and with a challenge to diversify the product portfolio.

The business has been working with KLA for some time originally providing basic metal components but moving to a situation where the business adds electro-mechanical devices to the sheet metal components. The business proactively invested in a clean room facility to offer new opportunities for KLA, and have also had to open a new factory building up. Firm management saw KLA as an attractive market, but winning the business involved a significant step change for employees and management, but this has been connected with manifold growth in its KLA-linked turnover.

In developing its links with KLA, the business had also needed to invest in a skilled assembly staff project manager and a general buyer. In addition, closer working with KLA had resulted in a significant investment in storage capacity at the plant. It was expected that in meeting the standards for KLA that new business would result with other firms. Firm management believed there were limits in terms of their ability to meet the needs of KLA. While they were able to provide value added manufacturing, going beyond this to provide advanced manufacturing requires expertise in material science, physics and chemistry that was out of scope for smaller firms.

Company B is a Wales-based supplier to KLA and was founded in 2003. Semiconductors had been a major part of the business growth story although they also serve businesses in the automotive and medical sectors. Much of the core expertise of the firm is in terms of PCB assembly, but they are able to offer a full turnkey solution for firms including completed sub assemblies for KLA. The company has around 100 employees and with over 60% of their business with the semiconductor industry. The business has a strong record in training and staff development. The interviewee from the firm commented that there were opportunities to move up the career ladder within their business and they did not want their employees to see their factory job as just the end of the pathway. The interviewee argued that there were very good opportunities and some of the people who had joined the business in operational positions had gone to managerial positions.

A key part of the business model with KLA is the ability to corral suppliers. The interviewee showed that there was a time when SPTS (KLA) would have had to hold all kinds of stock but now Company B could do much of this themselves. This meant KLA negotiates with one firm rather than lots. Company B had the expertise in terms of buying goods especially down to very small electronic components where KLA may not have this expertise, or was not part of their own value proposition. The interviewee believed that it was critical to gain a good quality division of labour and skills between KLA and Company B with the latter perhaps more efficient in managing the supply chain for engineered parts.

The business has also been proactive in developing a clean room facility where KLA have been able to place their own equipment giving them more flexibility. The clean room facility was developed with semiconductor manufacturers in mind, and with businesses willing to pay a premium for manufacturing undertaken in a clean room environment. The interviewee argued that it was better for KLA to build a new machine in their clean room as it saved them time and was a better value proposition for both partners; a key issue here was both shared knowledge and the shared skills resulting from the collaboration.

It was highlighted that there are different models of collaboration but that the relationship between KLA and Company B was complex inasmuch as the company could also undertake design and marketing development, could debug processes and help businesses such as KLA in speed to market. It was believed that other semiconductor machine manufacturers are following a similar strategy to KLA in terms of proactively developing elements of the domestic supply chain. This was a direct result of the problems resulting from COVID-19 and problems in global supply chains. In this context the interviewee argued that while issues of quality, cost and delivery was important, that there was also a need for a strategic partnership and risk sharing.

In this respect businesses such as Company B are well placed to profit as some semiconductor businesses seek to reshore activity to the UK to remove supply chain risks.

In common with other firms in the CS cluster, the business does have some skills shortages and have sought to proactively upskill the existing workforce and develop a new workforce through an evolving academy within the business. Company B had invested in training room facilities on its site and with the possibility of KLA staff using these same training facilities.

4.5 Capital spending

Before proceeding it is also important to recognise that as well as purchasing goods and services to support manufacturing operations, the CS cluster of businesses also engage in capital spending in the Welsh and UK economies.

Particularly significant here is the support of construction engineering activity, and then specialised installation in respect of machinery and infrastructure. Very noteworthy here has, for example, been activity of the Cardiff company CMB which has engaged in specialist clean room development for IQE, Cardiff University, CISM at Swansea, and who are now working with KLA on their new build.

This has become a much more important element of the economic impact of the CS cluster in recent years. Whereas the complex machine tools used in the CS cluster are normally purchased direct from overseas sources, construction engineering activity does support local employment and opportunity. Even where the managing contracts for significant new builds are awarded to rest of UK or overseas companies this still leads to the need to use local subcontractors to complete the programme of works. As highlighted above this has become a much more important element of the local economic impact of the cluster because:

- The new build being undertaken by KLA at Newport which is expected to require a capital investment of over US$100m.
- The new build for the Centre for Integrative Semiconductor Materials (CISM) at Swansea University which involved a capital investment of close to £30m.
- An expectation of continued capital investment in the cluster, not least including plans by Vishay at Newport to invest heavily in its plant following acquisition.

It is difficult to estimate the local (Wales) economic impacts of construction activity but prior research on large scale complex capital builds in Wales suggests that every £1m of construction spending in Wales, supports a further £1m of activity in the Welsh economy through supply chain and household spending effects.

4.6 Conclusions

This part of the report has revealed that while the CS cluster in South Wales makes a significant contribution in terms of employment, exports from Wales, locally focused R&D spending and Welsh productivity growth, there are limits to what these firms can buy in the local Welsh, or indeed wider UK, economy. Moreover, to date the businesses in the cluster do not tend to trade with one another although they do collaborate in terms of research and development projects. This noted, the case study elements signal that there is an opportunity to increase local purchasing of goods and services, and with the prospect that as the cluster grows that there will be more investment in the supply chain resulting from the investment of existing firms through to the attraction of new inward investors. The case material in this section has revealed the advantages for local and wider UK-based businesses of working with businesses in the cluster and beyond in terms of not just sales growth, but skills development and deepening of local manufacturing activity.

While this section of the report has signalled the development significance of imported component displacement, this is still only one means of creating opportunity for locally based suppliers to the CS cluster. For some multinational enterprises in the Welsh economy there has always been an opportunity to sub-contract out elements of activity currently being undertaken in house. Whilst the activity may just move from in house to external supplier, this may provide various wider benefits/spillovers for domestic firms (see also section 2.4).

This was very noticeable in the Japanese manufacturing sector in Wales in the 1980s and 1990s (Morris et al., 1993). Initially the new inward investments tended to undertake operations in house, that would have been subcontracted out in the domestic Japanese economy. However, the development of a local-UK supply base to service the needs of these firms gradually led to Japanese enterprises letting out more operations to locally based firms. Indeed, some of these firms were new inward investors that had been attracted from Japan to meet the needs of the cluster of Japanese enterprises in Wales.

Similarly, there is an emerging pattern in the CS cluster in Wales of some firms letting out activity that was previous undertaken in house, particularly around electronic assembly and steel work. Indeed, arguably some of these firms reside close to the boundaries of the CS cluster given their high dependence on the larger manufacturers.

5. Key issues

5.1 Some broad supply chain scenarios

The material in this report suggests that there are two broad scenarios that are likely in terms of local supply chain development in respect of the CS cluster. These are based around the notion that activity in the CS cluster under Scenario 1 Status Quo will be maintained at around current levels in terms of employment, capital investment trends and contribution to Welsh gross value added. The elements of this scenario might be understood as follows:

Scenario 1 Status Quo

- Economic base activity in the cluster continues at around current levels.
- Local purchasing behaviour of CS cluster continues along current trend.
- Selected high value components imported from overseas.
- Limited forward linkages from the CS cluster into the UK economy in terms of sales to UK-based firms.
- Limited linkages between the CS cluster participants in terms of buyer-supplier linkages
- Local purchasing propensity reflects needs in cluster to manage internal capacity.
- Locally purchased inputs largely linked to standard manufacturing consumables, utilities, transport services, rates etc.
- CS cluster contribution to Wales level GVA remains at current levels.
- Indirect impacts on Welsh economy of CS cluster (multiplier effects through supply chain spending continue at current levels).

Under the second scenario there is more sustained growth in cluster activity year or year which might be connected to the following:

Scenario 2 Sustained growth

- Economic base of the cluster grows in line with forecast demands for semiconductors and compound semiconductors.
- Economic base of the cluster grows in line with demands made by UK businesses on their goods and services (forward linkage growth), but also higher level of buyer-supplier links within the CS cluster in Wales.
- New capital investment in buildings and machines in the cluster leads to new inward investment by supply chain businesses from overseas.
- Local businesses supplying more specific components see growth in general demand and pressure from CS cluster to deepen their value added activity.
- The CS cluster in Wales becomes defined in terms of the manufacturers, research institutions and strong local supply chain.
- Prospect of UK firms providing a greater share on capital equipment.
- Supply chain to CS cluster in Wales grows businesses with semiconductor and other advanced manufacturing firms in wider UK economy.
- Supply chain grow overseas exports in their own right.
- CS cluster contribution to Wales level GVA grows strongly and multipliers linked to CS cluster activity grow.

There is also of course a risk of a reduction in the size of the cluster which would see demands placed on the local and UK supply chain reduced. However, we believe this is unlikely given current conditions and the stated investment intentions of firms such as KLA and Vishay International.

Clearly, from a strictly Welsh economy perspective there is limited potential to grow the supply side to the CS cluster simply because of the size of the local economy. Indeed, the manufacturing members of the CS cluster would seem to understand local sourcing as UK-based supply chain not just Wales. However, genuinely local supply chain development in Wales could occur as a result of new inward investment to serve the demands of a growing CS cluster. It is also noted here that there could be real pressures on the existing supply chain to the CS cluster as firms in other parts of the UK seek to expand activity and capacity, for example, Oxford Instruments Plasma Technology is already engaged in developing new capacity near Bristol.

The report here has shown that the development of the local and UK-wide supply chain to meet the needs of the CS cluster will be important in meeting the economic development goals as set out in the UKRI Strength in Places funding. While the focus of this report has been in terms of backward linkages to local businesses, it is expected that greater dividends will occur where the CS cluster firms are able in future times to meet the needs of firms in the UK. The current pattern is very much that goods from the CS cluster leave the UK economy and then become part of other devices or components that subsequently might enter the UK as part or finished goods. While this pattern is inevitable in terms the set up of global value chains there is the likelihood that recent geopolitical changes will change the pattern of forward and backward linkages of the existing CS cluster in South Wales, and indeed the linkages of other semiconductor businesses in the UK. Preparedness for these changes is important.

5.2 Recommendations

Following from the above scenarios is the question of what needs to happen to move from Scenario 1 through to the characteristics of Scenario 2. A series of recommendations for more locally focused interventions would include:

- Help for CS cluster firms to identify existing businesses in Wales and the rest of the UK who have the skills to meet their needs, particularly where supplies are currently being imported into the UK.
- As importantly identification of domestic firms who do not currently serve the semiconductor sector but who might be encouraged to diversify their offering to serve this expanding market. The cases in this paper illustrate this phenomenon.
- The encouragement of more events that bring buyer and suppliers together, or at the very least give a platform for the larger firms in the industry to explain their supply chain gaps, and the problems that they are experiencing.
- Encouraging new inward investment into the CS cluster which would bridge supply chain gaps and/or increase sector productivity, and making investors aware of the scale of opportunities.
- Dissemination of materials which shows how local firms benefit from working with the CS cluster and have expanded and/or diversified their operations as a result.
- Promote the collective CS cluster supply chain capability nationally and internationally as a cornerstone of UK and Welsh Government international trade policy.

The final recommendation above links to the UK wide context. Earlier in this report it was noted that the UK semiconductor strategy did not fully explore how the UK's national or regional economies might better integrate with, or benefit from, the semiconductor supply chain. Moreover there was limited attention given to the more general purchasing behaviour of semiconductor manufacturing activity in the UK and the potential for import displacement, It is recommended that further research is undertaken to address these issues.

5.3 Policy Context

At a UK level, the November 2022 House of Commons BEIS Committee inquiry into the semiconductor industry highlighted a lack of clear policy governance (it should be noted the inquiry predated the publication of the 2023 national semiconductor strategy). Furthermore, the Committee observed that 'there is…a mismatch between the output from UK fabs, which are relatively few in number and which commonly use older technology to produce niche products, and the requirements of UK manufacturing or technology firms…. On the other hand, manufacturers may not be fully aware of what can be acquired within the UK' (House of Commons BEIS Committee, 2022 pp. 17-18). This latter point would appear to indicate a general lack of existing knowledge relating to potential opportunities to grow domestic UK semiconductor supply chains.

The House of Commons BEIS Committee also noted that witnesses to its inquiry had told it: '*We do not have companies that are coming into the UK, because they are not really being incentivised to do that'* (p. 35). This would seem to imply that businesses that might otherwise come to the UK to set up local supply chain operations to sell to existing semiconductor firms are not being incentivised to do so. As indicated in this report, this is an important point as an important way of growing local supply chains would appear to be linked to further inward investment attraction. Moreover, although the national semiconductor strategy (DCMS, 2023) focused to some extent on international chip supply resilience, it did not appear to fully explore how the UK's national or regional economies might better integrate with the semiconductor supply chains.

Regionally, the Welsh Government's support for the semiconductor industry tends to be located within its wider economic policy context including its Economic Mission: *Priorities for a stronger economy* (Welsh Government, 2023), which particularly celebrates close associations between the CS cluster and Welsh Universities, and its innovation strategy *Wales Innovates: Creating a stronger, fairer, greener Wales* (Welsh Government, 2023b), which identifies that the cluster has been behind Wales' success in winning R&D funding from UK sources. Although containing stated aims to grow local supply chains generally, neither of these Welsh Government strategies provides much detail on how this might be supported in practice in areas relevant to semiconductor industry, and, instead, appears largely focused on public sector procurement, food, and forestry.

To conclude this report reveals that there could be a significant economic development opportunity in terms of supply chain development to serve the CS cluster and with a series of local and UK-based suppliers already seeing dividends from working with businesses in the CS cluster

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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/