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# Industrial policy, multilevel governance and regional development: the case of the UK semiconductor industry

Mark Lang <sup>1</sup><sup>o</sup><sup>a</sup>, Robert Huggins <sup>1</sup><sup>b</sup> and Max Munday <sup>1</sup><sup>o</sup><sup>a</sup>

#### ABSTRACT

This article identifies the main governance challenges in formulating and implementing national industrial policies that aim to foster regional development. It explores the interface between industrial policy, multilevel governance and regional development. The article takes a case study approach focusing on the UK Government's semiconductor industrial strategy in the context of an emerging semiconductor cluster in South Wales. It finds that in this case industrial policy emerged from a decision-making process that was particularly divorced from regional considerations. It concludes that national governments must more seriously engage with multilevel governance if industrial policy is to be successful.

#### **KEYWORDS**

regional development; multilevel governance; industrial policy; semiconductors; clusters

HISTORY Received 30 July 2024; in revised form 6 April 2025

# 1. INTRODUCTION

Persistent regional economic inequalities are a recurring theme in the regional studies literature, and a major and seemingly intransigent policy issue for policymakers (Rodríguez-Pose et al., 2024). Post-industrial UK has been particularly affected by what has been commonly termed 'the northern divide', where former industrial areas have had problems transitioning, and then falling further behind those areas that have successfully done so. This has subsequently limited overall UK economic growth (McCann & Ortega-Argilés, 2021). The geographical implications of these economic disparities are felt across a swath of UK public policy, from social and health inequalities to educational attainment and social progression (Martin et al., 2022). Moreover, with the new Labour UK Government prioritising economic growth, addressing differences in regional economic performance are paramount (McCann et al., 2023). How best to overcome this phenomenon continues to divide theorists and policymakers alike (Sunley et al., 2022). Alongside territorial and regional governance research, there has been a growing 'rediscovery' of industrial policy. Industrial policy fell out of favour from the 1980s alongside a retrenched role for the state in economic and social policy (Sunley et al., 2023). However, partially because

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of the growing recognition of regional divides, it has seen a renaissance over the past decade or so as a more interventionist economic policy agenda has re-emerged.

Against this backdrop of socio-economic regional divides and the contemporary role of industrial policy, this article seeks to examine governance challenges in implementing effective industrial strategies that can promote regional development. It addresses three interconnected research questions. First, what are the governance challenges in formulating and implementing national industrial policies to foster regional development? Second, what are the potential solutions to addressing these governance challenges? Third, what are the implications for ensuring effective future regional development policymaking? To answer these questions the paper uses the case of the UK semiconductor industry, and efforts to develop a compound semiconductor cluster in South Wales. The evidence informing the case study is drawn on data from two principal sources: a UK level policy review, with a particular focus on a House of Comments Business, Energy and Industrial Strategy Committee inquiry that was undertaken in 2022, including a detailed analysis of the responses to the inquiry consultation; and a review of Wales level policy and associated documents. The case study is based on a triangulation of the data within and across the two levels to ensure its reliability and validity. We believe the case is of value in offering an opportunity to explore the interfaces between industrial policy, multilevel governance and regional development within a lagging region.

The remainder of the article is structured as follows. The next section offers a conceptualisation of the connections between regional development, industrial policy and governance requirements literatures. The article then presents the case study of the UK semiconductor industry and the associated efforts to foster cluster development in South Wales. The article concludes with a discussion of the implications of the case in relation to the core research questions.

### 2. REGIONAL DEVELOPMENT, INDUSTRIAL POLICY AND GOVERNANCE

How best to improve the economic performance of lagging regions has become a recurring theme in regional development literature, and a persistent preoccupation for policymakers faced with stubborn regional inequalities. The UK, in particular, experiences significant and growing regional economic inequalities (Henley, 2005; McCann, 2016; Rodríguez-Pose, 2018), although it is by no means unique in this regard as many other OECD (Organisation for Economic Co-operation and Development) countries also experience significant variation in regional economic performance (OECD, 2023). To address such problems regional development strategies often seek to foster innovation and economic growth, and commonly involve multi-level governance, knowledge networks, cross-border collaboration and other policies tailored to the unique characteristics of each region (Huggins & Thompson, 2023). In this respect, institutional contexts and governance structures clearly have a significant impact on regional development strategies (Rodríguez-Pose, 2020), and those regions exhibiting low-growth trajectories naturally offer more challenging environments through which to progress such strategies (Huggins et al., 2018).

The process of selecting industries, or individual firms, for inclusion in nascent clusters has been likened to policymakers 'picking winners', and critics of this process have pointed to the limited economic analysis informing such decisions, or why such industries would improve regional economic performance (Bryan et al., 2005; Crawley, 2014; Sunley et al., 2023). Crawley and Munday (2017), for example, argue that decisions on which industries might bring regional economic benefits, and therefore command the use of scarce public resources to help develop, should be based on careful and well-informed economic intelligence and analysis. Moreover, and by extension, Morgan (2016) suggests that a balance needs to be struck in these selection debates between novelty and continuity, as well as intra- and extra-regional learning, and state versus network-centric approaches. This perspective appears to support the view that policy responses must be contextualised, and that the assemblage of regional policies, collaborative networks and institutional arrangements will impact significantly on regional innovation, competitiveness and economic development (McCann, 2016). Furthermore, it is important to note that policy transferability is often complex, as successful approaches in one region may not necessarily be successful or beneficial in another (Fernandes et al., 2021). Deep place-based knowledge of local circumstances would therefore appear to be a significant factor in contextualising broader perspectives and experiences, and in conditioning specific regional development strategies (Huggins & Thompson, 2023).

Within this line of thinking, smart specialisation strategies have gained traction across the EU and to varying degrees elsewhere, and can be considered to represent a form of 'territorial governance' that promotes policymaking driven by local knowledge. Moodie et al. (2023) highlight that this approach: 'Involves identifying the characteristics and assets of each region, emphasising its competitive advantages and bringing participants together around a shared vision' (p. 1401). Consequently, participants tend to engage in public-private partnerships involving business, universities and research centres in a process of entrepreneurial discovery, often through the mechanism of a cluster (Munday et al., 2024a). Whereas the EU has displayed significant interest in smart specialisation (McCann & Ortega-Argilés, 2015), in post-Brexit UK a renewed interest in industrial policy tended to be promoted more through the lens of the 'levelling-up' agenda (Bailey et al., 2023). Nevertheless, both approaches imply the need for a significant degree of territorial governance arrangements. Territorial governance is a vital element of place-based policymaking with public authorities below the national level, most notably regional and local authorities, potentially playing a core role in establishing a framework for territorial governance given their unique combinations of place-based expertise (Bailey et al., 2023). Cluster governance has, therefore, become an important field of research (see, for example: Ebbekink, 2017; Ebbekink & Lagendijk, 2015; Nelles, 2013), and clusters have increasingly been used as advantageous mechanisms to further partnerships in the furtherance of enhancing economic competitiveness (Porter, 2000), including in less favoured regions.

#### 2.1. Industrial policy

Territorial and regional governance has played an important role in formulating and implementing industrial policy. For example, emerging from wartime planning, post-war UK industrial policy was closely interconnected with regional policy, particularly as it sought to direct industry and manufacturing centres to different regional locations through location controls and financial incentives (Gooberman, 2024). More recently, industrial policy has also been influenced by concepts such as competitive advantage, which over time has taken a territorial dimension through the concept of clusters whereby the geographical concentration of firms helps facilitate the complex relationships and forces determining competitive advantage (Huggins & Izushi, 2011). Consequently, contemporary industrial policy, in large part, is concerned with each of these determinants, and has become closely associated with regional or territorial governance (McCann et al., 2023; Sunley et al., 2023).

As indicated above, industrial policy both in the UK and the EU has enjoyed something of a revival in recent years. Successive UK Governments from the early 1980s largely rejected industrial policy in favour of a more liberal approach to markets and, at most, the state's role was centred on regulating competition (Criscuolo et al., 2022). The UK's experience during this period was not unique, as Grabas and Nützenadel (2013) noted, after the late 1970s industrial policy and economic interventionism fell significantly out of favour in most European countries. Consequently, industrial policy at this time tended to be perceived as a mechanism to support declining manufacturing, an anathema to market driven economics. Renewed recent interest has come in response to a multiplicity of global challenges, most notably geopolitical conditions, trade and resource tensions (Bailey et al., 2023). The reappearance of industrial policy in the UK's regional productivity disparities are significantly undermining its overall productivity

performance (McCann et al., 2023). Prompted by a long process of manufacturing decline, coupled with significantly uneven regional development, various UK Governments have again begun to experiment with forms of industrial strategy.

Despite its re-emergence industrial policy remains a relatively loosely defined policy sphere, which is not a recent phenomenon as ambiguity was a persistent feature of post-war industrial policy (Grabas & Nützenadel, 2013). As a means of providing some parameters by which to examine such policies, Criscuolo et al. (2022) propose a deliberately broad definition of industrial policy as those 'interventions intended to improve structurally the performance of the domestic business sector' (p. 25). The policy response to this agenda has been in flux, seemingly searching for the right form and degree of intervention, and the resulting policy churn may have had a limiting effect on the impact of UK industrial policy. A UK Government industrial strategy was launched in 2017 (HM Government, 2017), but this was quickly replaced by a new post-pandemic '*Build Back Better: Our Plan for Growth*' strategy in 2021 (HM Government, 2021). Sunley et al. (2023) argue that efforts to develop a UK national industrial policy, albeit with local variation, were put under some question because of continual policy iterations.

Seeking greater clarity, Johnston et al. (2023) seek to codify UK industrial strategy as consisting of three essential criteria: (1) the identification of a set of priority technologies as a focus for innovation, (2) the promotion of formal collaborations between business and universities to utilise knowledge and expertise to develop new products and processes based on these technologies and (3) the need to 'rebalance' and 'level-up' the economy across all regions. More broadly, Sunley et al. (2023) argue that little attention had been given as to how place-based advantages might be best derived from the UK's recent approach to industrial policy, and whether, or how, traditional manufacturing regions, for example, might benefit from such policies. Moreover, as McCann et al. (2023) suggest, there remains a lack of clarity in the interface between industrial policy and regional development in the UK, with policy tending to be overly centralised. The evidence suggests that UK industrial policy not only remains in a period of flux, but appears as yet ill-defined, lacking a coherent formulation about how place-based benefits might be best derived to overcome the UK's persistent regional economic inequalities.

#### 2.2. Multilevel governance

The concept of multilevel governance (MLG) offers significant scope to interrogate the connections between place and industrial policy. Previous work in the field identifies several areas where MLG and industrial policy overlap with regional development. These include: territorial cohesion and 'spatial justice' (Madanipour et al., 2022; Medeiros et al., 2024); innovation ecosystems and regional competitiveness (Diemer et al., 2022; Fernandes et al., 2021); regional resilience and adaptation to shocks (Sutton & Arku, 2022; Webber et al., 2018); subnational fiscal autonomy (Blöchliger et al., 2016; Miranda-Lescano et al., 2024); cross-border cooperation (Krisztina, 2016; McCann & Ward, 2010); urban-rural linkages and sustainable development (Kratzer & Kister, 2021; Marsden et al., 2020); inclusive growth (Adamson et al., 2023; Atkinson, 2015); policy transfer (Evans, 2004; McCann, 2011); and, more fundamentally, place- versus peoplecentric policy (Barca et al., 2012). Studies of these themes commonly indicate MLG's propensity to disperse power, both vertically between levels of government (local, regional, national, supranational), and horizontally across various quasi-governmental and non-governmental organisations that seek to ensure policy harmonisation across sectors and regions. Furthermore, the complementary concept of 'territorial governance' and its focus on the integration of regional actors, and their respective knowledge, into locally driven policymaking processes has been offered as a means of overcoming some of the limitations of MLG in terms of policymaking between various spatial scales (Moodie et al., 2023). Nevertheless, the precise factors and conditions that determine the success of place-based industrial policy are not completely understood (Beer et al., 2023).

Clearly, place-based industrial policy presents challenges, not least that policy tends to favour those regions and places that already have certain advantages, such as stronger physical and social infrastructure, and business networks and ecosystems, and may not help level the playing field (Bailey et al., 2023). To counter this trend, policies such as incentive zones (for example, special economic zones, free zones, industrial parks, free-trade zones, free ports, foreign trade zones and export processing zones) are increasingly promoted as a means of encouraging more regionally varied economic growth (Frick & Rodríguez-Pose, 2022). The effectiveness of these incentive zones, however, varies significantly. In their study of EU incentive zones, Arbolino et al. (2023) found that this variance may be explained in two ways: either because of faulty government planning of the incentive scheme itself, or that they produce better results when implemented in strong economic systems. This would indicate that regions with greater institutional and/or economic advantages are likely to benefit most from these specific types of place-based interventions. Bailey et al. (2023) suggest that both the vertical and horizontal mix of policy, and successful coordination between governments at different levels, are critical to help correct these weaknesses. Coordinating vertical policies to achieve national standards, whilst also permitting local government autonomy to formulate place-based policies is considered central to this challenge (Bailey et al., 2023).

#### 2.3. Summary of key issues

A central question arising from the above review relates to national industrial policies and multilevel governance, the interaction between the two and the impact on regional development efforts in lagging regions. When considered through the lens of MLG and territorial governance, industrial policy appears to exhibit two key dynamics. The first of these is represented by a reconfigured role for the state, where traditional state actors must develop new approaches to coordination, steering, and networking (Martin et al., 2023). Collaboration networks and institutional arrangements have an impact on innovation, competitiveness and economic development (Álvarez et al., 2009). Extra-governmental organisations, such as clusters, can potentially support innovative policy formation, but they also offer adaptive governance mechanisms that promote collaboration, capacity building, and provide safe spaces for policy experimentation (Morgan, 2018). In the context of regional development strategies, these arrangements can challenge existing conceptualisations of democratic accountability, which must therefore be reimagined. Consequently, greater transparency and accountability becomes ever more critical.

The second dynamic appears to be a significantly increased role for non-state actors in developing industrial policy, particularly in the context of MLG. The growing complexity of state and non-state actors associated with policy networks have resulted in decision-making processes that appear to lack clarity (McCann et al., 2023). In addition to, and partially resulting from these dynamics, several issues have emerged that have complicated the industrial policy and MLG/territorial governance praxis. Policy divergence between various tiers of governance and regional competition are clear factors that potentially hinder policy consistency and coherence (Pope et al., 2023). Conversely, MLG and territorial governance promise the scope for greater flexibility and responsiveness for industrial policy to address location specific challenges. Moreover, the collaborative place-based ecosystems offered by regional partnerships of universities, businesses, and local and regional governments, offer the scope for locally rooted and creative policy discourse and delivery (Bailey et al., 2023).

Following the identification of the key issues for analysis, the next part of the article considers how these issues are playing out in the evolution of the compound semiconductor cluster in South Wales. The case study contributes to addressing the research questions identified in the introduction, which concern (1) the nature of governance challenges in national industrial policy formulation that addresses regional development, (2) the potential solutions to addressing apparent governance challenges and (3) the implications for effective future regional development policymaking? The case study considers how the furtherance of UK industrial policy (here UK semiconductor strategy) in the context of a geographically grounded cluster connects to MLG and territorial governance experiments, and then with the overall aim of supporting regional innovation in a lagging region.

# 3. THE UK'S SEMICONDUCTOR INDUSTRY

Semiconductors are a critical technology, a core component of electronic devices and consequently underpin modern economies, and national security, as well as emerging technologies in areas such as renewable energy, artificial intelligence and electric vehicles (Huggins et al., 2023). The global market in semiconductors is US\$500 billion and is projected to rise to US \$1 trillion by 2030 (Burkacky et al., 2022; SIA, 2023). Semiconductors have a highly globalised value chain that has evolved over a significant period and, it is argued, this has brought major benefits such as increases in production and technological advancements (BCG/SIA, 2022). The globalised industrial structure of semiconductors also has inherent weaknesses, however, such as a lack of flexibility in relation to supply and demand, geographical skills shortages, vulnerability to natural disasters and is particularly exposed to geopolitical conflict (Woods & Gajjar, 2024).

The UK's share of the global semiconductor market is just 0.5%, but it does have strengths in certain areas, such as research and development, chip design, intellectual property and compound semiconductors (Alsop, 2023; DCMS, 2023). The UK also has several semiconductor clusters, including the compound semiconductor cluster in South Wales, which directly employs close to 1800 people (Munday et al., 2024b). Despite areas of strength, there are weaknesses. The House of Commons BEIS committee (2022, pp. 17–18) observed,

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 .... [But] on the other hand, manufacturers may not be fully aware of what can be acquired within the UK.

At the global level, there are growing tensions across the global semiconductor market that impact the UK industry. There are concerns in relation to national security arising from import pressures from Asia, and, in particular from China's growing share in segments of the semiconductor value chain (Germann et al., 2024; Miller, 2022). There are also increasing concerns related to exports, witnessed particularly in US–China trade relations, and foreign ownership of domestic firms or facilities (Rolf et al., 2024). Although foreign ownership of semiconductor firms is typical – for example, just 28% of UK located semiconductor firms are UK owned – there has been a growing anxiety concerning those owned by Chinese investors (these account for 5% of UK located semiconductor firms) (Woods & Gajjar, 2024).

In November 2022, the UK Government used the powers it acquired under the 2021 National Security and Investment Act to require Nexperia, a Dutch company owned by China's Wingtech Technology, to sell the firm Newport Wafer Fab, a manufacturing or 'fab' facility in South Wales, which it had acquired in 2021. The UK Government had previously approved the sale of Newport Wafer Fab to Nexperia, which subsequently purchased the company. But, after significant criticism and much delay, the decision was reversed. In using its powers under the Act, the UK Government explained 'the Act is actor agnostic and interventions are made on a case-by-case basis'. It continued,

the Secretary of State considered that a risk to national security from this acquisition relates to the technology and know-how that could result from a potential reintroduction of compound semiconductor activities at the Newport site, and the potential for those activities to undermine UK capabilities. (BEIS Committee, 2023, p. 4)

It is important to note that the UK's approach is different from that taken by the US, which has a list of 'countries of concern', including China, Russia and Iran (Nikkei Asia, 2023). Subsequently, Newport Wafer Fab was then purchased from Nexperia by US-owned Vishay International and the deal was completed in March 2024 following the approval of the UK Government (FT, 2023; Vishay, 2023).

Regardless of this outcome, as outlined below it was the inability of the UK Government to make timely decisions regarding the sale of Newport Wafer Fab, as well as lengthy delays in bringing forward its National Semiconductor Strategy (presented in May 2023), that resulted in governance challenges that undermined the further development of the semiconductor cluster in South Wales. Furthermore, the limited powers and resources of the regional Welsh Government in this case exposed some of the limitations of the system of multilevel governance in the UK, particularly with respect to industrial policy. The South Wales semiconductor cluster is based on CSconnected, a private company limited by guarantee. Figure 1 illustrates the interconnections of the semiconductor cluster with the broader MLG ecosystem. The South Wales cluster has ambitions to compete with other European semiconductor clusters (Huggins et al., 2023).

It is important to note that the above developments have often occurred in the context of concerns over digital sovereignty (see: Adler-Nissen & Eggeling, 2022; Chander & Sun, 2023; Floridi, 2020; Hummel et al., 2021). There are, for example, parallels with the case of SoftBank's sale of UK-based Japanese owned chip business Arm to California-based Nvidia, which collapsed in 2022 (FT, 2022), and with the blocking of Huawei's involvement in the UK's 5G rollout (see: King, 2019; Schmitz & Seidl, 2022). The UK Government's previous experiences in these cases clearly had a lasting impact on its decision making, which are important in the Newport Wafer Fab decision, as it had the potential to act as a strategic partner within the developing South Wales semiconductor cluster. The original intent by regional stakeholders had been for Newport Wafer Fab to exist as an 'open access' manufacturing facility, available for so called



Figure 1. The South Wales semiconductor cluster and the MLG ecosystem.

'fabless' firms to commission the manufacture of chips. However, following the decision it was not clear if this was possible under the new ownership of the facility.

Given the above, the following sections explore the governance framework within which these developments have played out in respect of the UK's policy position regarding semiconductors, the relationships between different tiers of government including the UK and Welsh Governments, the City Deal-funded Cardiff Capital Region, and the development of the South Wales cluster (see Morgan and Henderson (2023) for a fuller discussion of the governance tiers in Wales).

# 3.1. Semiconductor industrial strategy in the UK and multilevel governance: the South Wales case

In 2022 the House of Commons Business, Energy and Industrial Strategy (BEIS) Committee held an inquiry into the semiconductor industry in the UK (BEIS Committee, 2022). The inquiry came against the backdrop of the global shortage of semiconductors that began in 2020 and the significant disruptive impact this had on worldwide manufacturing. The inquiry was held prior to the publication of the UK Government's semiconductor strategy in 2023, and was particularly concerned by the significant delay in the Government bringing forward this strategy. The November 2022 report noted,

the DCMS [UK Government Department for Digital, Culture, Media and Sport] strategy has already been nearly two years in the making, and there was some frustration in submissions to our inquiry about the pace of the work and the need for the Government to get on with support for the sector .... (p. 26)

Significantly, the Committee highlighted what it believed to be a lack of clear policy governance in relation to the UK's semiconductor industry. It said: 'many Government departments have intersecting interests in the UK semiconductor industry. But the sector is uncertain about where primary responsibility within Government lies and to which part of Government they should address concerns' (p. 3).

In a subsequent debate on semiconductors in the House of Lords (2023), Viscount Camrose for the Government observed, that whereas:

the ownership of the semiconductor strategy sits squarely with DSIT [Department of Science, Innovation and Technology]. There is a range of Acts – to do with export controls and protection of investment from states seen to be hostile to us – that of course come under other departments ....

This is potentially a key weakness in the UK's approach with different responsibilities existing in different places, with a simultaneously siloed approach existing in relation to specific industries. With regard to the overall support offered to the industry, the BEIS Committee (2022) inquiry report concluded, that 'it is not clear to us that the support or attention currently offered by Government is at anything like the scale which is needed ... ' (p. 5).

The BEIS Committee (2022) sought to codify what it called the 'role of government' in relation to the semiconductor industry. The Committee identified seven specific areas where the Government should seek to intervene in the industry, which are summarised in Table 1. In identifying these seven roles for government, however, the Committee does not address issues of multilevel governance in the UK. There was no substantive mention made of the MLG and regional context and whether this is likely to be an aid or barrier to effective policymaking. Consequently, its conclusions and recommendations appear to relate solely or mainly to the UK Government. Nor does the Committee distinguish between the role of government and the wider understandings of governance.

Government role	Report explanation				
Grants or tax credits.	Incentives for domestic and international research and development investment.				
Tax-advantaged investment schemes.	To support venture capital.				
Direct funding.	A pragmatic approach to existing (non-manufacturing) UK strengths				
	that require less capital intensive investment.				
Bridging the gap between research and	For example, university laboratories being fitted with manufacturing				
commercialisation.	equipment to enable a smoother transition to foundries.				
Helping secure inward investment.	Concerns over lack of joined-up approach or significant incentives.				
Ensuring a sufficient skills base.	Firms seeking to renew their skills base face difficulties in recruitment				
	and retention				
Facilitating the attraction of overseas	A mixed picture.				
talent.					

Tak	ble	1.	The	'roles	of	government'	in t	he se	emiconc	luctor	industry.
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Source: BEIS Committee (2022, pp. 30-38).

Issued to coincide with the publication of its much delayed National Semiconductor Strategy in the UK, the Government's substantive response to the Committee's report (BEIS Committee, 2023) made clear its intension to establish a UK Semiconductor Advisory Panel that would be chaired jointly by government and industry, but that its primary role would be delivering the Government's strategy. In its response to the Committee the Government emphasised the need to ensure security of a minimum level of chip supply by providing a: '... baseline level of manufacturing [that] could provide a low volume of chips for critical infrastructure' (pp. 6–7). Instead of seeking to develop a significant presence in chip manufacture, the UK Government's response sought to outline that its strategic response would

... maintain and build on the UK's leading edge in chip design and IP; make the UK one of the top global centres for compound semiconductor innovation; and build on our existing research base ... [and build] a foothold in the next generation of future semiconductor technologies .....

It also said it would seek to support commercial research and development (R&D) and small- and medium-sized enterprise (SME) growth, with funding for new enabling infrastructure across the country, including for the creation of a compound semiconductor 'open-foundry' ecosystem (p. 8).

The UK Government's response appeared to limit ambition with respect to growing the UK's semiconductor industry, particularly chip manufacturing, and, as explored below, can be considered by international and industry standards to provide limited funding for the implementation of the UK National Semiconductor Strategy. Much of the evidence to the Committee's inquiry was provided by the semiconductor industry. In its evidence, IQE, a South Wales head-quartered compound semiconductor materials manufacturing firm and a key player in the cluster, told the inquiry: 'Intellectual property and design expertise are important aspects of the semiconductor supply chain but these activities can be moved around the world relatively easily', whereas manufacturing had low geographic mobility due to the large capital-intensive facilities required (IQE, 2022). The failure to recognise the overall importance of chip manufacturing would appear to be a key limitation in the Government's approach to the industry.

In its evidence to the inquiry, the Welsh Government observed: '... it is unrealistic to create a full end-to-end semiconductor supply chain in the UK, and relationships with partners in Europe and the US will remain key' (Welsh Government, 2022, p. 2). Tellingly, Rockley Photonics –

another firm with a facility in South Wales at the time (for a period within the Nexperia facility) – told the inquiry:

when we consider scale-up and volume manufacturing, the UK is a laggard as former state-of-the-art facilities have been repeatedly sold (and usually shut down at a later time) despite sometimes receiving government support. What remains are some smaller facilities ... there are no longer any UK-owned volume-capable fabs in the UK ... .(Rockley Photonics, 2022, p. 2)

Even more telling is the fact that Rockley Photonics subsequently exited the South Wales cluster and the UK, concluding: 'is the Government currently providing the clarity and direction required to enable growth and security in the semiconductor industry? ... Unfortunately, the simple answer to this question is no' (p. 4). All of these factors and outcomes indicate, the lack of a clearly formed and articulated approach across central and regional governments strategic agendas for the semiconductor industry, which led to a largely reactionary policymaking response rather than a more proactive entrepreneurial and innovation-led approach.

The UK Government's strategic response to semiconductors, as set out in the National Semiconductor Strategy (DCMS, 2023), is focused largely on chip design. With the average cost of constructing and equipping a single new fab estimated to be around US\$10 billion this is perhaps not surprising (McKinsey & Company, 2023). On the issue of supply chain resilience, the strategy states '... the best way to build better resilience in supply chains will be through international action' (DCMS, 2023). In a debate on the semiconductor industry in the House of Lords (2023), held several months after the publication of the National Semiconductor Strategy, Viscount Camrose, who at that time was the Parliamentary Under-Secretary of State at DSIT, told the Lords:

... to build an advanced silicon fab would, first of all, cost tens of billions of pounds. It would run into not only costs of operation but substantial risks of uncompetitive yields ... it makes sense that our strategy should build on the country's strengths, particularly in design.

This would be a continuation of the UK's industrial stance since the 1980s, which has focused on niches rather than activity at scale (Munday et al., 2024a).

The importance for government financial support at critical junctures can potentially make a significant difference to the possible growth of semiconductor clusters, as has proven to be the case in Taiwan (Breznitz, 2021). The UK Government (BEIS Committee, 2023) argued that it had invested £290 million to support semiconductor companies over the previous ten years, with a further support for international R&D collaboration, domestic R&D, the creation of a UK semiconductor infrastructure initiative and new centres for doctoral training having been made available. Witnesses to the BEIS Committee Inquiry (2022, pp. 30–31) also observed that the Government had significantly invested in compound semiconductor research through universities and has also funded the Compound Semiconductor Applications Catapult, which is located in South Wales. The Committee reported concerns, however, from within the industry that later-stage technology was missing out on research funding. Other witnesses told the Inquiry that the UK Government approach had been '... to pour money into arbitrary research and leave the market to decide what to take advantage of ... '. In other words, an approach lacking in clear policies to advance the UK semiconductor industry.

Overall, the scale of this previous and projected investment was minimal in comparison to international standards. Since the passing of the Chips Act, for example, by August 2024 semiconductor ecosystem firms had announced over 90 new manufacturing projects in the US, totalling US\$450 billion in announced investments. Meanwhile, China has continued to invest heavily in its semiconductor industry, announcing a further US\$47 billion funding as part of its third phase National Integrated Circuit Industry Investment Fund. Moreover, the EU Chips Act is seeking to invest US\$47 billion public and private funding in Europe's semiconductor ecosystem, and aims to grow its global share of semiconductor production to 20% by 2030 (SIA, 2024). The Welsh Government (2024) argues that the UK National Semiconductor Strategy will not deliver any additional funding in Wales, and that £1 billion over 10 years across the UK was not a significant amount of additional capital. The comparatively small amounts of funding allocated to the UK semiconductor industry is likely to limit the growth of the industry and opportunities to scale up will be lost. Further, given the significant investment required, the UK semiconductor industry is unlikely to grow much beyond the current level. Furthermore, the UK semiconductor industry is likely to remain one largely based on niche areas such as design, IP, etc. (see: Johnston & Huggins, 2022). This will limit opportunities for economic development in regions such as Wales, which is implied by the Welsh Government's response.

The above indicates a confused and conflicting landscape within which the future strategic direction of the semiconductor industry in the UK is embedded. In the context of multilevel governance, and in relation to the South Wales Compound Semiconductor Cluster in particular, the strategic response of devolved government is an important consideration. The Welsh Government's strategic relationship with the semiconductor industry can be seen in the context of its 'Economic Mission: Priorities for a Stronger Economy' industrial policy (Welsh Government, 2023a). In this respect, the Welsh Government is partnering with industry, academia and Cardiff Capital Region (a City Deal funded entity) with efforts to grow the Welsh-based semiconductor industry. The Welsh Government also highlights that its support for the Welsh semiconductor industry aligns with its innovation strategy (Welsh Government, 2023b).

The Welsh Government has indicated its understanding of the importance of the South Wales semiconductor cluster, which exports more than 95% of its products and it contributes close to £0.5 billion in exports every year – around 3% of all Welsh manufacturing exports, to the overall Welsh economy. In the two years up to 2024, investment had been made in the cluster by Siemens (Germany), MaxPower and MicroLink Devices (USA), and Rockley Photonics (UK) (although as indicated above this company has now departed). In addition, the new European manufacturing and R&D centre of US firm KLA (a US\$100 million investment) has also been made (Welsh Government, 2024). The Welsh Government has also been investing in physical infrastructure at Newport's Celtic Lakes, a key location for the cluster, which connects with the Welsh Government's support for the new South East Wales enterprise zone where compound semiconductors are considered to be a central element (Welsh Government, 2023c).

Furthermore, and prior to the UK's departure from the EU, the Welsh Government led British participation in the European Commission's 'Important Project of Common European Interest in Microelectronics' programme' which was the forerunner to the European Chips Act (Huggins et al., 2023). This had approved plans by the UK, France, Germany and Italy to provide up to €1.75 billion in state aid for electronics production, of which UK companies would have received €48 million. The Welsh Government argues that this would have '... unlocked private sector investment in the UK of up to €337 m (£306 m)', but the UK Government did not honour this funding (BEIS, 2022, p. 3). In 2023, the Welsh Government became a signatory of the European Semiconductor Regional Alliance, but the work of the Alliance appears very much in the context of EU policy, and it is difficult to see what direct benefit this might bring to the South Wales cluster (Welsh Government, 2023d).

# 4. CRITIQUING THE CASE: THE GOOD GOVERNANCE OF INDUSTRIAL STRATEGY?

As indicated above, the semiconductor industry is highly vulnerable to geopolitical tensions, most notably resulting from growing tensions between the US and China, which have reverberated across the whole semiconductor ecosystem. In the context of the South Wales semiconductor cluster, these tensions were clearly witnessed in the case of Chinese-owned Nexperia's purchase, and subsequent forced sale, of Newport Wafer Fab. This experience exposed the weaknesses of the UK Government's decision-making processes in relation to the semiconductor industry, but there were also parallels with experiences in other industries and critical national infrastructure, such as the roll out of 5G. Moreover, the severely limited powers of the Welsh Government and other regional partners to engage with this process, clearly demonstrated the challenges of multilevel governance in the UK context (Hooghe & Marks, 2003).

The UK Government made much of its desire to develop the UK's semiconductor industry based on its existing strengths. However, in the case of Nexperia it did not adequately demonstrate a regional commitment, and its failure to act in a timely manner was a severe limitation. The UK Government's response to the Nexperia saga was largely reactive, rather than proactive, and may have been influenced by its experiences in other industries. The significant delay affected the business of Nexperia and appears to have impacted upon the decision of Rockley to depart the cluster and the UK, thereby losing important investment opportunities from Newport. Overall, it is clear that the decision made by the UK Government in this instance paid little regard to its likely impact on the South Wales cluster.

The UK national strategy aimed to build on the existing regional clusters of activity, especially South Wales, but there is little acknowledgement within the strategy of the need to learn from the evolution of those clusters. Moreover, it is far from clear whether the national strategy sought to understand the constraints existing at a local or regional level. It did not consider whether local systems have the capacity to effectively engage with the national policy process (Sunley et al., 2022; 2023). Fundamentally, it is not clear whether the development of the national strategy was largely a reactive top-down process or if there were genuine opportunities for bottom-up development based on the experiences of regional clusters and industry partners (Stoker, 1998). A lack of technical knowledge and experience within government on particular policy areas, such as semiconductors, may be a significant factor. While much is made within the strategy of the existing highly regionalised clusters, there appeared to be only a limited effort to understand the regional ecosystems within which the clusters are located, the locally grounded knowledge associated with them, or the importance of multilevel governance in this respect (Parsons et al., 2024). As has been noted, extra-governmental organisations, such as clusters and regional partnerships, can provide important industrial and place-based expertise in formulating and implementing policy. In specialised fields, such as semiconductor manufacturing, the nature of the geography of activity means that national government is often somewhat distanced from relevant expertise. This, as previously indicated, suggests a requirement for improved network linkage across the MLG chain. In this instance, such opportunities appear to have been missed.

Overall, it is not clear that the semiconductor strategy constitutes a fully-fledged industrial policy given that it appears to have limited integration with the expertise of regional partners, which is a key requirement in recent understandings of contemporary industrial policy formulation (Bailey et al., 2023). This supports previous conclusions on the lack of clarity at the interface of industrial and regional policy in the UK (Tilley et al., 2023). Given the growing interest in investment zones in the UK and other nations this is potentially a significant shortcoming in the future governance of regional development. The UK Government's strategic response to the semiconductor industry appears to have displayed a serious lack of understanding of the need for a reconfigured role for the state in the context of industrial policy and its governance. Instead, it was predicated on traditional notions of centralised governance trather than broader notions of networked multilevel governance (Pierre & Peters B, 2020).

# 5. CONCLUSION

This article examines three interconnected research questions related to governance challenges in national industrial policy and regional development. It analyses the difficulties in formulating and implementing such policies, identifies potential solutions to these challenges and considers their implications for addressing more effective regional development policymaking in the future. To explore these questions a case study of the UK semiconductor industry has been undertaken.

Formulating and implementing national industrial policies to promote regional development faces significant governance challenges. A key issue is the misalignment between national strategies and regional needs, often due to limited coordination in multilevel governance. While regional clusters play an important role in industrial ecosystems, national policies often overlook their specific constraints and expertise. This disconnect may be exacerbated by an over-centralised approach, reactive decision-making, and a lack of technical knowledge within government. To support sustainable regional development, industrial policy should adopt a more networked governance model. In particular, it should strengthen collaboration between national and regional actors, integrate local economic ecosystems, and ensure policies are responsive to both national priorities and regional capacities.

Addressing governance challenges in industrial policy will require a move towards more integrated and networked governance. Strengthening collaboration between national and regional governments is clearly essential, ensuring regional clusters have a meaningful role in shaping policy. This may be best achieved through formalised engagement mechanisms, such as advisory councils or dedicated regional policy forums. Enhancing technical expertise within government is also vital, allowing for more informed and proactive decision-making. Additionally, industrial policy should be designed with greater flexibility to adapt to regional economic conditions, aligning changing investment strategies with local capacities. A more decentralised approach – where decision-making is shared across multiple governance levels – is more likely to lead to policies that are both nationally strategic and regionally effective.

As with addressing governance challenges, ensuring effective future regional development policymaking will only occur once there is a more coordinated, place-sensitive approach that integrates national and regional priorities. The above analysis has made clear that strengthening multilevel governance is essential, with transparent mechanisms for regional engagement in policy formulation. Building government expertise in specialised, and often regionalised, industries will also improve decision-making and reduce policy fragmentation. Additionally, policies must be more adaptable to regional economic conditions if they are to establish the long-term resilience and innovation required in many regions. As indicated above, the establishment of more decentralised, networked governance – where regional actors have a greater role in shaping and implementing strategies – will undoubtedly be a paramount factor in allowing policies to better support sustainable and inclusive regional growth.

Despite clear evidence of a UK semiconductor industry that is highly regionalised and based on dispersed clusters, and a widely understood acknowledgement that such an industrial structure exists, industrial strategy emerged from a decision-making process that was too divorced from regional considerations. This policymaking *modus operandi* appeared unwilling or unable to seriously contemplate a radically reconfigured role of the state and a wider reliance on the intelligence and engagement of non-state actors. With limited financial support available for the industry and a lack of technical capacity to adequately contemplate high tech industries such as semiconductors, the inability to share power or relinquish control was a major limiting weakness, both in terms of supporting the development of the UK semiconductor industry and in maximising its potentially positive impacts in regional development strategies. A close empirical analysis of the implementation of the UK semiconductor strategy over its initial years may provide further evidence as to how to improve on industry involvement within multilevel governance configurations. This would inform the development and implementation of any revised strategy of the UK semiconductor industry and a renewed interest in growth as the driving force behind the government's economic agenda.

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