The Geopolitics of Semiconductors

Industrial Policy in a Sharpening National Security Environment

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Introduction

In the matter of a few years, semiconductors have evolved from being considered a niche technological concept with little relevance to Britain's national interest, to a vital commodity and supply chain at the centre of the greatest geopolitical challenge of the 21st Century. The story of the rising importance and competition for access to semiconductors is one that reveals much about the shifting nature of national security, our evolving understanding of our allied relationships, and the role that industrial policy will play in defining our resilience.

Semiconductors are an essential component of mobile phones, computers, data centres, and a wide range of other technology products that are now considered essential to our daily lives. They are also crucial to many advanced military technologies, including weapons systems, defence hardware and drones. They have a complex end-to-end supply chain, from research, to design, to commercial application, with just a handful of international companies holding hard-won expertise in these processes. Semiconductors require up to 300 different inputs, with as many as 50 different tools involved in their processing,[i] and many of the individual components involved in semiconductor manufacturing themselves have networked supply chains with international dimensions.

The different manufacturing elements for semiconductors are so niche that market positions are deeply ingrained after years of long-term investment, and it is difficult to unseat market leaders. The trend over recent years has been towards specialisation, which has fragmented the supply chain across a handful of countries, while also making it more difficult for others to compete at any individual point along the value chain. It is, however, relatively easy for a nation to lose indigenous expertise and capabilities through the cumulative attrition and acquisition of individual companies over time. Many Western nations, including Britain, have slowly ceded once-leading positions in elements of the semiconductor manufacturing process, allowing both capabilities and skills to move off-shore and into the control of our allies and strategic rivals.[ii]

Many liberal governments have now come to realise that competitiveness around technological research, production and supply chains, will be one of the most important aspects of national resilience in the coming years. Nations which hold vibrant domestic innovation marketplaces will be able to drive growth, defend their sovereignty, and succeed in an evolving global order. The decisions the UK Government must take around this valuable technology will establish a new British foreign policy culture and architecture, which fuses economic, social and geopolitical resilience.

Geopolitical Dimensions of Semi-Conductors

The Chinese Communist Party has offered its citizens a political compact predicated on continuous economic growth, which has recently seen the government prioritise investments in geo-technological advantage.[iii] This emphasis is likely to continue to sharpen as China's domestic landscape – across social, economic and political measures[iv] – becomes more challenging for its leaders, and the compact needs to be reinforced and reconstituted. President Xi Jinping's interest in semiconductors has partly been driven by their role in supporting China's militarisation, as it pursues the most substantial military build-up of any nation since the Second World War.[v] As his economic growth and national security ambitions are infused, the emphasis he is placing on achieving economic self-sufficiency will intensify his plans for the development of a sustainable domestic, consumer-oriented semiconductor marketplace, as well as a military machine.

Despite China's extraordinary progress in building its indigenous technological capabilities, semiconductors have been an area of relative competitive disadvantage for the authoritarian superpower.[vi] The Chinese Government identified semiconductors as a priority technological investment area in its 2014 'Made in China 2025' strategy[vii]. Yet nuts and bolts issues, such as a lack of highly trained engineers, have remained impediments to realising its ambitions to grow the industry in mainland China. China has been able to increase its competitiveness in back-end manufacturing, and other areas for which low-cost labour and efficiencies of scale are paramount, but it continues to lag on areas of technical specialism and advanced manufacturing.[viii]

China has therefore sought to grow its overall market position through acquisitions of a diverse suite of companies with different roles in the supply chain, focusing on those which can deliver high-value capabilities that are difficult to replicate. This has included taking over many Western organisations of various degrees of profitability, of little recognised interest to their governments.[ix]

The United States Government has been the most proactive in seeking to counter this strategy in pursuing its own self-sufficiency objectives, having understood that this is currently an area of relative American advantage in which both parties share the same level of vested interest. As of early 2021, China was importing more than $USD300 billion of semiconductor technology each year, with American firms drawing in around a quarter of their profits from Chinese buyers.[x] This interdependence has been an issue of growing concern for both parties, but particularly for China, which knew that any disruption to this arrangement would bear imbalanced negative consequences to its short-term national resilience.

Semiconductors have been a focus of China's efforts to capture intellectual property from Western private sector firms and research institutions[xi], and for the United States, the arguments to support such deep commercial entanglement and co-creation processes have become increasingly difficult to justify. This has been compounded by China's transparency about its own intentions, making clear that its goal is to reach "independence" in its technology capabilities.[xii] It is also seeking to pivot from a 'quantity over quality' approach to a 'quality-first' investment in higher-value technical

capabilities.[xiii] The outsized role that the island of Taiwan plays in global semiconductor production, particularly in terms of the most advanced chips,[xiv] has further heightened concerns about China's regional intentions,[xv] and the potential for widespread disruption to such an integral supply chain of global importance. This has created a sharp geopolitical edge to the national and supra-national investments being made in semiconductor capabilities.

In August 2022, the United States passed the CHIPS and Science Act, which secured bipartisan support in Washington through its focus on strengthening America's sovereign capabilities on semiconductors.[xvi] The Act drew attention for its process as much as its substance, causing an immediate disruption to the global technology marketplace, and particularly to firms in China or the United States with cross-national interests. The Act serves both a stick and carrot, penalising American firms wishing to engage with China's semiconductor industry, while strongly incentivising global semiconductor firms to invest in operations in America. It covers both advanced and 'legacy' technology, which, in crude terms, spans from cutting-edge computing to parts needed in basic consumer goods, such as cars.

Decisions around proactive decoupling must consider the optimum moment of leverage – a careful balancing act to ensure sovereign exposure is minimised while the disturbance to strategic rivals is maximised.[xvii] As demonstrated in the Cold War, while such choices can increase America's dominance in certain fields in the short-term, they can also inspire authoritarian states to invest concertedly in innovation.[xviii] There is a risk that over time, this could narrow the relative advantage gap, and ultimately dislocate American hegemony through providing non-democratic states with authoritarian supply chain alternatives, in which liberal market access can no longer be leveraged as an instrument of diplomacy. The United States has chosen to decouple from China on semiconductors during a period of relative 'peace', which means this card will not be available to play as part of its sanctions arsenal, should a period of more active warfare ensue.[xix]

Nonetheless, Washington would likely argue that securing its economic and technological dominance now through addressing its vulnerabilities in the semiconductor market, will more favourably position America to prevent and respond to such risks in the future. Moreover, the complexity and technicality of the semiconductor supply chain suggests that it will be difficult for China to redress its innovation imbalance with the United States with any great speed.

There is no question of the geopolitical intent behind the CHIPS Act. While such legislation had been anticipated, the provisions around the loyalty of individuals came as a surprise, forcing the hand of companies and workers seeking to hedge between the two rival powers. With the passing of the Act, US citizens working for semiconductor companies in or owned by China are now liable to be stripped of their citizenship. There is no starker expression of the relationship Washington perceives between technological advancement, economic growth, and national security.[xx]

The short-term impacts of the CHIPS Act have been meaningful, slashing profit forecasts for American companies which sell to the Chinese market, and immediately freezing major manufacturing contracts Chinese companies held with US firms.[xxi] Taiwan's major semiconductor producer, TSMC, has thrown its weight behind the Act's intentions, announcing it will triple its investment in Arizona and open a second US advanced manufacturing plant.[xxii] There will be a painful tail to this legislation for China, which is likely to struggle with the maintenance of semiconductor technology designed or produced by the United States or its allies. China's response to these deteriorating circumstances will be flint-edged. In light of its commitment to technical advancement, there will be an enhanced motivation to engage in indigenous innovation, but potentially also to engage in espionage and other nefarious activities, which will mean Western governments and companies will need to further invest in deep security measures.[xxiii]

For the United States, the implication of this enormous state intervention will be an ongoing Government investment in the commercial viability of its domestic industry, in order to retain its competitive advantage.[xxiv] This signals a new era of Western industrial policy, with economies put on a 'wartime' footing to mobilise all instruments of the state and private sector, alongside academia and citizens, in a concerted mission to secure collective national resilience. The European Chips Act, which is working its way through the European Union's institutions, will serve a similar purpose to America's legislation, aiming to leverage huge swathes of private and public sector investment in semiconductor capabilities. [xxv] Japan and South Korea have also announced major state subsidies to support domestic semiconductor industries to maintain and increase their market positions.[xxvi]

What is most striking about these decisions is that they are often being made opaquely, due to their market sensitivity and the calculations that have been made about the importance of indigenous advantage. They have highlighted the challenges inherent in striking the right balance between sovereign capability and collective resilience, around common goods of vital importance.

UK's National Security Approach to Semiconductors

The UK Government is seeking to pursue an integrated foreign policy, which takes a 'whole-of-society' approach to resilience. This necessitates a 'whole-of-government' strategy that prioritises interconnectivity and brings a wider range of departments and portfolios into the spectre of national security. Since the Government's Integrated Review of Security, Defence, Development and Foreign Policy was published in March 2021, the Cabinet Office has begun to play a more central role in the coordination of this agenda. But the UK's machinery of government has not yet been sufficiently reengineered to deliver on this integrated ambition, which can make it difficult to take decisions on the increasing number of cross-departmental issues with speed and clarity.

Several recent developments have highlighted the strains being placed on the system, with new and old state instruments struggling to effectively adapt to the demands of the evolving environment. The National Security and Investment Act,[xxvii] which was passed in 2021, was recently

harnessed to support a decision around the future of the Newport Wafer Fab semiconductor plant in Wales. This semiconductor manufacturing plant (such facilities are known as 'fabs') fell into commercial difficulty and was subject to a takeover by a Dutch-based company, majority-owned by a Chinese parent company.[xxviii]

Newport Wafer Fab is a 'legacy' plant, which does not work at the cutting edge of the kinds of advanced technologies being produced in places like Taiwan. However, it does support the manufacturing of technology that remains useful for many consumer applications. The UK Government ultimately decided to deny the majority acquisition under the powers of the Act,[xxix] after an extremely protracted process that highlighted the lack of institutional consensus around how such decisions should be taken. In a time of constrained state resources, it is obvious that such choices must also consider the prospects of alternative investors being secured, and the role of Government when the commercial viability of valuable commodities cannot be assured.

Semiconductors are so essential to such a wide suite of current and future British consumer, government and industry needs, that it is a matter of urgency to secure our access to these critical technologies, and to ensure that this access will remain resilient in the face of geopolitical upheaval in the years to come. While there are areas in which the UK can carve out distinct, high-value capabilities, it is obvious that the UK will not be able to build end-to-end, internationally competitive supply chains in semiconductors. Yet, the decisions that our allies have taken in recent months indicate that the sovereign imperative of supply and capabilities around semiconductors may impede initiatives to encourage allied collaboration. This means that friend-shoring decisions will have to be taken especially carefully, and on the basis of deep institutional trust.

As a nation particularly interested in and concerned by the challenges facing the rules-based international order, the UK will also need to be mindful of the implications of even our closest allies pursuing protectionist national security strategies. America's CHIPS Act increased anxieties amongst some of its allies in East Asia about the future of their stakes in global semiconductor pipelines, and Washington has struggled to actualise its proposed 'Chip 4 Alliance' with key partners.[xxx] Taiwan's status as holding a near-monopoly over certain aspects of semiconductor technology has certainly heightened awareness of its geopolitical circumstance, and there are understandably fears that the attention of Western partners could be diverted.[xxxi] The question of how to maintain globalised supply chains for semiconductors, while strengthening the competitiveness of established liberal partners in this industry, should be a priority for the UK's leadership in priority forums such as the G7.

History suggests that choices to be made on state industrial policy in technology are most effective when they anticipate national and global future needs and priorities, particularly in areas where scarcity of resources and capabilities are likely to become paramount. In developing such strategic advantage, nations are able to influence the geopolitical value of such technology. It is important to recognise that investments in British technological competitiveness will not only strengthen our

security towards our strategic rivals, but will enable us to shape the decisions of our allies in their own planning processes.

Britain has ceded much of its historical advantage in the current semiconductor supply chain,[xxxii] but there is scope for the UK Government to act quickly to secure the remaining areas in which we can continue to command competitive legitimacy. Moreover, to begin to anticipate the next frontiers of technological advantage, and foster an enabling environment conducive to our future resilience. Semiconductors provide an urgent, tangible prism through which the ambition for a truly integrated UK foreign policy can and must be brought to life.

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