UNIVERSITY OF CAMBRIDGE

Cambridge Industrial Innovation Policy

BABBAGE FORUM

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BABBAGE US REGIONAL MEETING

MEETING REPORT

Berkeley, California US

The Babbage Forum gratefully acknowledges our Berkley hosts, Professor David Teece and Dr Bowman Heiden and Dr Guendalina Anzolin for preparing the meeting report.

The first part of the meeting set out the main points for the discussion with three presentations on industrial innovation policy in the US, by focusing on the overview of US Industrial Policy and the technology race with China.

The important stimulus package that the US government put in place in the last two years contributed to the shift towards a new "modern supply-side economics". This approach aims to address the industrial competitiveness and resilience of the US productive structure in critical sectors where there is a large consensus.

Three roundtables followed with a general presentation and a discussion on the following topics: green transition, semiconductor and GenAI + Quantum Roundtable. In terms of the policy instruments, a wide agreement on the importance of subsidies for industry stimulation was also challenged in terms of subsidies' financial sustainability. While they are critical to spur private investment over the next decade, sustaining such levels of support may be difficult, and it may not assure a quick catchup in key sectors.

Catching up with China in key technologies will take time and participants stressed the importance of considering supply-side and demand-side elements in conjunction when designing policies; a critical advantage of China is the big market to serve, which is critical in terms of competitiveness and scale economies.

As for the other two technologies discussed in the meeting, quantum computing and artificial intelligence, looking ahead the US aims to already building competitive advantage and to be prepared when these technologies will be ready for widespread production and adoption. Unlike previous industrial shifts, the US aims to invest early in these areas to maintain a competitive edge, though this approach raises concerns about regulatory openness and energy demands.

One key point across the different technologies is the strengthening of the relationship between the private and public sectors. The semiconductor industry is where this model is happening at a fast speed and large scale. With substantial government support, Intel and other major players are shifting towards diversified supply chains to ensure resilience against market volatility.

There are many challenges and opportunities for policymakers in the US. One of the main challenges seems to be the balance between geopolitical goals and domestic priorities like regional equality and climate goals. Sustained bipartisan support for these policies could provide stability for the business sector, encouraging long-term investments, while also promoting a gradual independence from subsidies, presenting anopportunity for large-scale reindustrialization.

BACKGROUND

The return of industrial policy has materialised under different programmes, passed by a large majority and a bipartisan consensus on the importance of investing in critical areas of the American economy. The challenges at stake require mission-focused public spending, meaning that the overarching goal – whether it is geopolitics or technology/sustainability-related – should guide government action. After decades of frantic outsourcing and offshoring that resulted in massive deindustrialisation and, across several American regions, in the loss of 'industrial commons'1, the US government started to reinvert the trend after the Global Financial Crisis, with the first significant policy package being Obama ARRA legislation. More recently, geopolitical tensions, climate and societal challenges led to a series of policies that mark a watershed from the past. The main recent policy packages passed are three:

The Bipartisan Infrastructure Law (2021) authorised $1.2 trillion for transportation and infrastructure spending.

The Chips and Science Act (2022), $52.7 billion in appropriation targeting the development of the semiconductor sector.

The Inflationary Reduction Act (IRA) (2022) authorised $891 billion, focusing on providing measures to increase American competitiveness in clean energy technologies.

While such packages are critical to reinforce public investment into key areas of the economy, the Chips and Science Act and IRA reassess two cornerstones of the recent policy-making process in the US. First, the IRA, having less to do with inflation and much to do with the provision of funding to increase competitiveness and growth in the green sectors, provides a 10-year program of instruments (mainly subsidies) to sustain firms that invest in energy-related technologies, putting forward a strong signal in terms of delivering firms (and their investments) with certainty over time. This is a historic change, where support over time was given only to specific sectors, e.g., defence. Second, the Chips and Science Act is probably one of the clearest examples of recent industrial innovation policy, where the government attempts to target a specific sector with measures that span from early innovation to manufacturing and production, with targeted policies for different stages of the innovation and industrial processes (see Box 1).

The Chips and Science Act ($52.7 billion in appropriations)
Industrial innovation policy in use:

$11 billion for federal semiconductor research programs and workforce development (Department of Commerce)

$39 billion for domestic semiconductor manufacturing facilities (Department of Commerce)

$200 million for workforce development (National Science Foundation)

$500 million for duplicate efforts to build a global chip ecosystem (Department of State)

$2 billion of defence-related microelectronics

Box 1.

The main objective of recent policy packages is to increase competitiveness and stimulate growth across the US economy. Geopolitical tensions with China and increasing capabilities in the innovation and production of energy and green-related technologies are the two main engines behind the strong policy push. However, despite the green transition being one of the main priorities, some participants shed light on the lack of a comprehensive manufacturing program for renewable sectors. Another critical element that emerged from the regional meeting is a shared understanding that industrial policy requires a balance between supply-side and demand-side elements.

On the supply side, the US is following what has been recently named "modern supplyside economics"2, an approach where the government uses its power to make bold investments in areas where there is a (generally bipartisan) consensus that such areas are critical to economic growth (e.g., transportation infrastructure, technological innovation and clean energy). Modern supply-side economics in the US put 3.5 trillion over the next decade to develop productive capabilities to build at speed, scaling and accelerating commercialisation. On the demand side, the main concerns concern the size of the US market, which is not enough to scale up critical technologies, such as semiconductors and other renewable technologies, at the scale needed to increase American competitiveness.

KEY THEMES

The regional meeting touched upon several aspects of industrial policy, design and instruments for effective policy, and the role of China and the main US ally (i.e., Europe). Six key aspects emerged from the meeting:

Subsidies to specific sectors have been critical for the industry to take off. They have been one of the most critical policies – also for the scale at which they are being deployed – for the industry, which has already committed to unprecedented investments. While the business sector argues that sustaining these types of subsidies will be critical – arguing that this time the success lies on policy instruments' consistency over time – there are questions of financial sustainability on the government/policy side. In other words, policy consistency over time gives firms reliability, yet sustaining high levels of subsidies seems unlikely. This point was also specifically referred to in the case of California, where reliable subsidies coming from IRA have been critical. IRA differs from previous waves of subsidies because it has a 10-year time horizon, unlocking a huge amount of private investment. Few participants from the business sector argued that with no tax credits, Chinese technologies would dominate, and the US would not be able to compete.

Demand and supply-side policies need to be balanced. Industrial innovation policy requires action both on the supply side – to provide stimulus to the productive structure and specifically on the investments and skills side – yet it also requires a sustained demand for products and services in order to enlarge the market and, especially in scale sensitive sectors, increasing productivity through economies of scale. A recent term has been coined to reinforce the strong focus on supply-side policies, 'modern supply-side economics' stresses how the recent supply-side policies were built with a bipartisan consensus in key areas where productive capabilities can be built. On the demand side, reflections on this point emerged as a critical aspect where international equilibria and industrial innovation policies meet; few participants mentioned that the US would need to expand its horizons because it does not have a demand/market as China and, therefore, there should be other markets that require to be targeted. On this latter element, it was emphasised that the demand coming from the defence sector is not enough to sustain the level of investment (i.e., volume/demand of goods and services coming from defence is not enough) that is required to reindustrialise at the scale that the US needs to compete with China.

Geopolitics. Out of the different objectives/missions that inspire US industrial policy, it emerged that the real engine for it is geopolitics, specifically the competition with China given its leading position in key manufacturing sectors, outperforming the US in both magnitudes of the country and size. The other goals/missions (such as climate change and regional inequality/levelling up) appear less prominent in the policy agenda and in any case, subject to the geopolitical aspect. For example, a few participants from the academic sector pointed out how the recent tariffs on EVs imported from China(increased by the Biden administration to the highest 100%) would undermine the country's transition to EVs.

US reliance on China remains strong. Despite China's economic performance being the engine for a strong US industrial policy, the reality is that the US will remain reliant/dependent on China for almost every renewable technology (e.g., batteries, solar, wind sectors). IRA provides a strong promotion of onshoring, yet the effort needs to be targeted, and it cannot cover all the sectors where the US has deindustrialised and not invested over time; the locked-in relationship with China is likely to remain, especially in certain segments/technologies in specific sectors.

The bipartisan nature of recent US policy packages. One of the reasons the recent US policy packages worked/passed is their bipartisan nature; what became less bipartisan over time is the mix of policies embedded in the big policy packages. For example, the childcare piece of legislation inserted into the Chips Act, which was initially passed based on the need to have more people in the workforce (especially more women), would face strong opposition today.

Europe. The attitude towards Europe is a critical one. Regarding protectionism, few participants mentioned that Europe appears to be 11 times more biased towards its domestic producers than the American government, so there is still a margin "not to challenge our allies". In terms of industrial policy, Europe is seen as a place where government response is weak despite a stronger attention to certain sectors, e.g., quantum research and AI (more regulation side). Overall, Europe is seen more as an ally in case of geopolitical tension rather than a manufacturing/innovation ally.

In addition to key considerations across sectors and technologies, the regional meeting provided some technology-related focuses.

GREEN TECHNOLOGIES

First, the meeting offered a deep dive into the Californian experience on green technologies. The box below presents the main elements of such experience, which provides an interesting case study despite the difficult applicability to other states and regions. The two most important elements that emerged to be essential for the success of California in innovating, producing and adopting green technologies are i) a balance between demand and supply side policies and ii) strong coordination between different policy levels (federal, state, and city levels).

Case Study:

CALIFORNIA GOES GREEN

Overview: 61% clean energy on the grid (2024) – 39.4% renewables, 10.8% large hydro, 10.7% nuclear.

Future objectives: 90% of clean energy in 2035 and 100% in 2045.

California has:

The world's largest thin-film solar PV project (Desert Sunlight Solar Project) provides around 500 MW.

The world's largest geothermal power plant (Geysers Geothermal power plant), which provides 955MW.

The world's largest solar rooftop (Apple HQ) provides 17MW.

Win'd Third Largest Wind Project (Atlas Wind Energy), 1550 MW. They are also trying to reduce the environmental impact with smaller and more powerful turbines 9Vasco Wind Energy Centre Repowering).

California offshore wind goals: 5GW by 2030 and 25GW by 2045.

The world's largest battery storage project (Edwards and Sanborn), which provides 3287 MWh. Battery storage is essential to store enough clean energy for the demand peaks (which tend to occur in the evening).

Box 2.

California is a fascinating case where the alignment of federal, state, and city policies has proved essential to reaching renewable targets and setting achievable goals. Policies on innovation and manufacturing were accompanied by softer programs to, for example, increase awareness of green technologies. For example, at the state level, California has since 2018 the solar mandate – i.e., compulsory PV installed in all new constructions; this was possible thanks to the experience of seven cities that tried such a programme and that shared lessons learnt and best practices. California is also characterised by a high amount (one of the highest in the country) of investment at the public and private levels. Public procurement are coordination are key; the state partnered with 32 military bases situated in California and leading by procurement emerged to be critical.

Through such investment plans, they have also used American subsidies to invest in some Chinese companies; this has not been seen as contradictory because "there is much to learn from China regarding best practices and policies." In China, it is also critical to mention that despite being California quite advanced on the manufacturing side, it will remain highly reliant on China.

In terms of investments, California is also pushing for 250 million for clean vehicles, specifically targeting manufacturing.

SEMICONDUCTORS

If there is one sector encompassing an array of technologies that has been selected in recent policy programmes, this is semiconductors. In fact, although, as part of 'modern supply economics,' it was argued that the US does not 'pick winners'; policies in the semiconductor space are closest to picking specific sectors and specific firms. A few key points emerged in the semiconductor session:

Private-Public Partnerships: The future of the semiconductor industry and of the success of industrial policies lie in a well-functioning public-private partnership. This includes corporate management's responsibility to act responsibly, emphasising long-term goals over short-term gains (see Box 3 on Intel).

More resources for US manufacturing. Despite the enormous resources, at least in comparison with other advanced economies, and the increasing scrutiny that generous policy packages are receiving, the industry claims that more public funding will be needed to sustain the industry in the future. The world's largest solar rooftop (Apple HQ) provides 17MW.

National security and economic stability require increasing competitiveness in the global semiconductor industry and, thus, a plan for long-term strategic investment. Given the extent to which this industry is key to national security, both public and private funding.

Case Study:
INTEL

Intel is an American company that has been highly criticised for spending the past two decades on stock buybacks rather than investing in innovation and technology. The impact strong financialisation has been a loss of competitiveness and a reliance on government intervention.

However, more recently, high public investment is leveraging an unprecedented influx of private capital into the chip industry. Also, asset management actors such as Brookfield and Apollo are participating into key investments; the former has 40% of the manufacturing expansion project in Arizona (Ocotillo) and the latter has 49% of Fab34 in Ireland. While Intel is welcoming "as much cash as it can get", it has also made a series of commitments.

The government funding received by Intel has been substantial, yet contingent on meeting certain milestones to support efforts in building new manufacturing facilities, and to refrain from short-terminism.

Box 3.

In the semiconductor sector, the US has been historically strong in the design phase, yet Intel is already working on investments, which would give Intel the possibility to build foundries for other chip designers in order to be more competitive– on the same model of TSMC. This involves building new fabs and expanding globally.

Intel is also part of programs like RAMP C program, which enables a U.S.-based commercial semiconductor foundry ecosystem to fabricate leading-edge custom integrated circuits and commercial products required for critical DoD systems.

Shifting towards different modes of managing supply chain. Historically, sourcing from a single supplier was seen as beneficial for cost reduction and supply chain reliability, while also contributing to low inflation. However, this approach has faced challenges with new market dynamics.

Box 3.

QUANTUM & ARTIFICIAL GENERAL INTELLIGENCE (AGI)

The last part of the meeting focused on two technologies, which – at the moment – belong more to the research domain rather than an investment/industrial domain. This is especially true for quantum, where the strategy seems to be that of investing heavily in this technology (i.e., since the very beginning) to be 'ready' when it will take off, unlike what happened with recent technology domains such as renewables and semiconductors. Overall, there is a high awareness and scrutiny of what other countries are doing (especially European countries such as France and the UK, where policy/research programmes are already in place).

Artificial intelligence is also a research domain, with very different technologies emerging from this broad field. For example, the more recent AGI is considered "completely different from anything experienced before, and with the potential to become a general-purpose technology". This technology is expected to become 1000 more powerful in the next ten years and potentially do unthinkable things today, such as designing chips with new material.

The most discussed point about AI (whether it is Generative or General) is the vast difference between how the US approaches the technology compared to China. While the process is regulated in both countries, the US faces a strong dilemma regarding the degree of openness. Most of the conversations in the US in this space reflect risks brought by AI. At the same time, in other countries, there is a stronger focus on opportunities (besides Europe, where participants argue that there is too much constraint on AI), which is linked to open source. "We should not look at AI as a nuclear weapon to control but as a technology to produce", mentioned one of the participants. Along these lines, participants from the industry agreed that openness with control is needed, and it would be a mistake to refrain from and excessively control it – as it is already happening with measures that prevent certain Chinese IPs from downloading the model.

A final point touched on by a few people is the increasing energy demand from AI, which is estimated to be 10,000 MW in the near future. Policymakers have not already addressed this but will be required to do so.

IMPLICATIONS FOR POLICY:

OPPORTUNITIES & CHALLENGES

The US regional meeting, which covered overarching topics about industrial policy design and instruments as well as specific elements at the sectoral and firm levels, highlighted a series of opportunities and challenges for the US economy.

One of the most critical challenges is the lack of trust in 'anything coming from China', a trend that risks slowing down the progress towards sustainability and the overall urgency around climate change. The other side of the coin, i.e., the massive effort to reindustrialise around critical sectors, also presents a few challenges that will have to be considered, the most important of which is that the renewable private sector is not only strongly relying on measures such as IRA, but it also has the desire for a second IRA; for example, both the solar industry and EV are likely to be swamped away by Chinese firms without continuous subsidies. So, the real challenge is maintaining subsidies to a point (not too high) where the industry is 'forced' to speed up. Another critical aspect of the reindustrialisation effort is that there will be a massive increase in energy demand, and it is still unclear where the power for industrial adaptation will come from. Finally, in terms of the priorities that seem to lie mainly at the geopolitical level, few participants questioned what the balance between 'bold policies' and other (societal) priorities like regional levelling up would look like, especially in light of existing regional programs that seem to have targeted regions with existing capabilities rather than left behind regions.

Yet, these challenges also embed and entail a series of opportunities. The first and most important is that the approved policy packages, because of the long-term horizon and the high initial sunk cost to leverage private investments, are likely to continue independently from a change of government. The number of factories, Department of Defence centres, workforce training policies, and huge investments are already undertaken by big companies, and this is very hard to undo. Therefore, stability and certainty will mark the US's near industrial future. This is brought by the IRA, which has certainly been the big push, and a series of other measures such as tax credits, subsidies, tariffs, and a comprehensive and unique package rebuild of the US industrial structure, starting from the next ten years.

Main Challenges	Main Opportunities
Designing future policies in such a way that limit dependency on China while also continuing the learning process	Measures are likely to be maintained across political cycles
Balancing geopolitics priorities with other priorities such as climate change and regional inequalities	Very high level of private investments (commitment from the private sector)
Becoming independent from subsidies in key emerging sectors	Unique opportunity to reindustrialise

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