

U.S. in Juggling Act for Strategic Diversification of Its Semiconductor Supply Chains

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Abstract

Since the onset of COVID-19 pandemic, supply chains have been catapulted to the forefront of national security policymaking. Supply of critical semiconductor components and rare-earth elements has been choked due to increased 'work-from-home' demand globally. It thus becomes imperative for nations to secure their own supply chains for strategic purposes. This article analyses recent coercive actions taken by the U.S.A in securing their national interest for the same.

Keywords: *Semiconductors, supply-chains, international politics, Quad, Taiwan, industrial policy, coercive theory*

U.S. rethinking supply chains

In February 2021, U.S. President Joe Biden signed an executive order to initiate a 100-day review into American supply chains of wide-ranging critical products and services, including semiconductor chips, high-capacity batteries, and strategic minerals like rare-earth elements (REE). It came amid a global shortage of semiconductor chips, which is impacting industries from military equipment to medical devices. Automakers around the world have been severely affected, with vehicle assembly plants forced to cut down production.

In December 2020, the Trump administration added China's largest foundry, SMIC, and its affiliates to the Entity List for their ties with the Chinese military, effectively prohibiting U.S. companies from supplying them chipmaking equipment that is essential to manufacture cutting-edge semiconductors. While older equipment can still be exported

to the blacklisted companies after obtaining "routine" licenses, the U.S. government is (unsurprisingly!) taking its time to process them. Chipmaking equipment for larger than 10nm semiconductors can still be exported after getting approval from the U.S. government. The two largest semiconductor manufacturing equipment vendors in the world, both from the U.S., have been struggling to obtain export licenses for selling old equipment to SMIC, as government officials conduct rounds of questioning to determine whether the U.S.-made equipment could be diverted for manufacturing more advanced chips. Most license applications from U.S. suppliers have been pending since the blacklisting. The processing time for such licenses is usually one month! Lam Research has not even had an initial response back from the government!

This episode paints just a tiny portion of the bigger picture; a power in

relative decline when challenged for its primacy in the world order, is seeing no shame in adopting tactics of its geo-strategic rival, in stark contrast to its own enshrined liberal values.

However, governments should understand that intervening in markets to achieve ‘favourable’ geoeconomic outcomes has strings attached. Chinese technology companies like Huawei have been hoarding chips and other critical inputs for months now, in preparation for the inevitable technology denial from U.S, and this has been one of the leading causes of the current global shortage. Besides, many industries don’t require cutting-edge chips, like automaking, instead they rely on older technologies that SMIC specialises in. U.S. sanctions motivate the Chinese government to invest more heavily in its own self-sufficiency and technological catch-ups. With demand for its chips at an all-time high, SMIC is largely a winner from the confrontation.

Taiwan Semiconductor Corporation (TSMC) and semiconductor chokepoint

After months of cajoling by the Trump administration, TSMC, the world’s most advanced chipmaker, announced plans to open a factory in the U.S. producing its current flagship 5nm chips. While it is certainly a win in the U.S. quest to ‘revitalise domestic supply chains’, there are several ‘holes’ in the picture. By 2024 when the factory opens, its production capacity will only be 0.25 million (by then non-flagship) 5nm chips per year. The closest domestic substitute, Intel, will be nowhere near the expected cutting-edge chips by then.

Shifting production of the most advanced semiconductors to the U.S. can

also be detrimental for Taiwanese national security. As China inches ever closer towards ‘reunification’, and with doubts whether U.S. would intervene, TSMC is the bargaining chip that is protecting Taiwan. If the U.S. doesn’t have ‘chips’ at stake in Taiwan, Beijing could be persuaded to take a calculated risk and finally invade the island nation.

Towards REE security for the U.S: Casting the Quad ‘dies’ in place

One of the many strategic reasons behind the Quad reinvigoration is their mutual interest in diversifying their REE supply chains away from China. Rare-earths are vital for manufacturing any technological product, from high-capacity batteries to electric vehicles, from F-35 jets (420 kgs per plane) to American Virginia class nuclear submarines (4.2 tonnes of rare-earths per sub), not to mention semiconductors! China hosts both the world largest reserves of rare-earths, as well as a near-monopoly in their processing.

China’s crippling grip over rare-earth supply spooked the world in 2010, when amid its Senkaku Island dispute with neighbour Japan, it placed quotas on the export of REE. Prices jumped nine times, and whether it was intentional or not, Chinese rare-earth exports to Japan tanked, which quickly led Japan to invest in production in Australia. Similar threats were made against Lockheed Martin last year.

The U.S. has dramatically stepped up its own rare-earth production from negligibility in 2017, just before its trade war with China heated up, to now being the world’s second largest producer (15%), followed by Australia with 7% market

share in 2020. India is also being nudged by the alliance to bolster its production of REE. India has the fifth largest global reserves of rare-earths (6.9 million tonnes), more than Australia (4.1 million tonnes) and U.S. (1.5 million tonnes) combined. Despite this, India exploits a tiny proportion (just three thousand tonnes in 2020) of what the other two Quad countries mine (roughly 55 thousand tonnes in 2020). India has recently overhauled its mining laws to promote the sector.

Future of Pax Americana: Playing Minecraft in the Indian Ocean?

At a time when critics argue that increasing U.S. commitments in the Indian Ocean will lead to strategic overstretching, the region around India's coastline is rich in mineral sands, which after refining can produce rare-earths as one of the many useful by-products. Rare earth refining is very environmentally polluting, so until recently most countries thought best to take advantage of China's lax environmental

laws, but this view is increasingly changing. As the technological costs of seabed mining come down, the Indian Ocean region can become a cheap and sustainable source for rare-earths. The Chinese realised this significance, and have been aggressively campaigning for contracts with countries in the Indian Ocean and Africa. The ball is with United States now, let's see how it improves its game in the coming years.

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