Fragmentation of the Semiconductor Industry and National Sovereignty- Are Chips the new Oil?

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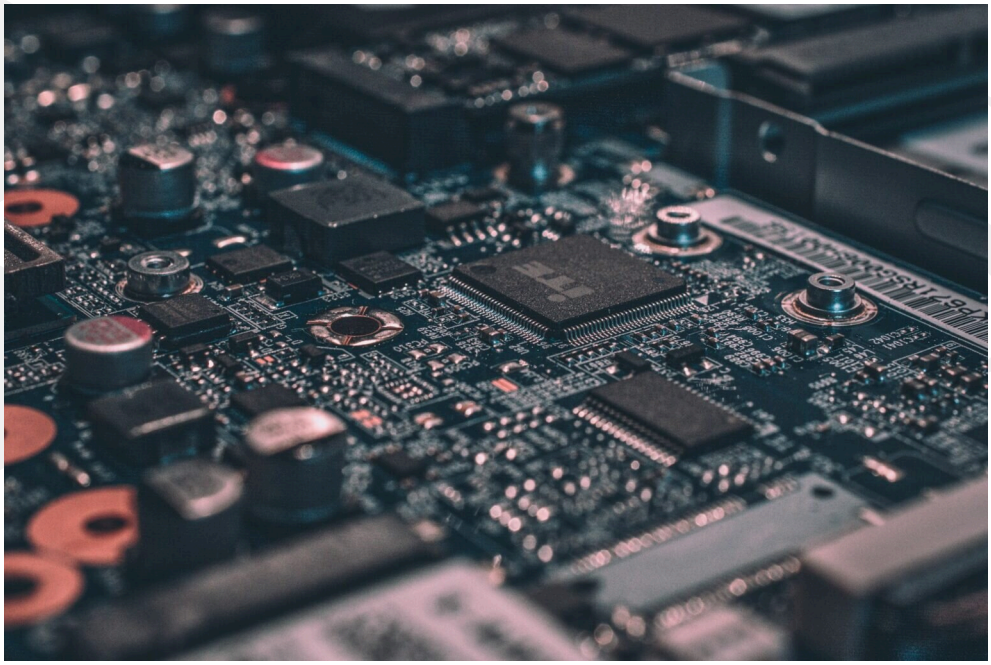


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Introduction

When the need for regional industry sustenance arising from forces of national security, clashes with global supply chains, it triggers a chain reaction over a global scale which can impact how firms interact and develop. Recent events following the semiconductor industry is an excellent medium to shed light upon the above argument proposed. Currently, the semiconductor industry stands at a whopping $975 billion and is projected to skyrocket till $1.1 trillion. Forecasts suggest by 2030, the figure stands at $1.47 trillion. Overall, the growth trend is moving exponentially. But the massive boom seems to be structurally sidelined towards AI chips. According to Deloitte,

revenue for AI chips is said to approach $500 billion in 2026 sold at an average price of $0.74. An interesting find arose when US noted 50% of their industry revenue owing to AI chips but they roughly formed only 0.2% of the total volume suggesting soaring prices in the coming years. Semiconductor trends for 2026 predict intensive usage of AI chips in various industries such as machines, drones, industrial robots, smartphones etc. in the form of "physical AI". It is becoming the "next fuel" for various commodities. However, this begs the question faced by many nationalities which is the over reliance and inter-dependance on other countries for consumer, capital and defense goods due to a complex global supply chain under the chip making industry. A minor disruption through factors like trade wars and political disagreements can threaten national security which pushes nations to rely on self-sustenance for semiconductors and thereby, motion towards its fragmentation.

Semiconductor Industry supply chain

The chip making industry follows a complex process of Extraction, design, manufacture, packaging and output. The key regions involve China, Taiwan, USA and South Korea. Companies in China such as Chinalco, Jiangxi Copper Co Ltd etc. control and export around 98-99% of Gallium, a significant input for semiconductors. US dominates design for AI chips built on semiconductors where companies like NVIDIA contribute through their extensive GPU design technology. The manufacturing stage is concentrated in Taiwan and South Korea. These chips are transferred back to China for their installment among various appliances.

Potential disruptions and the need for self-sustenance

Although the economic cost efficiencies among firms are guaranteed through this streamlined supply chain management, doubts may arise guaranteeing such stability owing to factors such as the intensifying technology rivalry between US and China, China's aggressive policies towards Taiwan and the instability of US trade policies under Trump administration. Geopolitical tensions such as the Russia-Ukraine war set as a reminder for the fuel supply disturbance. Currently, semiconductors are at the heart of future economy with the advancement of defense sector relying on it. Such events germinate seeds of political tension and global fragmentation that calls for a national policy that covers the sustenance of domestic industries for chip manufacturing. As stated by Christine Lagarde: "Central banks in a fragmenting world".

CHIPS and Science Act, Design linked incentive scheme, European Chips Act: successful tools for domestic growth or mediums for innovation redundancy?

The CHIPS and science act officially took place into action in USA on August 9,2022. The primary goal proposed was to reinvigorate and enhance the domestic semiconductor industry by providing consistent support for the country's competitiveness and R&D for chip making. The figures allocated under this Act for firms involved a total of $52.7 billion from which, $39 billion was for manufacturing. A tax credit of 25 percent is granted on semiconductor capital investments. The Act garnered interests of various tech firms to establish their manufacturing facilities for semiconductors, known as "fabs" in USA. TSMC, currently covering a significant portion of semiconductor manufacturing technology, established two plants valued at $40 billion and received a $6.6 billion subsidy. Samsung opened a fab in Texas for chip research and manufacture. Overall, through collaborations with MNC's via fabs combined with NVIDIA's effective chip design process, this Act is able to aid in streamlining an effective supply chain within domestic boundaries and limit external reliance.

Other countries also followed suit. India proposed the Design Linked Incentive scheme under the Semicon India Program where fabless semiconductor companies and chip making design are prioritized. Many startups and domestic companies capitalizing in semiconductors are encouraged through a 50% reimbursement capped at 15 crores per application under the product design linked incentive. The EU proposed the European Chips Act on 21st September 2023, where the focus sits on 2 pillars aiming towards domestic semiconductor development and supply chain security for which 18 state aid provisions have been guaranteed with a combined public and private investment of EUR 32 billion.

But it can become a noticing concern that under the guise of upcoming large-scale global projects; hidden costs in form Industrial redundancy, longer payback periods and talent shortages seem to arise. Taking USA for example, initial capital costs for building fabs are relatively more expensive than in East Asia by 10%. Since fab construction is labor intensive, operating costs are 35% higher in USA due to difference in wage pay by 4X as per McKinsey analysis. These underlying cost dynamics arise largely due to economies of scale that Mainland China and Taiwan benefit from, owing to consistent periods of research and development in manufacturing technology. Moreover, USA has not been equipped with labor skills that are at par with Taiwan's due to its decade long priority towards design, creating talent shortages. Such costs can disrupt R&D progress for chip design by over-allocating resources towards fab development.

Pursuing complete semiconductor sovereignty, therefore, can trigger capital duplication and research slowdowns. While countries hurry to subsidize domestic manufacturing to mitigate geopolitical risks, fragmen-

tation can establish parallel economies and impose inflationary taxes. The answer lies in anchoring consumer and commercial chip-dependent goods in the global supply chain to avoid fiscal strains. Additionally, to ensure sovereignty, targeted domestic subsidies towards defense grade chips used in military equipment and intelligence can be imposed. A balance therefore can be strategically established between national security and economic pragmatism.

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