INSS Special Publication

When the Axe Starts Chopping, Where Will the Chips Fall? The Global Microchip Crisis and its Strategic Opportunity for Israel

Ariel Sobelman | April 7, 2022

The struggle between the United States and China for technological supremacy in the microchip market, combined with the effects of the COVID-19 pandemic, has disrupted the global microchip supply chain, resulting in a severe shortage that has continued for over two years. This crisis highlights both the worldwide dependence on microchips and the strategic advantages accrued by countries that succeed in taking advantage of the crisis for their own benefit.

All the world's electronic devices run on microchips: small toys, household electrical appliances, medical equipment, and advanced weapons systems. The global microchip crisis, which has already continued for over two years, highlights the critical importance of these tiny components and their effect on all spheres of life and illuminates the global geostrategic significance of what seemed a gray and mundane technology. Like Middle Eastern oil in previous decades, microchips have become a resource upon which the world depends, and disruption of their supply chain is liable to have destructive consequences for global stability. Given the rivalry between the US and China, this crisis also presents Israel with a strategic opportunity to take a major step forward in the field of microchip technology.

The microchip crisis did not appear overnight. As part of its addiction to cheap prices, the US neglected the manufacturing of microchips over the past 30 years and instead focused on its research and development. Actual production migrated to Asia, where it was cheaper, with Taiwan becoming the world's largest producer of microchips – it now accounts for approximately 60% of the global microchip output. Notably, the importance of microchips today is infinitely greater than in the 1990s, when the US abandoned the sector.

The US has gradually realized the severity of its dependence on foreign production and its vulnerability due to foreign control of large parts of the supply chain for both civilian and military components. The Obama administration was the first to

formally identify and name this problem, and President Trump fired the opening shot in the crisis when he reached an astonishing agreement with Taiwan Semiconductor Manufacturing Company (TSMC), the world's largest microchips manufacturer. Under this agreement, TSMC will stop selling advanced microchips to China, while the US will subsidize the construction of the Taiwanese company's advanced factory in the US. The COVID-19 pandemic, natural disasters, an earthquake in Japan, a power outage in the vicinity of the microchip factories in Texas, and other disturbances have shut down production lines and further exacerbated the crisis. The Biden administration is continuing the efforts to prevent the transfer of technology to China and appears to be stepping up US measures against China.

Concurrently, over the last three decades, Israel has become a major power in microchip development. The industrial sector recognizes this, and many multinationals maintain development centers in Israel for the purpose of designing microchips for their products. Despite the boring image of microchip engineering, the largest exits in Israeli hi-tech industry in recent years have been in the microchip sector, among them Intel's recent $6.5 billion acquisition of Tower Semiconductor. The Israeli industry specializes in microchip development, but actual production takes place elsewhere. Intel has production plants in Israel, but these do not utilize the most advanced technology. Israel has no real microchip production capability to speak of.

As part of its rivalry with China, the US is investing huge resources in regaining the lead in the microchip sector, while striving to keep China from achieving its announced target of self-producing 70% of the microchips that it consumes by 2025, and especially to prevent China from manufacturing the next-generation microchips fabricated in less than five nanometer geometry. The US and Europe are also pushing special legislation to provide subsidies of $52 billion and €43 billion, respectively, to their microchip industries.[1] The American bill,[2] which Congress has already passed, is expected to provide large budgets for the microchip companies. Among other things, this bill refers to cooperation with likeminded countries and enlisting them in the efforts of American industry and explicitly mentions technological cooperation with Israel.

For example, Intel has already canceled its plans to build new foundries in China; instead, it will build them in the US for production of two-nanometer and three-

[1] "European Chips Act," *European Commission*, February 8, 2022, https://digital-strategy.ec.europa.eu/en/library/european-chips-act-communication-regulation-joint-undertaking-and-recommendation

[2] H.R.4521 – 117th Congress (2021–2022): America COMPETES Act of 2022 (March 31, 2022), https://www.congress.gov/bill/117th-congress/house-bill/4521

nanometer microchips. The intricate global supply chain of parts, materials, rare metals, chemical elements, access to natural resources and mineral deposits, as well as production machinery, transcends borders and regimes and is motivating the US to forge new technological partnerships. In its efforts, the US is now turning to its allies to join its efforts. Ultimately, few things are as difficult, complicated, and expensive as manufacturing microchips.

With the perpetual increasing of worldwide dependence on microchips, civilian and business technology and geostrategic and security technology have clearly converged. For example, Taiwan developed its "silicon shield" deterrence doctrine many years ago, but its origins were civilian and economic. The US recognition of China at the expense of Taiwan forced the latter to search for an independent economic engine, leading to an initiative to establish a local microchip foundry industry, with know-how and technology being transferred from the US to Taiwan. In less than two decades, Taiwan has become a world leader in the sector and now accounts for over 60% of global microchip production and 80% of advanced microchip production. The global demand for microchips is constantly accelerating, and the dependence on their supply has become a significant consideration in geopolitical conflicts.

The silicon shield doctrine is based on the idea that the world will take action to prevent any attempt to disrupt the supply of microchips, including a scenario involving a Chinese invasion of Taiwan. American strategic and military thinking recently proposed a possible "scorched earth" strategy in the form of an explicit threat to destroy the microchip fabs in the event of a Chinese invasion of Taiwan, which would also severely damage the Chinese economy itself.[3] Like other deterrence paradigms, the silicon shield doctrine evolves and is revised according to global developments,[4] but it appears to have been established as a permanent stabilizing factor that influences China's long-term thinking about how to achieve its ambition of unity with Taiwan.[5]

Chinese companies are among TSMC's largest customers (for older microchips, which are used in the world's most popular consumer goods), and any damage to the continuity of production will damage China itself. Furthermore, almost 80% of TSMC is foreign-owned. The economic shockwaves resulting from damage to the factories' output will be enormous and will be felt all over the world. China's

[3] J.M. McKinney and P. Harris, "Broken nest: Deterring China from invading Taiwan," *The US Army War College Quarterly: Parameters* 51, no.11(2021).
[4] P. van Gerven, "Taiwan's silicon shield is strong as ever," *Bits&Chips*, October 21, 2021, https://bits-chips.nl/artikel/taiwans-silicon-shield-is-stronger-as-ever/
[5] E. Yi-Ching Ho, "Semiconductors as a shield for Taiwan," *The Strategist*, March 16, 2021, https://www.aspistrategist.org.au/semiconductors-as-a-shield-for-taiwan/

strategic efforts to decrease its dependence on Taiwanese microchips through independent production show that it is aware of the power of Taiwan's silicon shield and the enormous damage that would result if the factories are harmed. For their part, the Taiwanese highlighted the importance of defending the factories in a war exercise in July 2020,[6] in which thousands of soldiers simulated defense of one of the production lines against a Chinese attack. An American war game held in early 2022 simulated a large-scale Chinese cyberattack on TSMC factories to assess the consequences of such an attack, its effects on the global supply chain, and the risk of beginning an all-out war.[7]

The war in Ukraine, an important supplier of neon, which is essential to the manufacturing process of microchips, is also affecting the global supply chain, thereby illustrating how global instability is liable to aggravate the microchips crisis. It may therefore play a role in the considerations of countries before they initiate conflicts. The American sanctions against China are hampering the development of a local Chinese microchip production industry, which could preserve the deterrent power of the silicon shield. At the same time, the US is making huge investments to encourage development and the construction of an independent production apparatus in order to eliminate American dependence on Asia. The Biden administration has realized this need and is taking measures of unprecedented scope – in legislation, budgeting, and cooperative efforts – to shorten and reconstruct the global supply chain, so that the most advanced microchips will be manufactured in the US or on the territory of its allies.

As noted, the Taiwanese deterrence doctrine was fully conceived only after the microchip industry was already an accomplished fact. In Israel, the technological element in the country's strength and national security developed simultaneously with the growing importance of technology in the military field and the establishment of the local hi-tech industry. The combination and reciprocal relations between the defense establishment and the IDF as incubators for technological entrepreneurship and the development of the civilian hi-tech industry are a key element in Israel's success. While technology was always regarded as an important part of Israel's qualitative advantage, but was conceptualized primarily at the technological and practical level of its military use, the abstract concept of "technology" appears now to be totally identified with Israel's national essence and strength. In other words, the hi-tech industry in

[6] Y. Lee, N. Shirouzu, and D. Lague, "Silicon fortress T-Day: The battle for Taiwan," Reuters, December 27, 2021, https://www.reuters.com/investigates/special-report/taiwan-china-chips/
[7] B. Wasser, M. Rasser, and H. Kelly, "When the chips are down – gaming the global semiconductor competition," *CNAS*, January 2022, https://s3.us-east-1.amazonaws.com/files.cnas.org/documents/CNAS-Report-Semidconductor-game-final.pdf

general and the microchip sector in particular have become an integral part of Israel's national security doctrine, and this needs to be conceptualized accordingly.

Inspiration can be drawn from Taiwan's strategic importance as a microchip supplier, which can serve as a model for creating a kind of "silicon dome" for Israel. If Israel acquires microchip production capacity, whether through a long-term plan for generating a local microchip industry, a partnership with Intel for gradually upgrading its factories in Israel, or encouraging other microchip manufacturers to build factories within Israel, Israel will benefit in many ways. One of the most important benefits is that Israel will enjoy the familiar and proven advantages of having a physical proximity between research and development and production.[8] Concentrating industries of all types within a geographic proximity is a well known phenomenon and it can increase the level of competitiveness,[9] including a regular flow of employees and suppliers, the formation of an ecosystem of peripheral service providers for industry, effective cooperation between industrial players, and more.[10] Furthermore, at the engineering level, physical proximity shortens and streamlines the interfaces between development and production and improves general productivity. Long-term planning of education, training, and employee recruitment also becomes possible. These all contribute to enhancing the competitiveness of the Israeli economy.

Another advantage of manufacturing advanced microchips in Israel is its potential contribution to narrowing gaps in Israeli society. The hi-tech industry currently provides a direct livelihood to about 10% of Israel's labor force. It is usually estimated that for every job in hi-tech, another 1.5 jobs are indirectly created. In advanced microchips factories, even though the level of automation is high and there are fewer employees, the number of indirect jobs created for every job is 4–5. There is an enormous gap in Israel between the wages in traditional industry and hi-tech. Making Israel a center for advanced microchip production will enable many more Israelis, including in outlying areas, to acquire the education and profession that they need to be part of both an advanced manufacturing industry and the opportunity at being part of the "Israeli dream". For example, the salary gap between a microchips development engineer and the production workers in

[8] N. I. Gust-Bardon, "The role of geographical proximity in innovation: Do regional and local levels really matter?" *Fraunhoffer Institute*, 2012, https://www.econstor.eu/bitstream/10419/60501/1/721218741.pdf

[9] C. Omobhude and S. Chen, "The roles and measurements of proximity in sustained technology development: A literature review," *Sustainability*, 11, no. 1 (2019), https://www.mdpi.com/2071-1050/11/1/224/htm

[10] Economist Intelligence Unit, "Spatial alchemy: Why proximity matters for innovation," *The Economist*, 2016, http://destinationinnovation.economist.com/wp-content/uploads/sites/3/2016/07/Destination-Innovation-Spatial_alchemy_why_proximity_matters_for_innovation.pdf

Taiwan is about 30% – far less than between hi-tech jobs and production workers in traditional industry in Israel. Salaries are much higher in advanced microchip fabs; the advanced microchip industry therefore would have enormous social significance as a factor in narrowing gaps by generating opportunities that would integrate diverse Israeli population groups – perhaps also Palestinians – into industry. With proper guidance, it will be possible to encourage the building of microchip factories in outlying areas, thereby promoting the Zionist enterprise, for example, in the Negev.

Microchips manufacturing is an especially expensive sector with high entry barriers. Few countries in the world possess the ability to manufacture microchips with the most advanced technology: TSMC in Taiwan, Samsung in South Korea, and Intel in its planned factories in the US. The direct cost of building a microchips factory is $10–20 billion. In addition to special production machinery, specific electrical and water infrastructure for operating and cooling is needed. Furthermore, maintenance and upgrading are also required, as well as ensuring the necessary know-how, education, and personnel training, only part of which currently exists in Israel. The vision of independent microchips production mandates a strategic decision by the Israeli government, allocation of resources, and the participation of the private market in Israel and overseas.

As a preliminary step, it is necessary to conduct a thorough examination of the matter to take advantage of the unique geostrategic configuration that has emerged in the microchip industry. This examination should include staff work, in cooperation with leaders of the semiconductor industry worldwide and in Israel, and should enable presenting a collaborative technological-business recommendation. There are signs of openness to and support for this idea among opinion makers and strategic thinkers in the US, as well as among key officeholders in the American administration dealing with the matter, who are interested in cooperation. It is important to continue fostering this trend in order to harness it to the common vision. It is also worthwhile working with members of the US House of Representatives and Senate, both directly and through the relevant lobbies, to ensure their support in advancing both the vision and possible budget allocations in the framework of American legislation.

In conclusion, the global microchip crisis is generating a rare opportunity to leverage Israeli hi-tech and upgrade Israel's global standing. The map of geopolitical circumstances, the rivalry between the US and China, Israel's leading position in microchip research, development, and design, the passage of the America Creating Opportunities for Manufacturing, Pre-Eminence in Technology, and Economic Strength (America COMPETES) Act of 2022 and its accompanying

funding, and Israel's special status as a reliable US ally have created a window of opportunity for formulating a national microchip strategy and a plan for applying it. These measures will strengthen the connection between the two countries and will lay the groundwork for a strategic technological alliance between them.