



Food Resiliency – A Soft Spot in Taiwan's Silicon Shield?

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Abstract

This article explores the link between Taiwan's semiconductor dominance and its food security, addressing issues like water and land scarcity, and emphasizes the need for policies that balance chip production with food resilience on the international stage.

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Analysis

The world today is a vastly different place than it was four years ago, and so too is Taiwan’s position on the international stage. Whoever wins next year’s presidential election will face ongoing challenges of cross-strait tension, possible contagion effect of China’s deflation, and delicate navigation of alliance relations, He will also face opportunities, including the chance to make constructive choices on China, Taiwan’s international space, and fortifying the island nation’s central role in the global semiconductor supply chain.

Supply chain problems during the covid-19 pandemic shone a spotlight on Taiwan’s vital role – given its dominant position of producing 92% of world market share for advanced chips – and this strength in microchips is often described as a “silicon shield” to deter Chinese aggression.

Back in 2021, TSMC chairman Mark Liu elaborated in CBS News’ “60 Minutes” that because “the world all needs Taiwan’s high-tech industry support”, war is unlikely in the region “because it goes against interest of every country in the world.” Rupert Hammond-Chambers, president of the U.S.-Taiwan Business Council, likewise noted the core of this shield is TSMC’s ability to “remain the unassailable leader of the world’s semiconductor manufacturing process...if that continues, Taiwan’s chip ecosystem remains central to the world’s commercial needs.”

Nonetheless, there are concerns that the silicon shield may “have holes in it.” According to Alexander Neill, a former Shangri-La Dialogue senior fellow at the International Institute for Strategic Studies, there were concerns some Taiwan chips were inadvertently diverted to the Chinese military as a third party end user, and ongoing supply shortage of energy and water could disrupt production. Water as a critical input in the chip ecosystem was especially highlighted during the 2021 drought, and government diversion of water from farmers to chip makers had attendant negative spillover on the agricultural sector.¹

This in turn brought to the fore the linkage of semiconductors, resource scarcity and food resiliency, as encapsulated by Frederik Kelter in a 2022 Foreign Policy article entitled “The Battle Over Semiconductors Is Endangering Taiwan.”² He contextualized the linkage in a naval blockade scenario, and warned that semiconductor favoritism may have negative externalities on the agricultural sector that could increase food insecurity for Taiwan.

With Taiwan’s food sufficiency rate at only 35%, when coupled with the government diverting water from farmers whenever there is water scarcity, Kelter argued that this food insecurity would leave Taiwan vulnerable to a possible blockade by China to weaken the country. Military officials in the U.S. and Japan have also begun to take note of this emerging challenge, and the next president will need balanced policies to redress these issues in order to fortify Taiwan’s silicon shield.

¹ Emanuela Barbiroglio, “No Water No Microchips: What Is Happening In Taiwan?”, *Forbes*, May 31, 2021, <https://www.forbes.com/sites/emanuelabarbiroglio/2021/05/31/no-water-no-microchips-what-is-happening-in-taiwan/?sh=5e0b56de22af>; Amy Chang Chien and Raymond Zhong, “Drought in Taiwan Pits Chip Makers Against Farmers”, *The New York Times*, April 13, 20-21, <https://www.nytimes.com/2021/04/08/technology/taiwan-drought-tsmc-semiconductors.html>

² Frederik Kelter, “The Battle Over Semiconductors is Endangering Taiwan”, *Foreign Policy*, September 16, 2022, <https://foreignpolicy.com/2022/11/09/tsmc-taiwan-battle-semiconductors-water-resource-scarcity/>

² Effendi Andoko *et al*, “Review of Taiwan’s Food Security Strategy”, FFTC Agricultural Policy Platform



Food resiliency and naval blockade

In May 2023, U.S. Army War College published a report on the vulnerability of Taiwan's food resiliency in a conflict with China, which has hitherto been overlooked in traditional national security assessments.³ Authors Gustavo Ferreira and Jamie Critelli noted growing structural risks within the food supply system, due to limited arable land and rapid urbanization, and assessed that Taiwan could endure trade disruptions for only six months. A 2020 Taiwan Council of Agriculture (COA) report revealed Taiwan's food self-sufficiency ratio is only 35%, meaning it imports almost 70% of its food, placing Taiwan in a vulnerable position in the event of a naval blockade. Given nearly 95% of agricultural imports arrive in Taiwan by sea routes, this concern was further underscored by China's 2022 military exercise of a blockade scenario.⁴

Another island nation, Japan, is also paying attention. Similar to Taiwan, it has a low food self-sufficiency ratio of 37% in 2020, slumping from 73% in 1965, and defense analysts warned the government's neglect of rice paddies and agricultural land is increasing this vulnerability.⁵ Toshiyuki Ito, retired vice admiral for the Maritime Self Defense Force, lamented that government officials "don't do anything for national security...they think only about economic efficiency." However, in a potential Taiwan crisis wherein Japan's own sea lanes are destroyed, "The whole of Japan would lose physical access [to imports] and it would lead to famine," warned Japan's former agriculture ministry official Kazuhito Yamashita.

In the case of Taiwan, the U.S. Department of Agriculture published a report in April 2020 indicating that Taiwan's food stock levels can feed its population for up to six months, with the exception of rice as the only food product with large reserves of 900,000 metric tons (MT) to endure beyond six months.⁶ However, these reserves will dwindle as chipmakers and rice farmers compete for scarce water resources. In southern Taiwan, rice farmers have not been allowed to plant their crops in three years in order to save water for semiconductor factories nearby, and Taiwan's shortage of arable land is further exacerbated by the conversion of farmland into solar panel farms in the chip sector's push for green energy.

This is to support TSMC's declared sustainability goal of having 40% green energy in its total energy mix by 2030, which is mandated by its biggest client Apple that aims to be carbon neutral across its entire business and manufacturing supply chain by then. However, the push for solar energy development has encouraged landowners in rural areas to lease their lands to build solar panels rather than to farmers because it is more lucrative, further diminishing supply of arable land. According to a landowner in Guanmiao District in Tainan, "The rent solar operators are paying me is at least 10 times higher than what I could get from farmers."

With chip makers and rice farmers competing for scarce natural resources in the context of a naval blockade scenario, can the next president implement policies that can arrive at synergy, rather than a trade-off, between

³ Gustavo F. Ferreira and Jamie A. Critelli, "Taiwan's Food Resiliency – or Not – in a Conflict with China", *The US Army War College Quarterly: Parameters*, Vol. 53, No. 2, May 19, 2023,

<https://press.armywarcollege.edu/cgi/viewcontent.cgi?article=3222&context=parameters>

⁴ Joel Gehrke, "Taiwan sees danger that China will blockade food imports to starve island", *The Washington Examiner*, September 3, 2022, <https://www.washingtonexaminer.com/policy/defense-national-security/taiwan-china-food-imports-blockade-military>

⁵ Isabel Reynolds and Grace Huang, "Low food self-sufficiency could cripple Japan in Taiwan Crisis", *Japan Times*, August 29, 2022, <https://www.japantimes.co.jp/news/2022/08/29/business/japan-food-self-sufficiency-security/>

⁶ Troy Lai and Lucas Blaustein, "Taiwan Confident in Food Stocks as COVID-19 Disrupts International Trade", U.S. Department of Agriculture report TW2020-0023, April 13, 2020,

https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Taiwan%20Confident%20in%20Food%20Stocks%20as%20COVID-19%20Disrupts%20International%20Trade_Taipei_Taiwan_04-05-2020



chips and rice in Taiwan's overall silicon shield?

Chips and rice, not chips or rice

To that end, perhaps Kaohsiung could serve as a model for the semiconductor industry as they grapple with issues of water, energy, and land. Back in August, the Kaohsiung City Government announced it was working with TSMC to make 2-nanometer (nm) chips at its new factory in Nanzih Technology Industrial Park, rather than the 28nm legacy chips as originally planned. Nanzih is forming the core zone of Taiwan's "Southern Semiconductor S Corridor", a project envisioned by Kaohsiung City Mayor Chen Chi-mai (陳其邁) of forming a new technology industrial cluster in Kaohsiung.⁷

Water. With increased demand for water in Kaohsiung, Mayor Chen acknowledged "We will need to make adjustments to the supply of water and electricity." TSMC had initially planned to produce 7nm and 28nm chips in its Nanzih fabrication facilities, now the 2nm chip is replacing the 28nm in the current fab under construction, and the 7nm plant is on hold. While a single new fab is estimated to increase Kaohsiung daily water intake by 118,000 metric tons, or 7% of Kaohsiung's overall water consumption, once the 7 nm fab begins production water consumption would rise to about 14% of overall consumption.

Back in July there were rumors the delay of Taichung City's planned 2nm plant may move to Kaohsiung due to water shortage in Taichung, but the plant was approved in late August. The water shortage concern is not without precedent though, when in 2021 Taiwan faced its worst drought in 56 years, sending TSMC and other chipmakers scrambling for water needed in their manufacturing process, including using tanker trucks to transport water from elsewhere.

This incident punctuated the real challenge of water scarcity facing the semiconductor industry, including TSMC and Intel fabs in Phoenix, Arizona, as chip companies continue to grapple with scarce supplies of land and water for expansion. During the drought, Taiwan government implemented emergency measures to divert water from agriculture to industry which pit Taiwanese farmers against chip makers, but this policy is not sustainable in light of food insecurity highlighted by the conflict in Ukraine.

To redress this, Kaohsiung and Tainan are linking reservoirs and building an interconnected network of water supply to hedge against any potential water shortage in the future. Efforts are also underway to build additional water reclamation centers, which already has a lauded history in Israel and Singapore, but just beginning to garner more attention in Taiwan.

Although Kaohsiung also faces a tight water supply when water levels of Gaoping River (高屏溪) drops, its municipal water supply has remained normal likely due to better supply management, and the Tsengwen-Nanhua water pipeline will bring water from Kaohsiung to Tainan for its new desalination plant. Hopefully these various measures would lessen the burden on farmers, who since 2021 have been applying Taiwan COA's "Rice Three Out of Four" (水稻四選三) initiative, to plant something other than rice for one season out of the four rice seasons that span two years. Farmers who adopt this practice are offered cash rewards in order to reduce water use, but some farmers worry their seed business will be affected, and the reduction of rice stock would equally reduce Taiwan's ability to endure a naval blockade longer than six months.

Energy. In terms of the chip sector's demand for green energy and the diversion of arable land for solar panels,

⁷ Christina Lin, "Kaohsiung could become key hub", *Taipei Times*, October 23, 2022, <https://www.taipeitimes.com/News/editorials/archives/2022/10/23/2003787545>



these panels also have negative environmental impacts in its life cycle – specifically difficulty with disposal and recycling of panels which contain toxic materials of lead and cadmium.⁸ As Tsai Chia-Shen argued in a February 2022 Taiwan Insight article, wastewater discharged by one electroplating factory could result in three years of fallowness in nearby farmlands and expensive remediation to remove heavy metals absorbed in the soil.

With the chip sector's demand for water and arable land for solar panels seemingly crowding out rice farmers, does the Taiwan government have a comprehensive and balanced approach to synergize the trade-off between chip security and food security? According to Professor Hsing-Lung Lien, Director of New Energy & Electricity Development Center at the National University of Kaohsiung, Taiwan Environmental Protection Agency (EPA) does consider the whole picture and uses what is called a Life Cycle Assessment (LCA). In support of circular economy policy goals, Taiwan EPA asks producers to pay a one-time recycling fee of NT\$1,000 per KW capacity to the government, so that at the end of the solar panel life cycle, that money will be used to properly recycle the panels.

However, more needs to be done, and Professor Lien recommends that "Taiwan EPA should take the Food-Energy-Water (FEW) nexus into consideration in order to better balance the needs between energy and environment" in its sustainable development assessments. The FEW nexus is a tool for improving security of these resources via an interdisciplinary approach, highlighting their interdependence and potential synergies and trade off within the nexus, and may be instructive for the next president to implement policies that synergizes chip security and food security within Taiwan's silicon shield.

Land. Finally, finding land for new foundries will be problematic as TSMC and other semiconductor companies continue to grow at a rapid pace and available agricultural or undeveloped land declines in Taiwan, as noted by Elaine Huang and Hannah Chang in a September 2021 Commonwealth Magazine article. As such, rather than pitting farmers against chip makers whether over water rights or land, perhaps a new form of "urban renewal" of renovating old industrial parks into technology parks such as Kaohsiung's S Corridor, could be an innovative solution to meet these critical challenges.

Remarks: Opinions expressed in this contribution are those of the author. This article first appeared in Commonwealth Magazine on October 6, 2023.

⁸ Tsai Chia-shen, "Crops, houses or panels? The land-use conversions of Taiwan farmland", *Taiwan Insight*, February 10, 2022, <https://taiwaninsight.org/2022/02/10/crops-houses-or-panels-the-land-use-conversions-of-taiwan-farmland/>