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# The chip industry's little-known global assembly line

BY LENNY SIEGEL, OPINION CONTRIBUTOR - 04/02/23 11:00 AM ET

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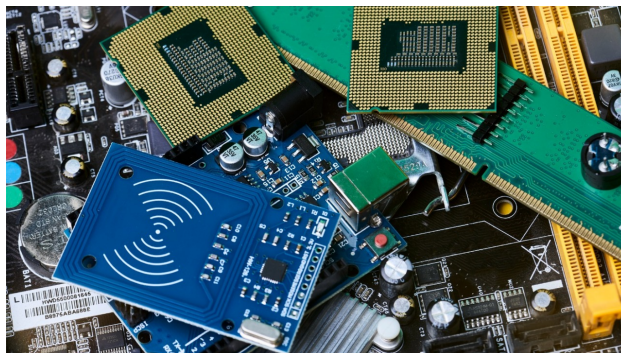
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Silicon Valley." The location is a commercial plaza in Mountain View, where in the mid-1950s Nobel Prize-winning physicist William Shockley established the Shockley Semiconductor Laboratory, the first commercial manufacturer of semiconductor devices.

The hundreds of retired engineers at the event understood the significance of silicon, the substrate from which most microelectronic "chips" are made. But although "Silicon Valley" is known globally as the Mecca of digital technology, policymakers in our nation's capital seem unaware of one of the greatest "contributions" of the semiconductor industry: the global assembly line.

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Semiconductors are manufactured from ingots of pure silicon, a common element most often found in sand. The ingots — a solid block — are sliced into thin wafers resembling CDs or DVDs, and through a complex, chemical-intensive process known as wafer

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fabrication, microscopic circuits are etched onto the wafers. Squeezing millions or even billions of “transistors” onto a flake or die of silicon is the miracle of microelectronics that makes computers, smart phones and other electronic devices possible.

Shockley’s business never made much money, but in 1957 eight of his top employees — including recently deceased Gordon Moore — universally recognized as [the “Traitorous Eight,”](#) departed to form Fairchild Semiconductor, which also set up shop in Mountain View. In its early years, Fairchild invented the planar process, the technology that later made possible the fabrication of integrated circuits. Over time, top engineers at Fairchild, including some of the Traitorous Eight, left to form their own chipmaking companies.

For decades, almost all of the semiconductor producers in Santa Clara Valley could trace their lineage to Fairchild. They were called the “Fairchildren.” The Valley became known as Silicon Valley, and [Electronic News published the Silicon Valley Family Tree.](#) Fairchild came up with another, lesser-known innovation: the global assembly line. Starting 1963, Fairchild shipped its fabricated wafers (or the small dice cut from those wafers) to Hong Kong for assembly into packages. Following testing, the completed chips were shipped to locations, in the U.S. and elsewhere,

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where they were built into all forms of electronic devices. Since that date, just about every company conducting wafer fabrication in the U.S. (or Far East) has shipped their wafers abroad for assembly and final testing. Most assembly plants have been in the Far East, though there are some in Mexico and one in Canada.

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Thus, most of the assembly workforce has historically consisted of Asian women. It made financial sense to manufacturers to ship their products back and forth across the Pacific because it lowered production costs. While wafer fabrication has historically relied mainly on low-wage women of color in the U.S., female labor costs in Asia have always been much lower.

Today, Intel owns and operates chip assembly plants in China, Malaysia, Vietnam and Costa Rica. Texas Instruments does the same in China,

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BY **ANGELINO'S COFFEE**

Malaysia, the Philippines and Mexico. Micron Technology assembles in China, Malaysia, Singapore and Taiwan. Advanced Micro Device utilizes Chinese and Taiwan-based partners and subcontractors.

The only outlier is IBM. [President Biden highlighted IBM's Bromont, Quebec, Canada assembly plant in his March 24 address to the Canadian Parliament.](#) The company advertises that it's the largest semiconductor assembly plant in North America. I am aware of no chip assembly factories in the U.S.

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Supporters of the CHIPS Act, which has numerous valuable provisions, say that it will harden the semiconductor supply chain and create jobs in the U.S. When it comes to assembly, however, that's simply not true. There is no benefit to disrupting wafer fabrication by locating it in the U.S. The wafers or dice are sent to China or other Far Eastern countries for assembly.

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CHIPS money cannot be spent on factories outside the U.S., but there is no requirement that semiconductors fabricated in CHIPS-supported plants be assembled in the U.S. This massive CHIPS investment of federal dollars could better reduce supply-chain vulnerabilities and provide many more production jobs if it forced chipmakers to set up domestic assembly factories near their wafer fabs. [Biden's](#) announcement of an investment of \$50 million in North American chip and printed circuit board assembly is, like the circuits, microscopic.

I don't advocate bringing it all home. There are advantages to retaining the chipmaking, as well as other manufacturing, partnerships among China, Taiwan and the U.S. Despite the bipartisan drumbeat of anti-China hostility in Washington, the economic benefits of those partnerships give all three countries strong incentives to deescalate then rising tide of bellicosity.

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