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Biden wants an industrial renaissance. He can't do it without immigration reform.

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Just 15 minutes outside of downtown Columbus, the suburbs abruptly evaporate. Past a bizarre mix of soybean fields, sprawling office parks and lonely clapboard churches is a field where the Biden administration — with help from one of the world's largest tech companies — hopes to turn the U.S. into a hub of microchip manufacturing.

In his State of the Union address in March, President Joe Biden called this 1,000-acre spread of corn stalks and farmhouses a "field of dreams." Within three years, it will house two Intel-operated chip facilities together worth $20 billion — and Intel is promising to invest $80 billion more now that Washington has sweetened the deal with subsidies. It's all part of a nationwide effort to head off another microchip shortage, shore up the free world's advanced industrial base in the face of a rising China and claw back thousands of high-end manufacturing jobs from Asia.

But even as Biden signs into law more than $52 billion in "incentives" designed to lure chipmakers to the U.S., an unusual alliance of industry lobbyists, hard-core China hawks and science advocates says the president's dream lacks a key ingredient — a small yet critical core of high-skilled workers. It's a politically troubling irony: To achieve the long-sought goal of returning high-end manufacturing to the United States, the country must, paradoxically, attract more foreign workers.

"For high-tech industry in general — which of course, includes the chip industry — the workforce is a huge problem," said Julia Phillips, a member of the National Science Board. "It's almost a perfect storm."

From electrical engineering to computer science, the U.S. currently does not produce enough doctorates and master's degrees in the science, technology, engineering and math fields who can go on to work in U.S.-based microchip plants. Decades of declining investments in STEM education means the U.S. now produces fewer native-born recipients of advanced STEM degrees than most of its international rivals.

Foreign nationals, including many educated in the U.S., have traditionally filled that gap. But a bewildering and anachronistic immigration system, historic backlogs in visa processing and rising anti-immigrant sentiment have combined to choke off the flow of foreign STEM talent precisely when a fresh surge is needed.

Powerful members of both parties have diagnosed the problem and floated potential fixes. But they have so far been stymied by the politics of immigration, where a handful of lawmakers stand in the way of reforms few are willing to risk their careers to achieve. With a short window to attract global chip companies already starting to close, a growing chorus is warning Congress they're running out of time.

"These semiconductor investments won't pay off if Congress doesn't fix the talent bottleneck," said Jeremy Neufeld, a senior immigration fellow at the Institute for Progress think tank.

Given the hot-button nature of immigration fights, the chip industry has typically been hesitant to advocate directly for reform. But as they pump billions of dollars into U.S. projects and contemplate far more expensive plans, a sense of urgency is starting to outweigh that reluctance.

"We are seeing greater and greater numbers of our employees waiting longer and longer for green cards," said David Shahoulian, Intel's head of workforce policy. "At some point it will become even more difficult to attract and retain folks. That will be a problem for us; it will be a problem for the rest of the tech industry."

"At some point, you'll just see more offshoring of these types of positions," Shahoulian said.

A Booming Technology

Microchips (often called "semiconductors" by wonkier types) aren't anything new. Since the 1960s, scientists — working first for the U.S. government and later for private industry — have tacked transistors onto wafers of silicon or other semiconducting materials to produce computer circuits. What *has* changed is the power and ubiquity of these chips.

The number of transistors researchers can fit on a chip roughly doubles every two years, a phenomenon known as Moore's Law. In recent years, that has led to absurdly powerful chips bristling with transistors — IBM's latest chip packs them at two-nanometer intervals into a space roughly the size of a fingernail. Two nanometers is thinner than a strand of human DNA, or about how long a fingernail grows in two seconds.

A rapid boost in processing power stuffed into ever-smaller packages led to the information technology boom of the 1990s. And things have only accelerated since — microchips remain the primary driver of advances in smartphones and missiles, but they're also increasingly integrated into household appliances like toaster ovens, thermostats and toilets. Even the most inexpensive cars on the market now contain hundreds of microchips, and electric or luxury vehicles are loaded with thousands.

It all adds up to a commodity widely viewed as the bedrock of the new digital economy. Like fossil fuels before them, any country that controls the production of chips possesses key advantages on the global stage.
Until fairly recently, the U.S. was one of those countries. But while chips are still largely designed in America, its capacity to produce them has declined precipitously. Only 12 percent of the world's microchip production takes place in the U.S., down from 37 percent in 1990. That

percentage declines further when you exclude “legacy” chips with wider spaces between transistors — the vast majority of bleeding-edge chips are manufactured in Taiwan, and most factories not found on that island reside in Asian nations like South Korea, China and Japan.

For a long time, few in Washington worried about America’s flagging chip production. Manufacturing in the U.S. is expensive, and offshoring production to Asia while keeping R&D stateside was a good way to cut costs.

Two things changed that calculus: the Covid-19 pandemic and rising tensions between the U.S. and China.

Abrupt work stoppages sparked by viral spread in Asia sent shockwaves through finely tuned global supply chains. The flow of microchips ceased almost overnight, and then struggled to restart under new Covid surges and ill-timed extreme weather events. Combined with a spike in demand for microelectronics (sparked by generous government payouts to citizens stuck at home), the manufacturing stutter kicked off a chip shortage from which the world is still recovering.

Even before the pandemic, growing animosity between Washington and Beijing caused officials to question the wisdom of ceding chip production to Asia. China’s increasingly bellicose threats against Taiwan caused some to conjure up nightmare scenarios of an invasion or blockade that would sever the West from its supply of chips. The Chinese government was also pouring billions of dollars into a crash program to boost its own lackluster chip industry, prompting fears that America’s top foreign adversary could one day corner the market.

By 2020 the wheels had begun to turn on Capitol Hill. In January 2021, lawmakers passed as part of their annual defense bill the CHIPS for America Act, legislation authorizing federal payouts for chip manufacturers. But they then struggled to finance those subsidies. Although they quickly settled on more than $52 billion for chip manufacturing and research, lawmakers had trouble decoupling those sweeteners from sprawling anti-China “competitiveness” bills that stalled for over a year.

But those subsidies, as well as new tax credits for the chip industry, were finally sent to Biden’s desk in late July. Intel isn’t the only company that’s promised to supercharge U.S. projects once that money comes through — Samsung, for example, is suggesting it will expand its new $17 billion chip plant outside of Austin, Texas, to a nearly $200 billion investment. Lawmakers are already touting the subsidies as a key step toward an American renaissance in high-tech manufacturing.

Quietly, however, many of those same lawmakers — along with industry lobbyists and national security experts — fear all the chip subsidies in the world will fall flat without enough high-skilled STEM workers. And they accuse Congress of failing to seize multiple opportunities to address the problem.

STEM help wanted

In Columbus, just miles from the Johnstown field where Intel is breaking ground, most officials don't mince words: The tech workers needed to staff two microchip factories, let alone eight, don't exist in the region at the levels needed.

"We're going to need a STEM workforce," admitted Jon Husted, Ohio's Republican lieutenant governor.

But Husted and others say they're optimistic the network of higher ed institutions spread across Columbus — including Ohio State University and Columbus State Community College — can beef up the region's workforce fast.

"I feel like we're built for this," said David Harrison, president of Columbus State Community College. He highlighted the repeated refrain from Intel officials that 70 percent of the 3,000 jobs needed to fill the first two factories will be "technician-level" jobs requiring two-year associate degrees. "These are our jobs," Harrison said.

Harrison is anxious, however, over how quickly he and other leaders in higher ed are expected to convince thousands of students to sign up for the required STEM courses and join Intel after graduation. The first two factories are slated to be fully operational within three years, and will need significant numbers of workers well before then. He said his university still lacks the requisite infrastructure for instruction on chip manufacturing — "we're missing some wafer processing, clean rooms, those kinds of things" — and explained that funding recently provided by Intel and the National Science Foundation won't be enough. Columbus State will need more support from Washington.

"I don't know that there's a great Plan B right now," said Harrison, adding that the new facilities will run into "the tens of millions."

A lack of native STEM talent isn't unique to the Columbus area. Across the country, particularly in regions where the chip industry is planning to relocate, officials are fretting over a perceived lack of skilled technicians. In February, the Taiwanese Semiconductor Manufacturing Corporation cited a shortage of skilled workers when announcing a six-month delay in the move-in date for their new plant in Arizona.

"Whether it's a licensure program, a two-year program or a Ph.D., at all levels, there is a shortfall in high-tech STEM talent," said Phillips. The NSB member highlighted the "missing millions of people that are not going into STEM fields — that basically are shut out, even beginning in K-12, because they're not exposed in a way that attracts them to the field."

Industry groups, like the National Association of Manufacturers, have long argued a two-pronged approach is necessary when it comes to staffing the high-tech sector: Reevaluating immigration policy while also investing heavily in workforce development

The abandoned House and Senate competitiveness bills both included provisions that would have enhanced federal support for STEM education and training. Among other things, the House bill would have expanded Pell Grant eligibility to students pursuing career-training programs.

“We have for decades incentivized degree attainment and not necessarily skills attainment,” said Robyn Boerstling, NAM’s vice president of infrastructure, innovation and human resources policy. “There are manufacturing jobs today that could be filled with six weeks of training, or six months, or six years; we need all of the above.”

But those provisions were scrapped, after Senate leadership decided a conference between the two chambers on the bills was too unwieldy to reach agreement before the August recess.

Katie Spiker, managing director of government affairs at National Skills Coalition, said the abandoned Pell Grant expansion shows Congress “has not responded to worker needs in the way that we need them to.” Amid criticisms that the existing workforce development system is unwieldy and ineffective, the decision to scrap new upgrades is a continuation of a trend of disinvesting in workers who hope to obtain the skills they need to meet employer demand.

“And it becomes an issue that only compounds itself over time,” Spiker said. “As technology changes, people need to change and evolve their skills.”

“If we’re not getting people skilled up now, then we won’t have people that are going to be able to evolve and skill up into the next generation of manufacturing that we’ll do five years from now.”

Congress finally sent the smaller Chips and Science Act — which includes the chip subsidies and tax credits, $200 million to develop a microchip workforce and a slate of R&D provisions — to the president’s desk in late July. The bill is expected to enhance the domestic STEM pool (at least on the margins). But it likely falls short of the generational investments many believe are needed.

“You could make some dent in it in six years,” said Phillips. “But if you really want to solve the problem, it’s closer to a 20-year investment. And the ability of this country to invest in anything for 20 years is not phenomenal.”

Immigration Arms Race

The microchip industry is in the midst of a global reshuffling that’s expected to last a better part of the decade — and the U.S. isn’t the only country rolling out the red carpet. Europe, Canada, Japan and other regions are also worried about their security, and preparing sweeteners for microchip firms to set up shop in their borders. Cobbling together an effective STEM workforce in a short time frame will be key to persuading companies to choose America instead.

That will be challenging at the technician level, which represents around 70 percent of workers in most microchip factories. But those jobs require only two-year degrees — and over a six-year

period, it's possible a sustained education and recruitment effort can produce enough STEM workers to at least keep the lights on.

It's a different story entirely for Ph.D.s and master's degrees, which take much longer to earn and which industry reps say make up a smaller but crucial component of a factory's workforce.

Gabriela González, Intel's head of global STEM research, policy and initiatives, said about 15 percent of factory workers must have doctorates or master's degrees in fields such as material and electrical engineering, computer science, physics and chemistry. Students coming out of American universities with those degrees are largely foreign nationals — and increasingly, they're graduating without an immigration status that lets them work in the U.S., and with no clear pathway to achieving that status.

A National Science Board estimate from earlier this year shows a steadily rising proportion of foreign-born students with advanced STEM skills. That's especially true for degrees crucial to the chip industry — nearly 60 percent of computer science Ph.D.s are foreign born, as are more than 50 percent of engineering doctorates.

"We are absolutely reliant on being able to hire foreign nationals to fill those needs," said Intel's Shahoulian. Like many in the chip industry, Shaoulian contends there simply aren't enough high-skilled STEM professionals with legal status to simultaneously serve America's existing tech giants and an influx of microchip firms.

Some academics, such as Howard University's Ron Hira, suggest the shortage of workers with STEM degrees is overblown, and industry simply seeks to import cheaper, foreign-born labor. But that view contrasts with those held by policymakers on Capitol Hill or people in the scientific and research communities. In a report published in late July by the Government Accountability Office, all 17 of the experts surveyed agreed the lack of a high-skilled STEM workforce was a barrier to new microchip projects in the U.S. — and most said some type of immigration reform would be needed.

Many, if not most, of the foreign nationals earning advanced STEM degrees from U.S. universities would prefer to stay and work in the country. But America's immigration system is turning away these workers in record numbers — and at the worst possible time.

Ravi (not his real name, given his tenuous immigration status) is an Indian national. Nearly three years ago, he graduated from a STEM master's program at a prestigious eastern university before moving to California to work as a design verification lead at an international chip company. He's applied three times for an H-1B visa, a high-skilled immigration program used extensively by U.S. tech companies. But those visas are apportioned via a lottery, and Ravi lost each time. His current visa only allows him to work through the end of year — so Ravi is giving up and moving to Canada, where he's agreed to take a job with another chip company. Given his skill set, he expects to quickly receive permanent legal status.

“The application process is incredibly simple there,” said Ravi, noting that Canadian officials were apologetic over their brief 12-week processing time (they’re swamped by refugee applications, he said).

If given the choice, Ravi said he would’ve probably stayed in California. But his story now serves as a cautionary tale for his younger brother back home. “Once he sort of completed his undergrad back in India, he did mention that he is looking at more immigration-friendly countries,” Ravi said. “He’s giving Canada more thought, at this point, than the United States.”

Ravi’s story is far from unique, particularly for Indian nationals. The U.S. imposes annual per-country caps on green cards — and between a yearly crush of applicants and a persistent processing backlog, Indians (regardless of their education or skill level) can expect to wait as long as 80 years for permanent legal status. A report released earlier this year by the libertarian Cato Institute found more than 1.4 million skilled immigrants are now stuck in green card backlogs, just a slight drop from 2020’s all-time high of more than 1.5 million.

The third rail of U.S. politics

The chip industry has shared its anxiety over America’s slipping STEM workforce with Washington, repeatedly asking Congress to make it easier for high-skilled talent to stay. But unlike their lobbying for subsidies and tax breaks — which has gotten downright pushy at times — they’ve done so very quietly. While chip lobbyists have spent months telling anyone who will listen why the $52 billion in financial incentives are a “strategic imperative,” they’ve only recently been willing to discuss their immigration concerns on the record.

In late July, nine major chip companies planned to send an open letter to congressional leadership warning that the shortage of high-skilled STEM workers “has truly never been more acute” and urging lawmakers to “enact much-needed green card reforms.” But the letter was pulled at the last minute, after some companies worried about wading into a tense immigration debate at the wrong time.

Leaders in the national security community have been less shy. In May, more than four dozen former officials sent a leader to congressional leadership urging them to shore up America’s slipping immigration edge before Chinese technology leapfrogs ours. “With the world’s best STEM talent on its side, it will be very hard for America to lose,” they wrote. “Without it, it will be very hard for America to win.”

The former officials exhorted lawmakers to take up and pass provisions in the House competitiveness bill that would’ve lifted green card caps for foreign nationals with STEM Ph.D.s or master’s degrees. It’d be a relatively small number of people — a February study from Georgetown University’s Center for Security and Emerging Technology suggested the chip industry would only need around 3,500 foreign-born workers to effectively staff new U.S.-based factories.

“This is such a small pool of people that there’s already an artificial cap on it,” said Klon Kitchen, a senior fellow focused on technology and national security at the conservative American Enterprise Institute.

Kitchen suggested the Republican Party’s wariness toward immigration shouldn’t apply to these high-skilled workers, and some elected Republicans agree. Sen. John Cornyn, whose state of Texas is poised to gain from the expansion of chip plants outside Austin, took up the torch — and almost immediately got burned.

Sen. Chuck Grassley, Iowa’s senior Republican senator, blocked repeated attempts by Cornyn, Democrats and others to include the green card provision in the final competitiveness package. Finding relief for a small slice of the immigrant community, Grassley reasoned, “weakens the possibility to get comprehensive immigration reform down the road.” He refused to budge even after Biden administration officials warned him of the national security consequences in a classified June 16 briefing, which was convened specifically for him. The effort has been left for dead (though a push to shoehorn a related provision into the year-end defense bill is ongoing).

Many of Grassley’s erstwhile allies are frustrated with his approach. “We’ve been talking about comprehensive immigration reform for how many decades?” asked Kitchen, who said he’s “not inclined” to let America’s security concerns “tread water in the background” while Congress does nothing to advance broader immigration bills.

Most Republicans in Congress agree with Kitchen. But so far it’s Cornyn, not Grassley, who’s paid a price. After helping broker a deal on gun control legislation in June, Cornyn was attacked by Breitbart and others on his party’s right flank for telling a Democratic colleague immigration would be next.

“Immigration is one of the most contentious issues here in Congress, and we’ve shown ourselves completely incapable of dealing with it on a rational basis,” Cornyn said in July. The senator said he’d largely given up on persuading Grassley to abandon his opposition to new STEM immigration provisions. “I would love to have a conversation about merit-based immigration,” Cornyn said. “But I don’t think, under the current circumstances, that’s possible.”

Cornyn blamed that in part on the far right’s reflexive outrage to any easing of immigration restrictions. “Just about anything you say or do will get you in trouble around here these days,” he said.

Given that reality, few Republicans are willing to stick their necks out on the issue.

“If you look at the messaging coming out of [the National Republican Senatorial Committee] or [the Republican Attorneys General Association], it’s all ‘border, border, border,’” said Rebecca Shi, executive director of the American Business Immigration Coalition. Shi said even moderate Republicans hesitate to publicly advance arguments “championing these sensible visas for Ph.D. STEM talents for integrated circuits for semiconductors.”

“They’re like … ‘I can’t say those phrases until after the elections,’” Shi said.

That skittishness extends to state-level officials — Ohio's Husted spent some time expounding on the benefits of "bringing talented people here to do the work in America, rather than having companies leave America to have it done somewhere else." He suggested that boosting STEM immigration would be key to Intel's success in his state. But when asked whether he's taken that message to Ohio's congressional delegation — after all, he said he'd been pestering them to pass the chip subsidies — Husted hedged.

"My job is to do all I can for the people of the state of Ohio. There are other people whose job it is to message those other things," Husted said. "But if asked, you heard what my answer is."

Of course, Republicans also pin some of the blame on Democrats. "The administration ignores the fire at the border and the chaos there, which makes it very hard to have a conversation about controlling immigration flows," Cornyn said.

And while Democratic lawmakers reject that specific concern, some admit their side hasn't prioritized STEM immigration as it should.

"Neither team has completely clean hands," said Sen. Mark Warner, the chair of the Senate Intelligence Committee. Warner noted that Democrats have also sought to hold back STEM immigration fixes as "part of a sweetener" so that business-friendly Republicans would in turn back pathways to citizenship for undocumented immigrants. He also dinged the chip companies, claiming the issue is "not always as straightforward" as the industry would like to frame it and that tech companies sometimes hope to pay less for foreign-born talent.

But Warner still supports the effort to lift green card caps for STEM workers. "Without that high-skilled immigration, it's not like those jobs are going to disappear," he said. "They're just gonna move to another country."

And despite their rhetoric, it's hard to deny that congressional Republicans are largely responsible for continued inaction on high-skilled immigration — even as their allies in the national security space become increasingly insistent.

Stuck on STEM immigration

Though they've had to shrink their ambitions, lawmakers working to lift green card caps for STEM immigrants haven't given up. A jurisdictional squabble between committees in July prevented advocates from including in the House's year-end defense bill a provision that would've nixed the caps for Ph.D.s in "critical" STEM fields. They're now hoping to shoehorn the provision into the Senate's defense bill instead, and have tapped Republican Sen. Thom Tillis of North Carolina as their champion in the upper chamber.

But Tillis is already facing pushback from the right. And despite widespread support, few truly believe there's enough momentum to overcome Grassley and a handful of other lawmakers willing to block any action.

“Most members on both sides recognize that this is a problem they need to resolve,” said Intel’s Shahoulian. “They’re just not at a point yet where they’re willing to compromise and take the political hits that come with it.”

The global chip industry is moving in the meantime. While most companies are still planning to set up shop in the U.S. regardless of what happens with STEM immigration, Shahoulian said inaction on that front will inevitably limit the scale of investments by Intel and other firms.

“You’re already seeing that dynamic playing out,” he said. “You’re seeing companies set up offices in Canada, set up offices elsewhere, move R&D work elsewhere in the world, because it is easier to retain talent elsewhere than it is here.”

“This is an issue that will progressively get worse,” Shahoulian said. “It’s not like there will be some drop-dead deadline. But yeah, it’s getting difficult.”

Intel is still plowing ahead in Johnstown — backhoes are churning up dirt, farmers have been bought out of homes owned by their families for generations and the extensive water and electric infrastructure required for eight chip factories is being laid. Whether those bets will pay off in the long-term may rest on Congress’ ability to thread the needle on STEM immigration. And there’s little optimism at the moment.

Sen. Maria Cantwell, the chair of the Senate Commerce Committee, said she sometimes wishes she could “shake everybody and tell them to wake up.” But she believes economic and geopolitical realities will force Congress to open the door to high-skilled foreign workers — eventually.

“I think the question is whether you do that now or in 10 years,” Cantwell said. “And you’ll be damn sorry if you wait for 10 years.”