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Intel's Latest Hail Mary Is a $20 Billion Bet on American Manufacturing

The chipmaker helped create Silicon Valley—but cultural complacency and a missed mobile boom have left it far behind competitors.

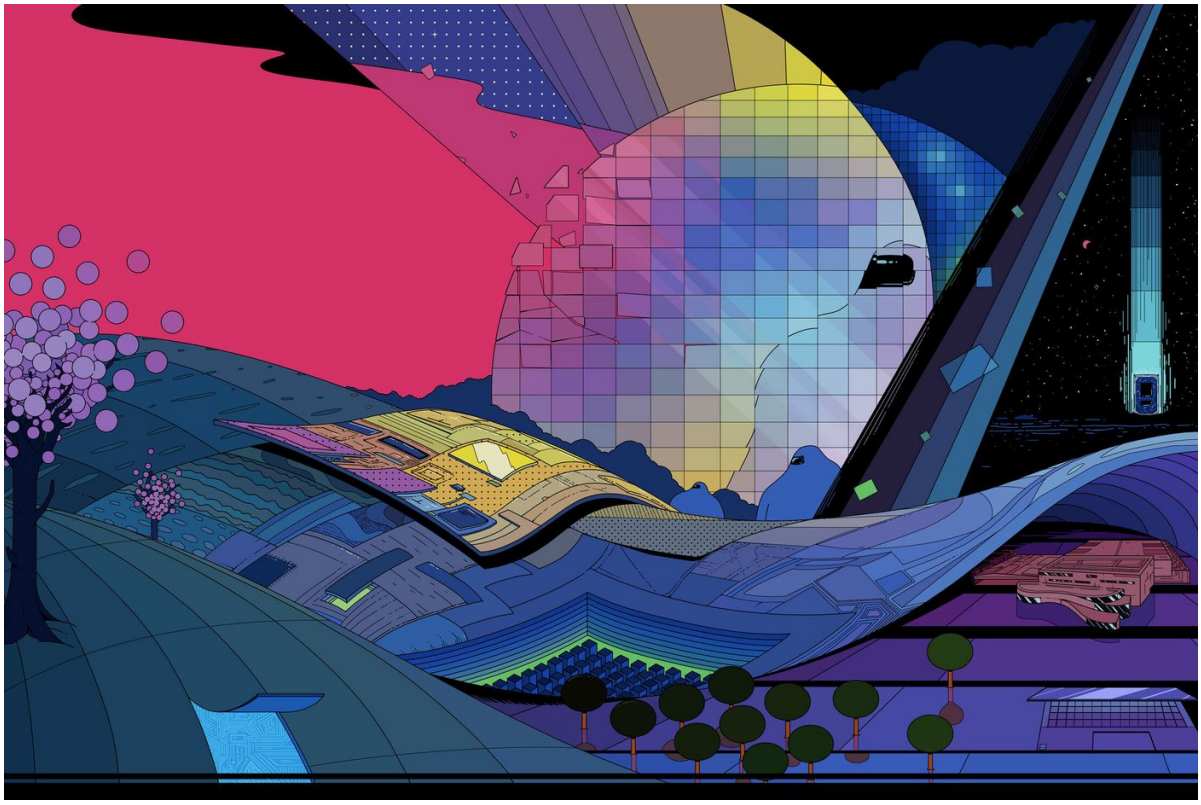


ILLUSTRATION: ORI TOOR FOR BLOOMBERG BUSINESSWEEK

By Ian King and Tom Giles

The statement, conveyed as the third bullet point of a quarterly earnings release, was both mind-numbingly technical and inscrutably terse—almost to the point of meaninglessness for anyone who was not a professional investor or analyst. "Accelerating 10nm product transition," it read, "7nm product transition delayed versus prior expectations."

To those who do make a living scrutinizing financial releases, this was disastrous. It meant that Intel Corp. was struggling to produce its latest and greatest

chips. The company had promised it would be manufacturing chips with transistors that have dimensions as small as 7 nanometers, or 7 billionths of a meter, with 2021 as the most recent deadline. The smaller the transistors, the more you can cram together, which makes for faster or more efficient processors. The delay meant that Intel would be stuck selling an older generation of chips for another year.

Intel has been a jewel of American manufacturing since the late 1960s, when Robert Noyce and Gordon Moore started the company in Mountain View, Calif., and in doing so helped create the modern chip industry and Silicon Valley itself. The company, now based in Santa Clara, has suffered delays in the past, but Intel's engineers have always ensured each setback was short-lived.

By July 2020 things had changed. During the conference call that followed the earnings release, Intel's unassuming chief executive officer, Bob Swan, indicated that the company's futuristic chip fabrication plants—"fabs"—might never be able to catch up. Instead the company was considering using contractors to build the 7nm chips. "To the extent that we need to use somebody else's process technology, and

we call those contingency plans, we will be prepared to do that," Swan said in response to the first question from an analyst.

His words were halting and coldly technical, but every analyst on the call heard this and thought the same thing: Holy crap. Swan's suggestion was possibly the most radical thing to happen to Intel in its 52-year history. Intel had climbed to the top of the more than $400 billion-a-year chipmaking industry by designing sophisticated processors and mastering the complicated techniques needed to produce hundreds of millions of them to power the world's computers—doing all that in-house.

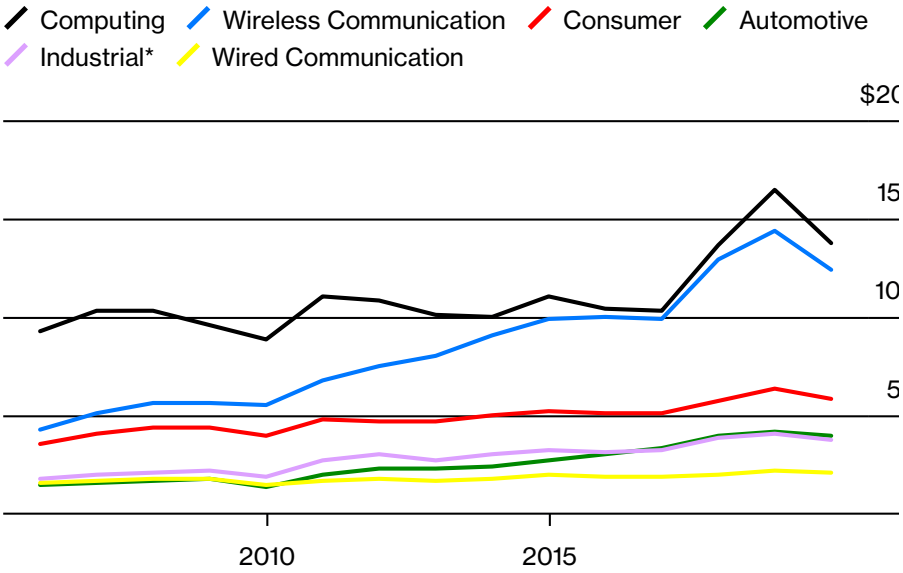
This technical prowess made Intel the leader in chips and a key part of the mythology of 20th century American capitalism. Yes, most electronics were made in factories in Asia, but that was low-margin, low-wage work that the U.S. didn't want anyway. Intel's American factories, on the other hand, made the most sophisticated, highest-margin components for those devices. Presidents Bill Clinton, George W. Bush, and Barack Obama all visited Intel fabs, and "Intel Inside" was emblazoned on desktops and laptops the world over. During the 1990s, at the height of the company's cultural cachet, Intel ran

television commercials featuring clean-room workers in full Tyvek, disco dancing to Wild Cherry's *Play That Funky Music*. The plan Swan suggested would repudiate that legacy and possibly damage the leadership of the U.S. in high-end manufacturing.

Before Swan could follow through on the outsourcing plan, the company changed course again, replacing him with Pat Gelsinger, who'd been Intel's chief technology officer and who was still very much a believer in its manufacturing prowess. In March he announced a plan to spend $20 billion on new U.S. factories that could make chips for other semiconductor companies that want to outsource their production. He presented this plan to make Intel into a contract manufacturer, or what's known as a foundry, as a statement of his turnaround ambitions. "Intel is back," Gelsinger told journalists. "The old Intel is the new Intel. We're going to be leaders in the market, and we're going to satisfy the new foundry customers, because the world needs more semiconductors, and we're going to step into that gap in a powerful and meaningful way."

Global Semiconductor Revenue by Industry

Intel dominates in computing but failed in wireless communication



Data: IDC

*Includes energy, medical, military, and aerospace.

Even today, even in its current diminished form—having lost the title of most valuable American chip company to Nvidia Corp., which designs graphics processors and outsources most of its manufacturing to Asia—Intel still controls about 80% of the computer processor market, with an even bigger share in servers, the powerful machines that run data centers. But Intel's biggest customers, including Amazon.com, Apple, and Microsoft, have all begun designing their own chips and hiring outsourced manufacturers to make them. Intel rival Advanced Micro Devices (AMD) Inc., another so-called fabless chip company, has been selling 7nm components for months. That's caused many to question whether, despite Gelsinger's promises of a restoration, the company can recover from

its production stumbles. “Progress on the manufacturing side has utterly come off the rails,” says JoAnne Feeney, a partner at Advisors Capital Management LLC and a longtime chip analyst.

Intel’s predicament didn’t come about overnight. It’s been a consequence of a decade’s worth of missteps—including a failure to break into chips for smartphones—and cultural decay that blinded the company to serious shortcomings, according to more than two dozen current and former employees, most of whom asked not to be identified for fear of retribution or jeopardizing their job prospects. It’s also a function of global shifts that gave rise to Asian manufacturing giants such as Samsung Electronics Co. and Taiwan Semiconductor Manufacturing Co. These companies increasingly sit at the center of the industry, and it’s their chips that are increasingly finding their way “inside” the most advanced devices.

▲ Silicon Valley before Intel. SOURCE: SAN JOSE PUBLIC LIBRARY/CALIFORNIA ROOM

Although founders Moore and Noyce were among those who created the first semiconductors back when the San Francisco Peninsula was better known for its almond orchards than for its silicon products, the person at the center of Intel's rise was Andy Grove. The Hungarian-born engineer was Moore and Noyce's first hire and served as the company's CEO from 1987 to 1998. Grove's Intel, which would influence a generation's worth of management thinking, prized discipline, intellectual honesty, and focus.

Grove was famously demanding, introducing a "Late List," which required employees who showed up for work after 8 a.m. to sign their name on a sheet of paper at the front desk, and a ranking system that placed all engineers in one of four performance categories. The ranking system, and many other of Grove's techniques, would be adopted by almost every major tech company, and Grove's approach to organizational discipline influenced bestselling business books such

as *Radical Candor* and *Great by Choice*. In dealings with senior managers, he promoted "constructive confrontation," what he saw as an unvarnished frankness designed to ensure that problems were brought to light and resolved efficiently. In Grove-speak, employees were supposed to "disagree and commit."

This approach could make meetings at Intel a bit hostile—employees furtively referred to the "Hungarian Inquisition"—but it also meant that Grove was willing to listen to critics. He courted junior-level naysayers ("Cassandras," he called them)who learned to speak up about potential problems without fear of reprisal. "Mentoring with Andy Grove was like going to the dentist and not getting Novocain," Gelsinger recalled in an interview in 2016, shortly after Grove's death. He intended this as a compliment, praising Grove's "aggressive pursuit of the right answer."

During Grove's decade-long tenure, the most ambitious engineers competed for the distinction of being the CEO's "technical assistant." This role, which now exists at Amazon.com Inc. and Microsoft Corp., entailed menial tasks such as serving as the executive chauffeur and helping with Grove's schedule, but it also involved

writing presentations and standing in for the CEO in high-level meetings. Many technical assistants went on to senior positions at Intel or at its competitors. Former CEO Paul Otellini was a technical assistant to Grove.

Part of the reason Grove's approach was so influential is that it resulted in impressively consistent technical and financial progress, which was so reliable it eventually came to be seen as something close to a law of nature. Grove's discipline ensured Intel chips became more powerful even as they became cheaper to make, in keeping with Moore's law, which predicted the pace of chip improvements and was named after the company's co-founder. Intel was one of the few American electronics makers to thrive in the 1980s and '90s as Japan, South Korea, and Taiwan emerged as manufacturing powerhouses.

Grove stayed on as chairman until 2005 and closely counseled company executives until his death, but even his formidable influence couldn't prevent one of Intel's biggest stumbles. In the mid-2000s, as Apple Inc. was preparing for the release of its new smartphone, Steve Jobs approached then-CEO Otellini about providing the chips for the iPhone. Intel already sold Apple the

processors that ran its Macs. But Jobs made what Otellini considered a lowball offer, and Apple awarded the contract to Samsung. It later began designing the chips itself and eventually outsourced production to TSMC, a contract manufacturer in Taiwan that had been founded in 1987 and focused on catering to fabless semiconductor companies.

Intel made other attempts to gain a toehold in chips for smartphones. It acquired the division of Infineon Technologies AG that made processors for mobile phones for $1.4 billion in 2011, but the division struggled under intense competition from Qualcomm Technologies Inc., the market leader. It tried paying customers, such as Korea's LG Electronics Inc., to make devices based on its chips, though those never sold in significant volumes. Ultimately, according to several people with knowledge of Intel's strategy and operations, the company was never willing to divert its production and design resources away from PC and server chips, and its mobile efforts suffered as a result. Intel not only forfeited billions of dollars in revenue, but it also gave its competitors an opening to gain the manufacturing expertise that comes from making chips at

such high volume and to exacting specifications. There are far more mobile phones than PCs and servers in the world, and the chips that run them need to be energy efficient to preserve battery life. Landing Apple as a customer “became such a driver for TSMC,” says Risto Pahukka, president of VLSI Research Inc. “The combination turned out to be very fruitful and is staying that way.”

In 2010, Otellini’s heir apparent, Sean Maloney, suffered a debilitating stroke, which was followed two years later by Otellini’s sudden announcement that he was retiring. His replacement was Brian Krzanich, a 53-year-old veteran of the company, but one who had not been steeped in Grove’s culture of relentless self-criticism. What Krzanich did have, according to people who worked with him, was an almost unshakable faith in Intel’s engineering acumen, especially the acumen of the division he’d previously run with

another executive, the technology and manufacturing group, which was responsible for formulating each new chip-production process.

In 2013, shortly after his appointment, Krzanich convened 250 of the chipmaker's senior-most managers in a hotel conference room near Intel's sprawling research and manufacturing campus in Hillsboro, Ore. For many in the room, it was the first opportunity to get a feel for what it would be like to work with him.

Krzanich used the speech to set some new ground rules. Senior managers, who'd been trying to find ways to spend time with the new boss, were told to stop asking if they could join Krzanich on one of his regular jogs around campus. "I like to run alone," attendees recall him saying. "And I don't like people in general." There was an awkward silence as the executives awaited a punch line that never came.

Over his five-year tenure, Krzanich reversed Grove's policy of embracing Cassandras. Instead he publicly humiliated executives with whom he disagreed, ignoring warnings that Intel was falling behind in its ability to manufacture key products. "Brian did not create an environment where people could bring him

problems that could be worked on," one former executive says. "Limiting the truth is death for a complex company like Intel."

In the review meetings that his predecessors had used as forums for debate, Krzanich answered emails, shopped online, or left to make phone calls, say people who worked for him. Colleagues say this was his way of showing those presenting that he wasn't interested, had made up his mind already, or didn't value what they were saying. When he did participate it was often to sneer at presenters or verbally abuse them, sometimes telling experts they had no idea what they were talking about, according to a dozen sources. Krzanich did not respond to repeated requests for comment.

Krzanich reserved some of his harshest scorn for Aicha Evans, who ran Intel's mobile business and was one of the highest-ranking Black women in the chip industry. Evans was tasked with shifting production of a key component to Intel's plants from TSMC, which had manufactured mobile chips for Infineon, but concluded that the transition wouldn't work. Intel's fabs were designed for high-performance server and PC chips, not processors that had to get by on limited battery life. In a detailed three-

hour presentation, she outlined her concerns to Krzanich, Chairman Andy Bryant, and 10 other top executives. Her presentation, according to people who were in attendance, was thorough and compelling. TSMC should continue to manufacture the products, she insisted.

But after she finished, Krzanich seemed not to have absorbed any of those specifics. Instead he raised his arm in the air and brought his fist down, pounding on the table. “F---ing shit, Aicha Evans,” he shouted. “You don’t understand Intel, and you don’t have any f---ing balls.”

She glared at him. “You’re right,” she said.

For a time it seemed that Krzanich’s confidence in Intel’s chipmaking strength was justified. In 2015 it became the first company to release a line of chips with 14nm transistors, an improvement from the previous generation’s 22nm. But in early 2015 an engineer approached Krzanich with another warning: The company’s next generation of chips, which would be based on a 10nm process and which were due to be released in 2017, was already six months behind schedule.

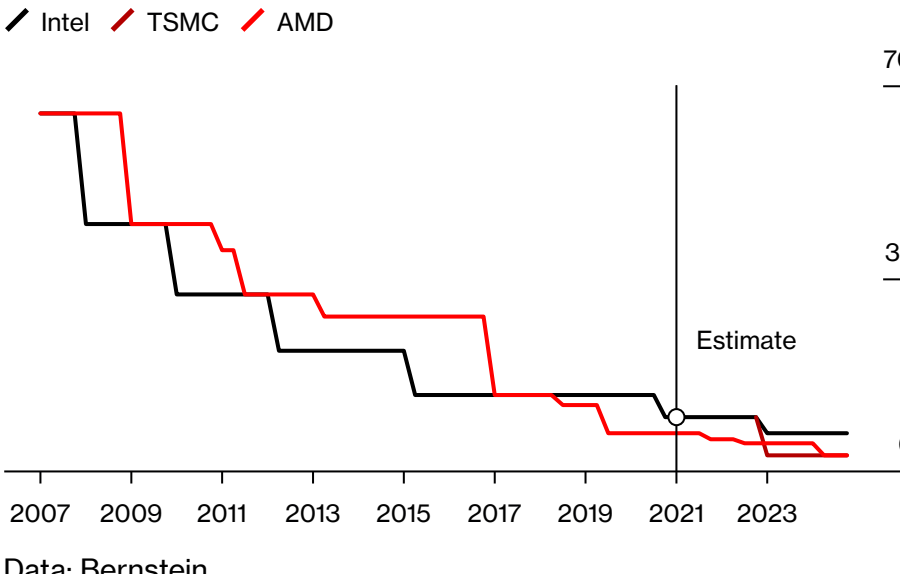
Krzanich responded just as he had to Evans, according to the engineer—with an

expletive-laden tirade. The following year, two other engineers presented Krzanich with data showing an alarming trend in what's known as the yield curve for the forthcoming chip. A metric known as the error rate, or the percentage of faulty chips in a given production run, was not improving quickly enough. Also, a competitor, TSMC, might release its 10nm chips first, they noted. According to several witnesses, Krzanich told them, in effect, that they didn't know what they were talking about.

The six-month delay would eventually expand to three years, and it wasn't until 2020 that Intel released its 10nm chips. The lag caused Dell Technologies Inc., one of its biggest customers, to cut its full-year sales forecast by more than $1 billion. "Obviously we're not extraordinarily happy with them right now," said Dell Chief Financial Officer Tom Sweet at the time. In public statements, Krzanich continued to promise that the 7nm chips would arrive on time, a prediction that many inside the company already doubted.

CPU Process Technology

Size in nanometers



What you need to know: The Global Chip Crisis

The official reason was that he'd had an affair with a subordinate. But Intel had previously tolerated interoffice relationships among senior executives, and many executives speculated that the board had grown fed up with his performance and treatment of underlings.

Evans, the head of the mobile business, outlasted Krzanich. (She left in 2019 and became CEO of Zoox, the driverless-car maker that was sold to Amazon last year.) But by the time Krzanich departed, many of Intel's most senior executives had been forced out. These include former CFO Stacy Smith, who'd been in charge of operations;

of experience at Intel.

▲ Krzanich in 2014. PHOTO: XINHUA/ZUMA PRESS

The company's plight isn't exclusively a function of internal missteps. It also reflects the decades-long shift of manufacturing out of the U.S. to parts of the world that have undergone rapid industrialization and economic development, aided in part by government policies that encouraged an expansion of export production. One of the biggest beneficiaries of the change has been TSMC, based in Hsinchu, Taiwan, which pioneered outsourced manufacturing in chips. AMD, Intel's longtime rival, uses TSMC, as do Nvidia, Qualcomm, Broadcom,

and many of Intel's biggest customers. Amazon Web Services designed an in-house server chip, Graviton, in 2018, which it used to replace some of Intel's Xeon server chips. Amazon has since announced other chips, all of them made by TSMC. Google and Microsoft also have in-house chip programs.

Even Intel's status as the company that powers high-end personal computers seems to be in jeopardy. Apple has begun designing chips for Mac laptops and desktops and, in November, unveiled three new computers boasting a central processor that its own engineers designed and TSMC manufactured. Apple said at the time it will phase out Intel entirely, calling its new Macs "a completely different class of product." Apple plans a series of chips that will be used in higher-end Macs to be released as soon as this year, according to people with knowledge of the matter.

TSMC's power has been made plain by a global shortage of chips that's slowed auto manufacturing, with companies in Europe, Japan, and the U.S. all imploring TSMC to step up production. In February, President Joe Biden signed an executive order aimed at addressing the shortfall and lessening U.S. dependence on foreign countries, and

on April 12, his administration will meet with executives from auto and semiconductor companies, including Gelsinger, to discuss the shortage further. The semiconductor industry, meanwhile, has been pressing the federal government for tax breaks and other incentives to encourage domestic investments. That's on top of efforts already made, under President Donald Trump, to slow Chinese advances in electronics and chipmaking. Declaring that Chinese companies pose a threat to U.S. national security, Trump's White House blacklisted the big Shanghai-based chipmaker Semiconductor Manufacturing International Corp., along with Huawei Technologies, ZTE, and other Chinese companies, denying them access to U.S. software and semiconductor designs.

This move may help Intel in the long run, but the immediate job of fixing the company lies squarely with Gelsinger and the team he assembles. Even before he formally started, Gelsinger began recruiting Intel executives who'd left under Krzanich. Sunil Shenoy, who departed in 2014, rejoined as a senior vice president of the group in charge of design engineering, and Glenn Hinton, who previously led the development of a key chip design, also

returned.

On his first day, Gelsinger invoked the memory of Noyce, Moore, and Grove, reminding the staff in a memo that he was "inspired by the leadership" of Intel's founders. A few weeks earlier, in January, as he addressed Wall Street on a conference call, Gelsinger recalled a period in the 2000s when Intel lost, and then regained, market share in the server-chip market. "Great companies are able to come back from periods of difficulty and challenge, and they come back stronger, better, and more capable than ever," he said.

Gelsinger followed that assertion in March with his pledge to build new factories and break into the foundry business. But to succeed, Intel will need to rectify its manufacturing snags, get new fabs up and running—a feat that can take years—and, ultimately, figure out a way to balance the demands of a new set of customers with the already massive needs of its existing ones.

TSMC has a more than three-decade head start as a foundry. It's been producing 7nm chips since 2018, and Apple began making 5nm processors last year. Gelsinger's determination to have Intel regain its position of leadership is

underlined by its $20 billion bet on the foundry business. But the company's plan to increase its capital expenditures by about 35% in 2021 puts it almost $10 billion behind what TSMC will spend this year. Money alone won't bring back the old Intel.

Read next: This Is How Tim Cook Transformed Apple After Steve Jobs

(Updates with details about Apple's in-house chips in 31st paragraph. Earlier versions of this story corrected the timing of Evans's arrival at Intel and type of component in 22nd paragraph, and the list of U.S. presidents who visited Intel.)

What you need to know: CityLab's Coverage of Tokyo

A restored interior of a Hasune Danchi apartment built in 1957, exhibited at the Urban Renaissance Agency's Housing Apartment History Hall in Tokyo. Danchi offered residents a new middle-class lifestyle, complete with modern appliances like televisions.

Photographer: Noriko Hayashi/Bloomberg

CITYLAB

How Tokyo's Public Housing Defined Japan's Middle Class

The postwar danchi style of homes lured Japanese salarymen and their families out of the city with suburban

comforts and privacy.

By Max Zimmerman
8 April 2021, 00:00 GMT+3

If you think public housing complexes have few fans, a visit to Tokyo might change your mind. In Japan's capital, modernism enthusiasts make pilgrimages to concrete apartment blocks built in its suburbs in the wake of World War II, drawn by the mesmerizing uniformity of their designs.

The attraction of these complexes, known as danchi, is more than aesthetic. These developments embodied the aspirations of Japan's war-weary citizens for better lives, and retain a place in the popular imagination. Fitted with amenities then virtually unattainable elsewhere and a pioneering specification – stainless steel sinks, flush toilets, a kitchen and private bedrooms – people lunged at the chance to pilot this modern lifestyle and participate in a grand social experiment.

A “star house” building, front, at Hibarigaoka Park Hills in Tokyo. Some of the iconic star buildings are registered as cultural monuments.

Photographer: Noriko Hayashi/Bloomberg

The danchi (whose name means “group land”) were not just cheap housing. They were laboratories where the physical and ideological model for middle class families to support Japan’s rapid growth were developed. Architects and officials envisioned a reorientation of living space that would house nuclear families, elevate women, promote privacy and encourage consumer lifestyles. Their heyday is past, but danchi remain a testing ground for the intersection of architecture and social change in Japan. Aging and diversifying residents have once again put them on the front line of demographic trends. While several complexes have been demolished, others have been rebuilt or renovated.

Inside Tokyo's Groundbreaking Danchi Housing Complexes

Out of the Ashes

By the mid 1950s, Japan's postwar recovery was stalling in one key area: housing. From a 4.2 million unit shortfall in 1945, the country still lacked 3 million in 1955, according to figures cited in Laura Neitzel's *The Life We Longed For: Danchi Housing and the Middle Class Dream in Postwar Japan*. To address this issue, the government established the Japan Housing Corporation as the final of three housing policy pillars. The first gave loans to well-off citizens to build homes, while the second provided low-income housing. The JHC would exist somewhere in between – by providing public housing for the blue and white collar workers pouring into urban hubs like Tokyo, who would form the backbone of a new middle class.

A restored interior of a Dojunkai Daikanyama apartment built in 1927. The Dojunkai apartments were a predecessor to the postwar Danchi unit.

Photographer: Noriko Hayashi/Bloomberg

The typical JHC danchi was a cluster of roughly five-story concrete buildings, usually built on the outskirts of Tokyo and other cities, although later developments were significantly taller. Buildings ranged from simple boxes to the iconic Y-shaped "star house", a triple-pronged tower whose structure offered better natural light and circulation. These complexes were essentially ground-breaking suburban commuter towns, self-contained communities with their own shops, police boxes, clinics and schools. This move out of the urban center changed Tokyo life. Suburban danchi necessitated train lines, initiating long commutes that remain stereotypical of so-called "salaryman" to this day. Yet distance from downtown was part of their initial appeal for occupants seeking escape from urban life, as were prewar associations of suburbia with the middle class.

But the danchi's true selling point was their amenities and floor plans, typically featuring two bedrooms with a kitchen and dining area (known as a 2DK), a model that could be scaled up or down to one or three bedrooms. Later floor plans included an additional living room, creating a template (called an nLDK – LDK for "living room, dining room, kitchen" and "n" short for number, a placeholder for the number of bedrooms) that dominates Japanese housing today.

Illustrator: Josh Kramer/Bloomberg CityLab

New Homes for New Norms

The designs were a radical departure from pre-war houses, which contained multi-use rooms and a kitchen concealed at the back. Extended families often lived together in these, with inter-generational shared sleeping arrangements commonplace. This,

post-war reformers argued, wasn't just unsuitable for modern life but actively reinforced feudal, imperial social structures responsible for the war. Housing thus became the focus for debate on modernizing society as a whole, in which modernist housing played a social engineering role. Uzo Nishiyama, the father of Japanese housing studies, criticized traditional rooms' multi-functionality for allowing patriarchs to surveil family members, advocating an end to co-sleeping to improve hygiene, sexual morality and privacy. Architect Miho Hamaguchi, meanwhile, argued that the kitchen's placement ostracized women.

The DK layout addressed these concerns by making the kitchen central, bringing wives to the home's heart, providing a dedicated space to eat and two private bedrooms. The small size also obliged families to organize as nuclear ones. With independent rooms, they gained a level of privacy so novel Japanese borrowed the English word for it, rendered as "*puraibashii.*"

A restored interior showing the dining kitchen, right, as seen from the living room of the Hasune Danchi, built in 1957. This pioneering design reoriented life for Japanese families and would become the country's dominant apartment layout.

Photographer: Noriko Hayashi/Bloomberg

The dining room and kitchen of a renovated apartment in the Kunitachi Fujimidai Danchi in Tokyo. Some Danchi have been adapted for aging residents and a greater diversity of lifestyles.

Photographer: Noriko Hayashi/Bloomberg

The DK's success, however, hinged on the introduction of key amenities – chief among them the stainless steel sink, considered more attractive than its concrete predecessor and thus suitable for the newly central kitchen. Lockable metal doors, private baths and flush toilets added to the middle-class allure. This new configuration encouraged the acquisition of new electronics and appliances – and of semi-fixed, western-style furniture. This was uncommon in traditional houses, whose convertible, multi-use spaces required foldable, storable fittings such as futons and low tables to function smoothly. As single-function rooms became the norm, furniture could stay put, meaning that families started to acquire couches, raised beds and dressers. As much as social changes, it was these material lifestyle features that

would come to define the ideal middle class family.

“With the danchi, the JHC created and promoted a specific configuration of urban, everyday life that became a prototype of middle-class life,” Laura Neitzel wrote. “It became a test bed for the development of housing technology and played a pioneering role in the standardization and modernization of interior living space.”

Prince Akihito and Crown Princess Michiko visit the Hibarigaoka Danchi in Tokyo in 1960. Their visit would help solidify new middle-class values embodied by the Danchi lifestyle.

Source: Kyodo News

This model penetrated wider cultural consciousness. In 1960, Prince Akihito and his wife visited a Tokyo danchi, cementing the middle-class values danchi symbolized and remaking the imperial image in that light. Families who lived in these complexes were called the “danchi tribe” as they tended to be a fairly homogeneous group – typically one-to-two child families with stay-at-home mothers, and fathers working decent, if non-elite, jobs. Their lives were scrutinized by newspapers and aspiring residents

alike.

So popular were the danchi that, during peak demand for them in the mid-1960s, Tokyo applicants with qualified incomes had only a one in 145 chance of winning the lottery needed to gain a tenancy, says Neitzel. The number of units built by the JHC was still a tiny fraction of Japan's new housing in the later the 20th century. But while most people never actually lived in a danchi, they set a national template as private developers adopted the JHC's construction methods and fixtures. The nLDK floor plan was soon ubiquitous. Plans that were initially experimental became standard practice within three decades.

But the experiment also revealed unintended consequences. Women's initial euphoria over the DK was succeeded by a sense of confinement, stuck at home while husbands left to work in the city. With new suburbs still somewhat empty, there was little for danchi wives to do beyond housework, which took less time than ever before. The liberation promised by privacy also gave way to isolation and lack of community. The danchi left little room for gatherings, either inside or outside the home, making it difficult to form relationships with neighbors. Long commutes, especially for newer danchi, diminished their appeal.

As housing shortages eased from the mid-1970s, danchi construction trailed off and the JHC shifted to urban renewal. The makeup of Japanese families also began to move away from the danchi ideal. Many Japanese were marrying later, living alone or remaining childless. In the other direction, greater

affluence meant that larger families expected bigger homes – and the habit of acquiring larger furniture and appliances that the danchi themselves had encouraged meant they quickly started to feel small and cramped, too. This provoked a fall from favor, a trend exacerbated by distant locations and, in a country which often prefers new construction to renovation, their increasing dilapidation.

This has led to widespread demolitions in recent years. Some, however, have been renovated to make them more modern, suitable to a variety of lifestyles and senior friendly. Akabanedai Danchi in north Tokyo, completed 1962, has been almost entirely reconfigured– with the exception of a few of its iconic star buildings now registered as cultural monuments. The new buildings, completed in 2010, more closely resemble the interior configuration of the typical “mansion”, as modern apartments buildings at least three stories high are called. What

the refurbished danchi have that mansions don't is more surrounding open space and greenery – a rarity in Tokyo. Retailer Muji also teamed up with semi-governmental rental housing organization (and JHC's successor) Urban Renaissance Agency in 2012 to renovate danchi interiors, developing floor plans with greater flexibility and newer fittings such as fold-up desks, in contrast to the rigid layout of early danchi.

A children's playground in the Kunitachi Fujimidai Danchi in Tokyo. Danchi offer open, green spaces that are rare throughout the city, a feature renovators have leveraged to revitalize the complexes.

Photographer: Noriko Hayashi/Bloomberg

Some danchi renovations are going yet further,

boosting a community feel by remodeling public spaces around the units. The Yokodai Danchi renovation project in Yokohama, led by renowned architect Kengo Kuma, is once again trying to put these complexes at the forefront of contemporary and provide a model for the future. The Future of Housing Complex Project built a sunken garden, new lawn, cafe and library to add green space and community life not found in most urban settings. Tokyo's danchi may have been built for starkly different conditions from those in today's Japan, but there's clearly some life in the form yet.