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The Forgotten Origins of Silicon Valley

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Sebastian Mallaby, *The Power Law: Venture Capital and the Making of the New Future*, Penguin Press, 2022.
Christophe Lécuyer, *Making Silicon Valley: Innovation and the Growth of High Tech, 1930-1970,* MIT Press, 2005.

CAMBRIDGE – In his new book *The Power Law*, Sebastian Mallaby has produced a rich and rewarding account of how Silicon Valley co-evolved with the professional venture capital (VC) industry since the late 1950s. His book complements two other recent works: *VC: An American History*, by Tom Nicholas of Harvard Business School, and *The Code: Silicon Valley and the Remaking of America*, by Margaret O'Mara of the University of Washington – both of which I reviewed previously.

Together, Mallaby, Nicholas, and O'Mara offer a comprehensive survey of how capital is mobilized to finance high-risk ventures at the technological frontier, whereas historian Christophe Lécuyer's *Making Silicon Valley*, published in 2005, provides the essential "pre-history" by taking the story back to before World War II. Both perspectives are essential to understanding what gave rise to and has sustained the world's premier hub of technological innovation.

The Power Law is especially valuable for its deep dives into the lives of leading VC funds and the firms that they have created and led. Mallaby gained access to and won the confidence of two generations of VC leaders, and his book is all the more impressive for its (selective but effective) integration of the burgeoning academic literature on VC and entrepreneurship.

Mallaby's focus on the most significant and financially successful venture investors fits well with two well-established "stylized statistical facts" of professional VC: that the industry has yielded extraordinary returns over the four decades for which we have reliable data; and that a very small number of firms are responsible for those returns. This extremely skewed distribution of returns expresses the "power law" of Mallaby's title.

Mallaby starts by recounting how Arthur Rock "liberated" the "Traitorous Eight" founders of Fairchild Semiconductor from the dictatorial grasp of William Shockley, the co-inventor of the transistor who by that time had left Bell Labs, in New Jersey, to set up shop in Mountain View (where his ailing mother was still living in Palo Alto). The book then walks us through a succession of venture champions and their distinctive styles and triumphs: Tom Perkins of Kleiner Perkins and Don Valentine of Sequoia, both firms founded in 1972; Arthur Patterson and Jim Swartz of Accel, founded a decade later; the team at Benchmark, launched in 1995 just in time for the dot-com bubble; and, most recently, Marc Andreessen and Ben Horowitz of the eponymous firm.

Mallaby guides the reader through the problematic but generally successful passing of the torch to the next generation (John Doerr and Vinod Khosla at Kleiner Perkins; Mike Moritz and Doug Leone at Sequoia). He details how Kleiner Perkins lost its edge in the years after the dot-com bubble, and how Sequoia renewed itself as the most successful of all VC firms over a 50-year span. As the narrative approaches the present, familiar recent players appear, including the aggressively contrarian Peter Thiel of the "PayPal Mafia" and Founders Fund; and Paul Graham, the imaginative inventor of the first entrepreneurial "incubator," Y Combinator.

The Cult of the Entrepreneur

Behind the personality profiles, Mallaby tells the story of Silicon Valley and its VC enablers in three acts. In the early days, risk capital was scarce and the "Golden Rule" of VC held: "He (it was virtually always a 'he') who has the gold makes the rules." But as capital began to flow west in the 1980s, competition between funds became the defining feature of the game. Then, as the new mode of finance became an industry, Mallaby suggests, competition yielded to coordination among venture capitalists who orchestrated strategic partnerships across their portfolios.

The current VC epoch has been characterized by "nontraditional" funders who have found their way to Silicon Valley's fountain of value. The most visible, Masayoshi Son of

SoftBank, made his first pass through the Valley during the dot-com bubble and then returned on a gargantuan scale with his $100 billion Vision Fund. The Russian-Israeli entrepreneur Yuri Milner, who arrived in the Valley around the same time, was both more discreet and far more successful as an investor.

These outsiders turned the classic VC model inside out. The old way involved intense scrutiny of the entrepreneurial team and its technology, with close, active, board-level engagement. But the new VCs conducted minimal due diligence and wrote checks with the promise never to seek board representation. As a result, founders became increasingly entrenched, with many of them holding super-voting shares.

The capital and valuations offered were irresistible. In 2021, the aggregate amount of capital invested in VC-backed deals in the US reached an astounding $330 billion, of which some $250 billion came from "nontraditional" sources. Moreover, the *median* late-stage financing round valued these private companies at no less than $500 million. Globally, almost 1,000 venture-backed companies had achieved "unicorn" status: a nominal valuation of at least $1 billion. The new investors were snatching up shares they could not sell and backing founders they could not fire.

Appropriately, Mallaby gives center stage to two horror stories of entrepreneurial excess: Adam Neumann at WeWork and Travis Kalanick at Uber. In each case, a senior partner of Benchmark – Bruce Dunlevie and Bill Gurley, respectively – fought successfully for accountability. He also notes that professional VC funds almost unanimously rejected the third extreme caricature of the contemporary heroic entrepreneur, Elizabeth Holmes of Theranos; the $900 million that she raised came largely from VC neophytes like Rupert Murdoch and the DeVos family.

Mallaby fully appreciates that this "Unicorn Bubble" was the consequence of unprecedentedly easy monetary policy following the global financial crisis (and renewed during the pandemic). "The financial climate promoted irresponsibility," he notes. Now, the first months of 2022 have shown how fast the game can unravel. The prospect that high inflation would end this uniquely loose financial regime generated a discontinuous drop in tech companies' public market valuations, especially the cash-burning ventures whose value lay further in the future. The fundamentals of finance reasserted themselves: an increase in the rate at which the future is discounted exponentially reduces its present value.

The longer-term consequences for VC and for Silicon Valley itself remain beyond the scope of *The Power Law*. What can be anticipated with confidence, however, is that the sky-high returns reported by VC funds from the most recent vintages will be re-marked to significantly lower levels as illiquid portfolios are ultimately distributed or sold.

Why Silicon Valley?

In explaining how Silicon Valley became the place where VC reached critical mass and funded the digital revolution over two generations, Mallaby relies on the work of University of California, Berkeley sociologist AnnaLee Saxenian. In her 1994 book, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Saxenian documents how Silicon Valley's "porous" social structures lent momentum to the pioneering VC funds that ultimately achieved technological and then commercial

dominance. But this explanation is incomplete – a lacuna that highlights the shortcomings of Mallaby's book.

Mallaby does note that both the professional venture capitalists and the ventures they financed were originally concentrated on the East Coast. The Route 128 circle around Boston was home to a mass of VC-backed computer companies that had escaped the overbearing dominance of New York's IBM. Mallaby also considers the evidence for and against the role of non-compete employment contracts in Massachusetts versus their effective absence in California. However, he misses a substantially more important factor: namely, that the first generations of computers – from IBM mainframes and DEC minicomputers to the workstations of the early 1980s – were proprietary, closed systems.

Since everything from the custom-designed hardware processors and the operating system to all the peripheral devices was unique to each brand, an engineer trained within the DEC environment had to start from scratch to master the knowledge needed to work for the cross-town competitor, Data General. Regardless of any legal hurdles, inter-firm mobility was highly constrained technologically. So, too, was market entry. For a startup to launch a competitive new system, it had to innovate at every level, from the core processor to all the requisite software.

All that changed in the 1980s, when the information-technology (IT) sector started opening up. This era featured a double irony. First, when IBM responded to Apple's (closed-system) Apple II by introducing its own personal computer in 1981, it relied on third-party technologies – an Intel microprocessor and a Microsoft operating system – for critical functions for the first time in its history. Because these platform technologies were available to the world, an army of "clones" quickly emerged. The most proprietary of earlier "Big Tech" firms ended up sponsoring the first truly open computing industry.

At the same time, within Route 128 itself, researchers for MIT's Project Athena were working on technical standards for rendering different proprietary systems interoperable across networks; and engineers in AT&T's East Coast labs were creating an open, freely distributed operating system: Unix. Together, these projects kicked open the doors for innovation. But the East Coast computer companies – including IBM in its core mainframe business and all the proprietary minicomputer firms – ended up paralyzed not only by technological lock-in but also by the profits and the culture of their own proprietary systems. (Ken Olsen, DEC's founder and CEO, notoriously referred to Unix as "snake oil.")

Meanwhile, out west, the entrepreneurial founders of startups like Sun Microsystems and Silicon Graphics took full advantage of the new shared protocols, open standards, and the universal Unix operating system. The old "vertical" computer industry suddenly went "horizontal."

The Other Side of the Story

A second big omission stems from Mallaby's near-exclusive focus on VC investments in IT. Although IT has accounted for at least half of all venture dollars over the past 40-plus years, biotech has long been the second-largest segment, accounting for around a quarter of VC investments. Yet with the exception of Genentech (founded in South San Francisco and funded by Kleiner Perkins), Mallaby ignores this domain of VC. The word

“biotechnology” does not even appear in the book’s index. This is frustrating, because Mallaby clearly understands the VC world’s central tension: the degree of technical risk and market risk that entrepreneurs and their funders are prepared to accept.

Nothing illustrates this tension more plainly than the “Biotechnology Paradox.” Since the late 1970s, VCs have invested hundreds of billions of dollars in biotech and other health and life-science ventures, despite dauntingly long development times and challenging regulatory hurdles. In the case of biotech startups specifically, first-round investors can be sure that they will not see a dollar of revenue in the 10-12-year life of the investing fund.

The explanation of the paradox is obvious. Only in the case of health-care firms is market risk negligible once technical risk is overcome and FDA clearance is achieved. With the prospect of purchases being funded by public- and private-sector third parties (like Medicare or health insurers), biotech ventures, in the US at least, have a chance of benefiting from a vertical demand curve: demand remains the same regardless of how high the price rises. But it is “only” in these instances that prospective cash flows can be anticipated with confidence.

One suspects that Mallaby omitted biotechnology in order to keep the focus on Silicon Valley as the unique locus of successful VC. Yet that focus itself is too narrow. While he briefly tips his hat to East Coast VC pioneers like Laurance Rockefeller, Jock Whitney, and American Research and Development’s Georges Doriot, he categorically ignores the non-Silicon Valley individuals and firms that still constitute a substantial share of the US VC industry. In 2020, New York and Massachusetts accounted for some $150 billion of VC assets under management, while California accounted for just over $300 billion. Route 128 may have lost to Silicon Valley in digital technologies, but Boston and Cambridge, Massachusetts remain the leading hub of biomedicine.

Moreover, Mallaby’s concentration on Silicon Valley leads him to overlook other critical roles played by East Coast VCs. For example, no single external catalyst was more important to the emergence of VC as a substantial asset class than the relaxation, in 1979, of the “prudent man rule” constraining investment by pension funds. This policy change came as a result of lobbying by Cleveland’s David Morgenthaler, then chair of the National Venture Capital Association, and New York’s Lionel Pincus, the founder of the largest original member of the NVCA.

Similarly, Mallaby’s extended discussion of Accel Partners and its co-founders omits any mention of the mentor under whom Patterson and Swartz painfully mastered their craft: New York’s Fred Adler, who also spearheaded the creation of the Israeli VC industry. Finally, by skipping over biotechnology, Mallaby ignores the serially successful Tony Evnin, whose New York-based firm Venrock played the decisive role in the first funding of Apple Computer.

The Prime Mover

Mallaby also marginalizes an even bigger player: the government. Yet there is a reason why VC has focused almost entirely on just two industrial sectors – computing and biomedicine. Before the VC firms invested their billions, the US federal government had invested its billions both in the funding of upstream research and development, and, as the collaborative first customer, in the procurement of the outputs of R&D. The seeming miracle of mRNA vaccines reaffirms that history: they are the joint product of long-term research funding from the National Institutes of Health and the Department of Defense under the federal government's "advance purchase agreements."

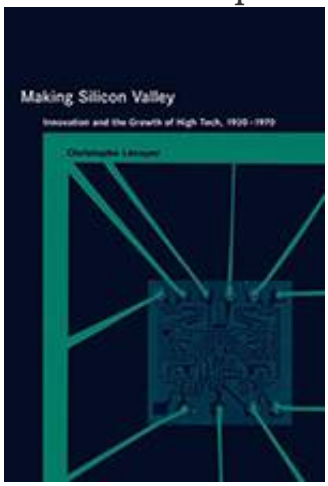
The DoD and the NIH were the original sponsors of computing and biomedicine, respectively. Each pulled the early innovators down the learning curve toward lower costs and more reliable development and production. While the trade-off between technical and market risks differs radically between the two sectors (IT is exposed to far greater market risk than biomedicine, and the technical risks facing biomedicine are rooted in the basic science), it was government sponsorship that rendered ventures in each sector "investible" for VC players in the first place.

By contrast, consider the haphazard and frustrating recent history of VC in Greentech and Cleantech. Mallaby documents the manifest failure of VC investors, led by Kleiner Perkins, to generate a Cleantech bubble in the early 2000s, after the dot-com bubble burst. But the problem was not just that venture capital was missing in action; it's that the American state was, too.

Neither nascent alternative energy sources nor energy storage technologies received anything close to the support lavished on computing by the DoD or on biomedicine by the NIH. (Or consider another data point: the sole product of materials science research that was commercialized through VC funding was silicon – and the research had been exclusively sponsored by the DoD.)

Computer Age Continuity

Unlike Nicholas and O'Mara, Mallaby makes no reference to Lécuyer's detailed pre-history of Silicon Valley. And yet, the most striking feature of Lécuyer's account lies in the sheer continuity of the computing industry's development from its earliest days to the better-known post-war period and into the VC era.



It all began with the discovery of electromagnetic radiation, which was applied to the propagation and reception of radio waves for point-to-point communications

(broadcasting came later). The first customers were the British Royal Navy and the US Navy, which gained a unique medium for ship-to-ship and ship-to-shore communications.

Like the Homebrew Computer Club from which Apple's Steve Jobs and his founding partner Steve Wozniak emerged more than two generations later, communities of amateur radio ("ham") operators started springing up. And the Navy's substantial presence in the San Francisco Bay Area meant close engagement between proto-hackers and an arm of government as they explored a new technological frontier. The early users hacked their way to improved techniques and technical components.

By the 1930s, the peninsula south of San Francisco was home to a thriving microelectronics industry. With Stanford University nearby, the entrepreneurial designers and manufacturers of vacuum tubes and specialized radio components enjoyed a two-way flow of people, ideas, and technologies.

Years before becoming the dean of engineering at Stanford after World War II, Frederick Terman, then a young professor, was already positioning the university as a critical third player vis-à-vis the US government and the technical entrepreneurs. Although Route 128 had an even more substantial technical center (MIT) at its core, it was Terman and his colleagues who recognized the potential in sponsoring startups and providing them with ongoing academic support.

It would be many decades before MIT would follow suit. I well remember painfully negotiating MIT's first-ever agreement to accept equity in a startup in exchange for the intellectual property created in its lab. That was in 1980. A senior staffer from Stanford was on sabbatical and had educated the MIT administration on the benefits of collaborative technology transfer. In the absence of those arrangements, Olsen had been forced to leave MIT to start DEC; MIT received no return from his success.

But before any of that came the microelectronics boom during WWII, when some of the leading Bay Area firms were required by their military customers to move at least some of the operations to the East Coast. Although demand collapsed following the Allied victory in 1945, the onset of the Korean War revived military demand, and companies such as Varian and Litton thrived. They were joined by Fairchild Semiconductor in 1957, and then by the growing number of startups funded by refugees from Fairchild (which itself had been created by refugees from Shockley), starting with Intel.

The Customer Is Always Right

One critical episode from this period illustrates the strategic role played by the DoD as a customer for the pioneers of microelectronics, including semiconductors. In the late 1950s, the US Air Force pioneered the transition from analog to digital computing devices. "Analog-based avionics systems," Lécuyer explains, "depended on failure-prone vacuum tubes and a multitude of moving parts that were sensitive to vibration and wear and tear."

The key elements of digital devices were Shockley's transistors; and, for a long decade, the material of choice for those transistors was germanium, not silicon, owing to germanium's superior electron mobility. But since germanium had a propensity to fail at high temperatures, the Air Force "insisted that avionics firms employ silicon transistors

as much as possible," Lécuyer writes. The south San Francisco Bay Area became known as Silicon Valley, not Germanium Valley, because private-sector entrepreneurs were responding to the wishes of their most important customer: the US government.

In addition to providing the carrots that fed the microelectronics industry from its earliest days, the government also wielded a stick. In 1961, President John F. Kennedy's secretary of defense, Robert McNamara, fresh from bringing operational and financial discipline to Ford Motor Company and its extended supply chain, set about imposing comparable discipline on defense contractors. The ensuing "McNamara depression," Lécuyer recounts, "was a turning point in the history of the electronic component industry."

The industry was forced both to consolidate and to discover commercial applications for its technology. Varian's military sales generated 90% of its revenues in 1959; eight years later, they accounted for only 40%. Fairchild learned to deploy aggressive "forward pricing," cutting bids to customers in the confident expectation that process improvements and economies of scale would drive down costs in time to preserve profit margins.

By the time Mallaby's chosen VC funds had reached critical mass in Silicon Valley, the electronics industry had already mastered advanced manufacturing techniques and frontier process technologies under the sponsorship of the DoD. When that dominant customer forced commercialization on the industry, "Silicon Valley firms learned how to create new markets for their products."

But Fairchild and its venture-backed spinoffs did not only master commercial practice. Varian, Litton, Hewlett-Packard, and other pioneers of Silicon Valley's pre-history also trained the talent that would lead the digital revolution beyond its military birthing ground, ultimately making Silicon Valley its epicenter. When the pioneering VC shops opened, they found not only entrepreneurial partners to back but also a technically trained reservoir of human capital to employ.

From Silicon Valley to the World

Mallaby concludes *The Power Law* with the assertion that "America's venture-capital machine" stands as "an enduring pillar of national power." Thus, he reverses the historic relationship between an enabling state, on the one hand, and speculative financial investment and the emergence of innovative technology businesses, on the other.

This perspective is foreshadowed in his riveting account of the rise of China's VC industry, in which Chinese-American investors, investment bankers, and venture-savvy lawyers played a key role. After various "work-arounds" had been devised to allow Chinese startups to gain access to external VC, American players brought the Silicon Valley model to China, pioneering the creation of stock options, among other innovations. Notably, two women played a leading role: Shirley Lin of Goldman Sachs, who orchestrated SoftBank's investment in Alibaba in 1999; and Kathy Xu, who moved from PricewaterhouseCoopers to her own venture firm in 2005 and funded JD.com in 2007.

Alibaba and JD.com are two well-known examples of foreign entrepreneurs appropriating business models that had been invented and proven in the US. But this

appropriation pales in comparison to the much broader and deeper appropriation of intellectual property sponsored by the Chinese state.

There is nothing new in this practice. In the seventeenth and eighteenth centuries, England took textile technology from India and Italy to establish what became the leading component of the first Industrial Revolution. The young American nation then did the same. The first profitable textile mill in the US was founded by Samuel Slater, a refugee from England's draconian industrial regime, which criminalized exports of textile machinery and even the emigration of textile workers – felonies punishable by death or transportation to Australia. The industrial history of Japan and Korea offers comparable examples.

But the most significant example of successful copying has been China's adoption of the American model of public-private collaboration at the scientific and technological frontier. As Mallaby illustrates, the American model of VC does indeed represent a profound innovation in the commercialization of technologies that are already mature enough for private, profit-seeking finance. China is now demonstrating the power of that model at scale (as are the VC funds that finally appear to have reached a critical mass in Europe).

But VC is not enough, as the failure of Cleantech in the early 2000s showed. One final irony underscores what is missing in Mallaby's book. Over the past two years, something resembling a green bubble finally seemed to be gathering force. Its iconic example is Tesla and its inimitable CEO, Elon Musk. But it is worth recalling that in 2009, while Tesla was still struggling to learn how to make electric vehicles – let alone make them at a sustainable profit – it received a $465 million loan from the US government. That was more than twice the venture funding it had received to date, and it was critical to raising aggregate capital approaching $20 billion from the financial markets.

Tesla, too, has demonstrated the power of public-private collaboration at the frontier of innovation. Once again, historical analysis reveals that the state was a strategic contributor to VC's power law.

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