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Technology Strategy and Management

Extrapolating from Moore's Law

Behind and beyond Microsoft, Intel, and Apple.



IMAGE BY ANDRIJ BORYS ASSOCIATES/SHUTTERSTOCK

ALL GREAT STRATEGIES start with a vision of the future. For entrepreneurs and company leaders, the vision should include a sense of what opportunities lay ahead, what kind of organization can exploit those opportunities, and what products or services customers are likely to buy. The devil, of course, lies in the details.

To get all the details right, successful leaders rely on both extrapolation and interpretation to "look forward" into the future and then "reason back" to what they need to do today and over the next several months. Extrapolation is relatively easy: information on industry trends is widely available. However, someone has to interpret that information—identify key changes, opportunities, and threats for a specific organization and market. Interpretation is where visionary leaders make their mark, as we can see in the companies once led by Andy Grove, Bill Gates, and Steve Jobs.[a]

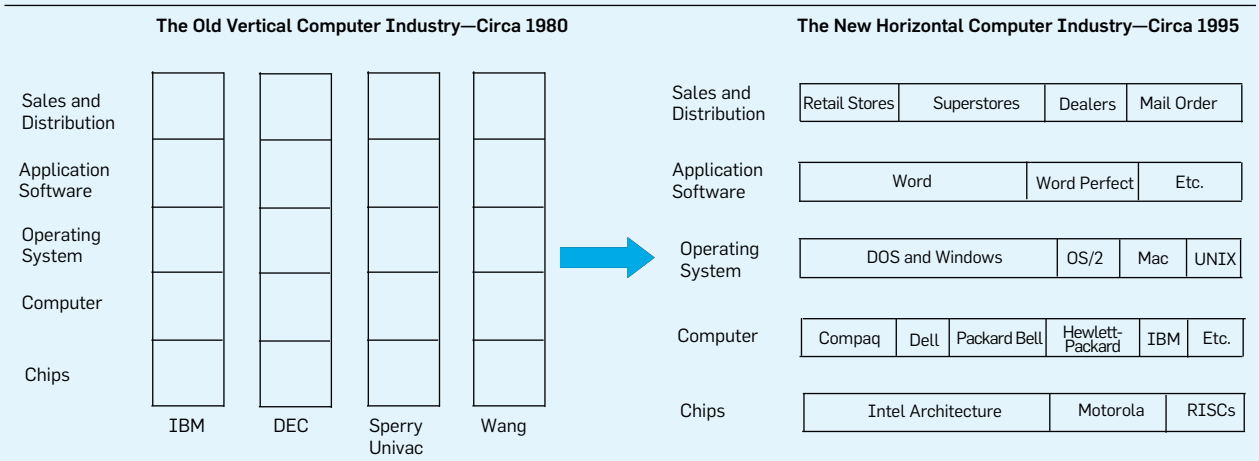
Grove and Intel

Andy Grove, trained as a Ph.D. in chemical engineering at Berkeley, was employee number one at Intel, founded in 1968. He quickly took charge of engineering and then other operations. He became president in 1979 and CEO in 1987, when he had to clarify the company's strategy. Grove would base his vision on an extrapolation from "Moore's Law." Recall that, in a 1965 article, Gordon Moore, who co-founded Intel with Robert Noyce, predicted the number of transistors on an integrated circuit would double every 18 to 24 months.[b] Some people saw Moore's Law as just another example of progress in engineering. Grove interpreted it as a strategy that would

a This column is adapted from a new book by David B. Yoffie and Michael A. Cusumano, *Strategy Rules: Five Timeless Lessons from Bill Gates, Andy Grove, and Steve Jobs* (Harper Business, 2015), 23–59.

b See also Michael S. Malone, *The Intel Trinity: How Robert Noyce, Gordon Moore, and Andy Grove Built the World's Most Important Company* (Harper Business, 2014).

The transformation of the computer industry (not to scale).



Source: Re-created from Andy Grove Intel presentation, with permission.

transform the structure of the computer industry. He concluded that, if Intel continued to pursue Moore's Law, competitors would need massive scale economies to produce integrated circuits. Inevitably, this would topple vertically integrated giants like IBM and Digital Equipment Corporation (DEC) that had dominated the industry for decades.

Several years before it became obvious to the world, Grove foresaw the rise of an industry organized in horizontal layers—chips, hardware, operating systems, applications, distribution—each dominated by a small number of powerful companies (see the accompanying figure).[c] Based on this vision, he focused Intel's strategy on leadership in the microprocessor segment. The top priority became the innovations needed to double the transistors on an integrated circuit every 18 to 24 months.

This evolution in Grove's thinking did not happen all at once. In 1987, he proclaimed 50% of Intel's business should be "systems" of fully assembled computers. By 1990, he believed the company should focus on its core strength—microprocessors. In the future, Intel would make products such as motherboards and chipsets that would help sell microprocessors. But Intel would steer far away from layers of the computer industry dominated by large product companies with scale economies on their side.

Gates and Microsoft

Bill Gates also built his vision of the future on Moore's Law, but in a different way. Gates saw the future through his own "personal anchor" in software, with a deep understanding of how to program the early microprocessors Intel was producing. Gates believed the repeated doubling of computing power would turn hardware into a commodity, leaving software as the true source of value. In a 1994 interview, he recalled his thinking when launching Microsoft in 1975: "When you have the microprocessor doubling in power every two years, in a sense you can think of computer power as almost free. So you ask, why be in the business of making something that's almost free? What is the scarce resource? What is it that limits being able to get value out of that infinite computing power? Software." [d]

This insight was revolutionary and prophetic, as was Gates' conviction there would one day be a personal computer on every desk and in every home. Gates proclaimed this vision when industry luminaries such as Ken Olsen of DEC and even Gordon Moore of Intel believed home computers were a silly idea. Gates disagreed, and in 1975 dropped out of Harvard to make his vision of the future happen. Later in his career, Gates delegated some of the work of extrapolating from the present to others. But, until he stepped down as CEO in 2000, Gates led the way when it came to interpreting how new trends such as the Internet would impact Microsoft's strategy and product portfolio.

Like Grove, Gates was highly disciplined when it came to strategy and execution. Co-founder Paul Allen originally wanted to produce hardware and software, but Gates insisted they should focus on software. Microsoft started with programming languages and then set out to dominate PC operating systems, first through MS-DOS and then Windows. As secondary fronts, Microsoft added applications and then servers, browsers, and other software products that complemented the Windows platform, largely ignoring hardware until the Xbox in 2001.

Steve Jobs and Apple

Like Andy Grove and Bill Gates, Steve Jobs took inspiration from the advances in computing power described by Moore's Law. Unlike Grove and Gates, however, he was not a technologist by training and wanted to see computing devices made as simple to use as a toaster or a typewriter. This

c Grove also published this graph in his best-seller book, *Only the Paranoid Survive* (Currency/Doubleday, New York, 1996), 44.

d "Playboy Interview: Bill Gates," *Playboy* (July 1994), 63.

focus led to Jobs' goal of transforming complex personal computers into "insanely great" consumer products defined by simplicity and ease of use. Eventually, his vision for Apple (founded in 1976) expanded beyond creating individual products to designing the entire digital experience.

By the late 1990s, Jobs and others had come to realize the explosion of devices was creating a digital Babel, made worse by poor usability and connectivity. He also had a solution. In 2001, Jobs told MacWorld attendees the Macintosh (originally introduced in 1984) "can become the 'digital hub' of our new emerging digital lifestyle, with the ability to add tremendous value to these other digital devices."[e] With its focus on consumers and the user experience, Apple was uniquely suited to deliver on this vision. Ron Johnson, former head of Apple retail, explained how Jobs' concept of a digital hub set Apple on a new path: "[The digital hub vision] created a mental roadmap for products ... how Apple would win in the marketplace. Apple had been locked into a PC model for most of its history and this liberated the company to be relevant in all emerging categories from music players, to cameras and beyond. It really became how we allocated resources."[f]

Jobs also saw focus as a central element in a successful strategy, explaining that, "the way we've succeeded is by choosing which horses to ride very carefully."[g] While Jobs was out of the company during 1985–1997, Apple did not follow this rule. When he returned in 1997, Jobs found the company's product portfolio too broad and weak. In one meeting, out of frustration he drew a simple grid, labeling the columns "Consumer" and "Professional" and the rows "Desktop" and "Portable." He insisted that, going forward, Apple focus on just four products, one for each quadrant in the grid. And even within the professional segment, Jobs later told company executives to abandon the enterprise market.[h]

What will be the next equivalent of Moore's Law? Will it again transform the world?

From Vision to Strategy

The visions of Gates, Grove, and Jobs are noteworthy not only for their ambition, but also for their clarity and simplicity. Clarity and simplicity, however, are not the same as immutability. These visions did not spring fully grown from the minds of their creators. They were continuously revisited, revised, and redefined as new events and information emerged.

Grove, for example, refined his vision over five years as he transformed Intel from a broad-line maker of mostly commodity semiconductor memory products into a microprocessor company and platform leader in the computer industry. Les Vadasz, one of Grove's longtime senior executives, explained how Grove managed this strategic transition: "You can only look so far, and so you better just keep looking frequently. That's the most important element of strategy: You understand the direction you're going, but you also know what you're going to do in the next six months. Most companies will do a pretty good job many times about the direction, but then they never break it down to shorter metrics. Intel did a super job on that. When you ask why [we] succeeded, this is one of the reasons."[i]

Gates moved Microsoft in the opposite direction, broadening its product portfolio over time—but maintaining a tight focus on software. Similarly, Jobs' vision for Apple evolved continuously, from personal computers to the digital hub, and then to digital media, smartphones, software distribution, tablets, and "the cloud." But Apple under Jobs always remained tightly focused on producing simple, elegant products and services for the consumer—not for technologists or enterprise users per se.

Former IBM CEO Lou Gerstner once said, "Vision is easy. It's so easy to just point to the bleachers and say I'm going to hit one over there. What's hard is saying . . . how do I do that."[j] In other words, vision is essential but never an end in itself. Leaders must translate vision into strategy that defines the scope of an organization's activities—what it will and, perhaps even more important, what it will *not* do. The ability to update visions in response to changes in the environment, while preserving clarity and focus at the core of their strategies, was an important strength Gates, Grove, and Jobs shared.

How Moore's Law lay behind the founding of Microsoft, Intel, and Apple should also make us wonder about the future: What will be the next equivalent of Moore's Law? Will it again transform the world? The Internet as well as mobile computing and cloud-based services are technologies that, in some sense, all flowed from Moore's Law. They are also distinct innovations. But how should we think about what comes next? How frequently do we need to revise our assumptions? What are the implications for hardware and software platforms as well as digital services? Who should be in on these conversations about the future? These are questions not only for technologists and entrepreneurs, but for all organization leaders and society more broadly. C

e "Steve Jobs introduces the 'Digital Hub Strategy' at Macworld 2001" (Jan. 9, 2001); https://www.youtube.com/watch?v=9046oXrm7f8

f Ron Johnson, interview with the authors, Oct. 10, 2013.

g Quoted in Adam Lashinsky, "How Apple Works: Inside the World's Biggest Startup," *CNNMoney* (Aug. 25, 2011); http://tech.fortune.cnn.com/2011/08/25/how-apple-works-inside-the-worlds-biggest-startup

h Fred Anderson, interview with the authors (Oct. 9, 2013).

i Les Vadasz, interview with the authors (Oct. 7, 2013).

j "In Focus: Lou Gerstner," CNN.com (July 2, 2004); http://edition.cnn.com/2004/BUSINESS/07/02/gerstner.interview/

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